NSF | ASPIRE

2025 Annual Report



PHOTO BY KAT WEBB

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Directors' Welcome

This is a very exciting time to be part of ASPIRE! We are optimistic about what lies ahead. We invite all who are interested to join us as we drive transformative changes with national impact in grid and transportation infrastructure.

We want to take this opportunity to share our amazing journey as we are now in Year 6 as an NSF Engineering Research Center (ERC). We have made great strides with exponential growth, including significant turning points every five years.

In 2010, we were a disparate group of colleagues with growing programs and initial collaborations. In 2015, we formalized our partnership and launched as a "modest" industry-sponsored SELECT Center with 20 industry and innovation members, 5 universities, 2 full-time staff, and a $2 million annual operating budget. In 2020, we achieved remarkable recognition as the first Gen 4 National Science Foundation ASPIRE ERC dedicated to infrastructure for electrified transportation. This designation and support has propelled ASPIRE into a cohesive collaborative network with national and international impact. Today, ASPIRE stands stronger than ever with annual expenditures of over $20 million, 70 industry and innovation members, over 30 full-time staff, and 10 partner universities.

As we step into our sixth year as an NSF ERC in 2025, we embrace a new chapter. We are evolving ASPIRE into a university-owned nonprofit with a professional structure that will provide greater operational agility and diversified funding streams for long term self-sufficiency and growth. This transition will further strengthen the relationship between ASPIRE and its partner universities, with a strong presence of ASPIRE for students and faculty at each campus, and with each campus serving as a regional hub for ASPIRE.

We've created the nation's leading research center in electrified transportation, and we're now deploying many firsts in the world including a 1 MW wireless charger for local and regional operation of heavy-duty trucks and a 200 kW high power in-road wireless charging system on a state highway for heavy-duty trucks. Our efforts have transformational potential in industries, resolving many significant questions on the best path forward — and we are showcasing our work on national and international stages!

We are solidifying our position as an international leader. We thank and honor the tremendous efforts of our more than 450 faculty, staff, and student participants and our dedicated team of industry and innovation partners. We are committed to training the next generation of innovators and leaders who will carry this vision forward.

–Dr. Regan Zane & Dr. Ivonne Santiago



Dr. Regan Zane, USU, *ERC Co-Director*



Dr. Ivonne Santiago, UTEP, *ERC Co-Director*

ASPIRE *by the Numbers*

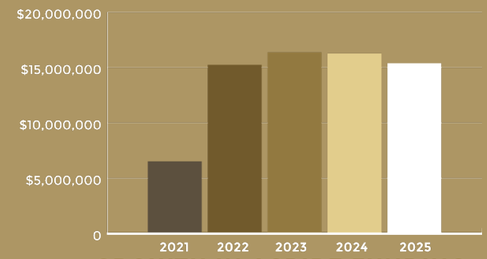
ASPIRE

$174 Million+

CONTRACTED + ANNOUNCED SINCE 2020

40,000+

ATTENDEES REACHED THROUGH EVENTS



GROWTH IN ASPIRE FUNDING

240+

PEER REVIEWED PUBLICATIONS

39

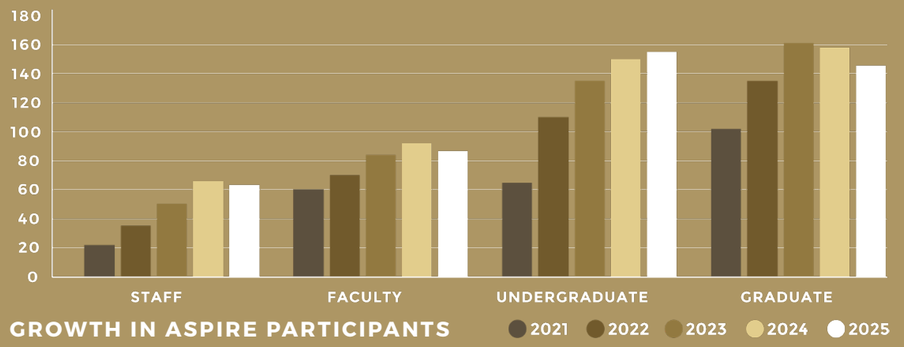
PATENTS AWARDED

~70

INDUSTRY AND INNOVATION (IIB) MEMBERS

~450

FACULTY, STUDENTS & STAFF



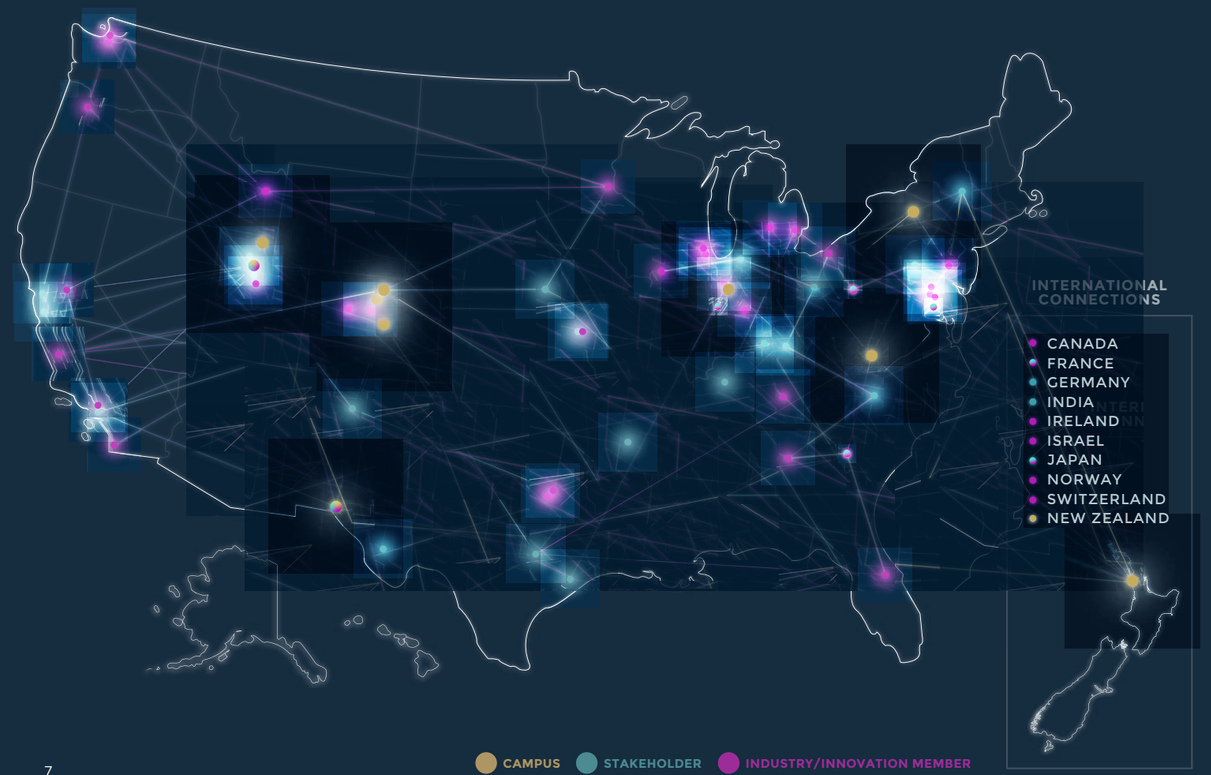
GROWTH IN ASPIRE PARTICIPANTS

Vision & Impact

Vision

The Center's unique approach will continue to focus on the nexus between transportation, electric utility infrastructure, and power systems. ASPIRE's competitive edge will continue to be in its highly symbiotic relationship between its university research partners and its professional services. This approach provides a "one-stop-shop" for access to advanced technology, workforce talent, and services, guiding society through the complex labyrinth of transforming the transportation and electric utility industries. The approach provides university partners with the path they need through technology push and pull to translate their technologies into meaningful societal impact, while providing professional development and growth opportunities in the industries to students and faculty. ASPIRE's approach is highly cooperative and partnership based. ASPIRE will continue to strengthen its partnerships with national labs and related non-profits, government agencies, and community and workforce development programs.

ASPIRE recognizes that achieving these ambitious goals cannot be done alone. This vision requires the collective efforts of our partners, stakeholders, and the broader community to make this vision a reality. We are committed to supporting the nation's goals by serving as a trusted guide, driving innovation and workforce development to track industry needs.



Vehicles drive the national economy. In the U.S. alone, they transport more than 20 billion tons of freight and travel over 3 trillion miles per year.[1] Electric vehicles (EVs) offer tremendous opportunity to strengthen the economy and improve grid resilience by reducing costs and serving as a resource to the grid. However, significant challenges remain in the pursuit of widespread adoption of EVs, and these challenges are centered around batteries, range, and supporting charging infrastructure. At the same time, nationwide, transportation and electric utility infrastructure need extensive renovation, and major investments are underway. Now is the time to rethink these industries and set in motion plans to build a future with intelligent and connected transportation and utility infrastructure, rather than to rebuild the past. ASPIRE is the first of its kind in the world to take a holistic approach to eliminating range and charging as barriers to electrifying all vehicles, from passenger cars to Class 8 trucks and beyond. ASPIRE is leading the charge by championing national grand challenges and defining the path forward for practical transitions toward cost effective electrification with energy efficiency and grid resilience.

Electrifying transportation requires more than replacing engines with batteries — it demands a complete rethinking of how vehicles, roads, and utilities work together. ASPIRE advances a systems-level approach that integrates electrified roadways, advanced charging, and intelligent energy management. This convergence enables smaller batteries, longer range, and cost-effective scaling across passenger and freight vehicles while strengthening utility networks and preparing for future autonomous and electric fleets. These innovations not only solve engineering challenges but also improve daily life — lowering costs for families, strengthening local economies, and reducing pollution in communities.

ASPIRE serves as a trusted guide for society on this important path forward. It also serves as a champion for welcoming pathways from varied aspects of life into the engineering workforce needed to support the transformative changes across industries. ASPIRE's Mission and Vision reflect its views on the important role electrified transportation will play in forging a better and brighter future for generations to come.

MISSION

Catalyze practical transitions to widespread electrification in transportation.

VISION

Seamless integration of electrified transportation with interconnected intelligent systems infrastructure.

IMPACT

Enhanced quality-of-life for all through improved air quality, economic opportunity and access to advanced, affordable transportation.

[1] https://www.energy.gov/eere/vehicles/energy-efficient-mobility-systems

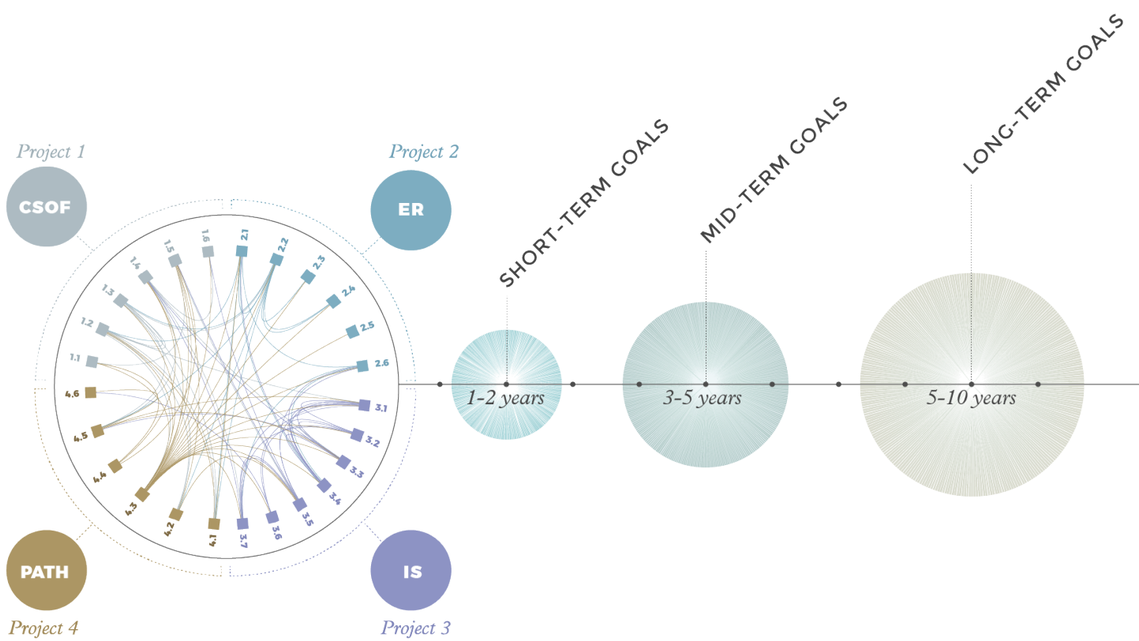
The long-term **societal impact targets** for electrification in transportation, which were outlined by ASPIRE at its launch in 2020, are intended for the entire industry and not just for ASPIRE alone:

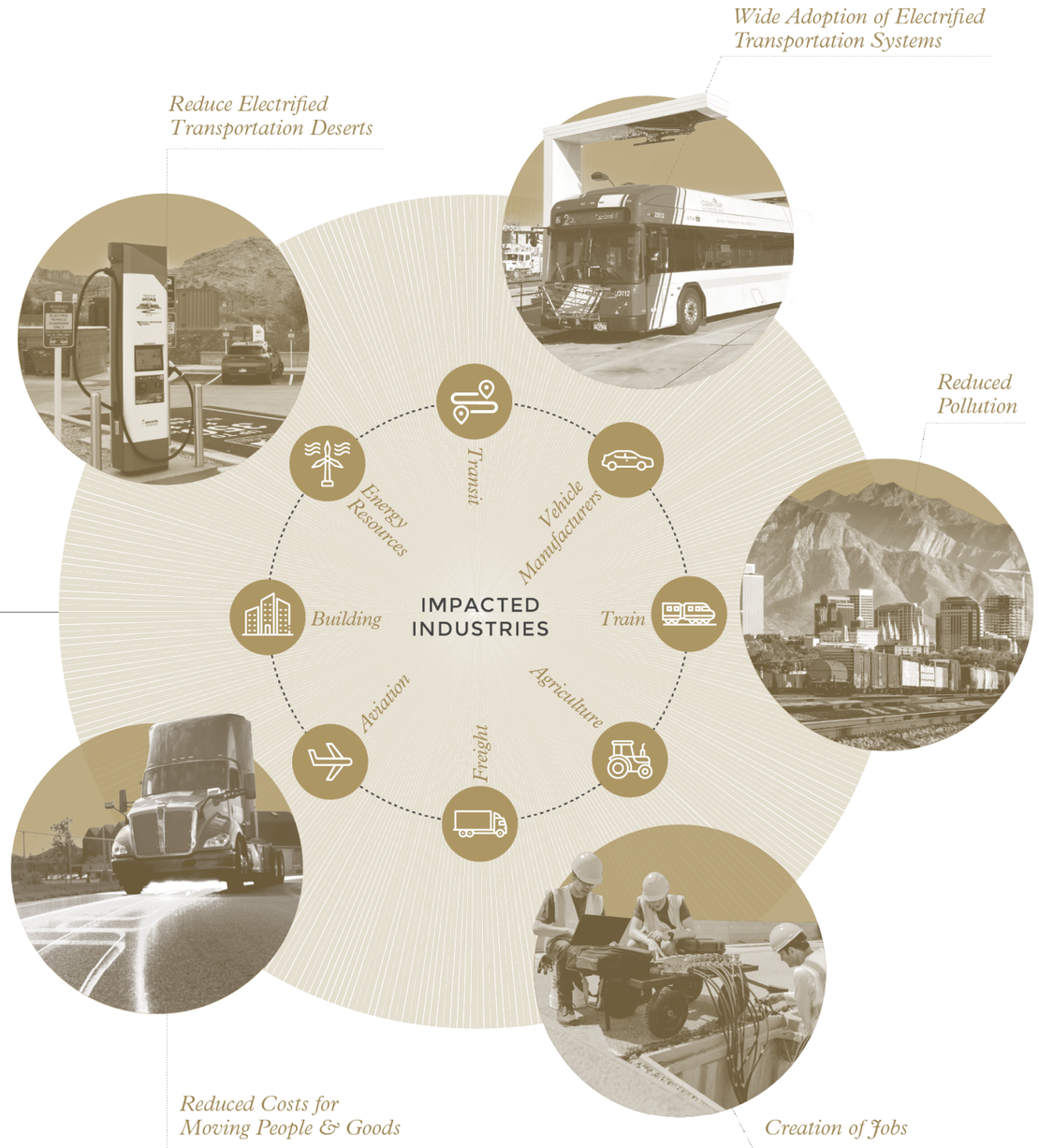
- Reduced cost to move people and goods: **Target 35% reduction in total average cost to move people and goods by 2050.**
- Widespread electrification of all vehicle classes: **Target 70% of energy used in the transportation sector is electric by 2050.**
- Reduced Pollution: **Target 60% reduction in urban air pollution emissions from transportation by 2050.**
- Creation of jobs: **Target creation of 5 million jobs and retooling more than 10 million jobs through transformations in oil and gas, transportation, electric utility and construction by 2050.**
- Increased availability in communities: **Target integrated electrified transportation planning in all states by 2050.**

	Short-Term Goals (1-2 Years)	Mid-Term Goals (3-5 Years)	Long-Term Goals (5-10 years)
Goal 1 *Charging Hardware*	Advances in high power static wireless and plug-in charging and dynamic wireless charging hardware are developed and demonstrated in ASPIRE testbeds or pilots, with active engagement of key stakeholders by Q2 2025 and impact on standards and industry perception by Q4 2025.	ASPIRE technologies in static wireless and plug-in charging and dynamic wireless charging are licensed and integrated into standardized interoperable systems solutions offered by stakeholders. Infrastructure deployment is moving beyond pilots into early deployments in multiple states, and continued advancements show improvements to key stakeholder metrics by Q2 2028.	Cost-effective systems solutions with integrated ASPIRE and partner technologies are deployed to provide seamless and ubiquitous charging experiences for a wide range of vehicle classes and user groups in cities in multiple states by 2040.
Goal 2 *System Models & Tools*	Open-source models and tools of key components for interdependent power and transportation networks are developed with active engagement of stakeholders and validated in ASPIRE testbeds or pilots by Q4 2024 with impact on perspectives of stakeholders regarding viable solutions for infrastructure deployment by Q4 2025.	ASPIRE models and tools are combined with tools from national labs and stakeholders to provide systems solutions that evaluate interdependent intelligent power and transportation networks — with metrics for resiliency, reliability, and security — and are used by stakeholders in multiple states to perform strategic planning on infrastructure deployment by Q2 2028.	Tools that combine ASPIRE, national lab, and partner technologies are widely available and used by 2040 in multiple states to plan, develop, and operate co-dependent intelligent power and transportation networks that provide resilient, reliable, and secure management of transportation and building loads in support of a decarbonized electric grid.
Goal 3 *Powered Pavements*	Methods, materials, and construction techniques are developed and validated in ASPIRE testbeds or pilots for integrating wireless charging pad, power inverter, and power distribution components in pavements for wireless charging in roadways and parking structures by Q2 2025, with active engagement of stakeholders including contractors and trade unions.	Solutions for cost-effectively building long-life roads and parking structures are validated through pilots and early deployments in multiple states and climates by infrastructure firms, contractors, and trade unions in partnership with ASPIRE by Q4 2028.	1,000 miles of interstate highways are electrified with wireless charging solutions from ASPIRE and its partners, and new technologies continue to be rolled out to improve lifetime, constructibility, maintainability, and resiliency of electric roads by 2040.
Goal 4 *Practical Transition*	Frameworks for practical transportation electrification transition plans are developed for an urban corridor by Q4 2024 with active stakeholder engagement that integrates economic, policy, user, and market perspectives; this is then generalized into modules incorporated into ASPIRE testbeds for broader use by Q3 2025.	Lessons learned from frameworks for practical transportation electrification transition plans in specific regions are expanded to consider differing regional priorities and needs and incorporated into ASPIRE testbeds for broad dissemination by Q3 2028.	Regions covering cities and rural areas in multiple states have taken coordinated action in partnership with ASPIRE to achieve practical transitions to electrified transportation considering access to jobs, improved air quality, mobility, and financial stability by 2040.
Goal 5 *Informed Public*	Audiences of all backgrounds and ages in communities with links to ASPIRE are well-informed about the implications of transportation for jobs and the economy, and become aware of the many potential benefits of electrification and opportunities for them to be involved by Q4 2025.	Audiences of all ages in communities across multiple states — beyond those with direct links to ASPIRE — are well-informed about the implications of transportation and related policies on jobs and the economy and become aware of the potential benefits of electrification and opportunities for them to be involved by Q2 2028.	Public policy makers, educators, and professionals across the nation are equipped with consumer and market insights that allow them to develop effective outreach and communication activities to support practical electrification by 2035. A majority of the nation is prepared to make informed decisions on public policy and personal choices related to electrified transportation systems by 2040.
Goal 6 *Ready Workforce*	Pathways for a ready workforce are developed with active engagement of local stakeholders, and launched in communities with links to ASPIRE by Q4 2025 to support the early transition stage of transforming industries impacted by electrified transportation systems.	Broadened pathways are available and expanded across multiple states by Q4 2028 for a prepared workforce, supporting the accelerating transformation of industries impacted by electrified transportation systems. This is achieved through nationwide partnerships in distributing pre-college and college curricula training programs for skilled workers, best practices in community engagement, and a Center-wide culture of entrepreneurship and innovation.	Significant STEM capacity is evident across the nation specifically aligned to support the workforce needs of electrified transportation by 2040. A prepared workforce is ready to contribute to the rapidly transforming power and transportation industries by supporting increased productivity, industry and policy decision making, technology adoption, and economic growth by 2040.

Center Impacts

This graphic illustrates how ASPIRE's research project — Charging Stations of the Future (CSoF), Electrified Roadways (ER), Integrated Systems (IS), and Pathways (Path) — are built on a foundation of the Center's Strategic Pillars: Convergent Research, Electrification Workforce Development, and Innovation Ecosystem. The efforts of these projects strategically align to achieve short-, mid-, and long-term goals ultimately driving societal impacts. ASPIRE aims to improve quality of life on both local and global scales.We recognize these efforts require collaboration and consideration from industries related to electrified transportation systems.





Impact

ASPIRE is already having an impact in targeted regions across multiple states and is on a strong trajectory to achieve broad national and international impacts.

Schools & Communities

- ASPIRE's Creative Engineering Design course has been launched on TeachEngineering. This builds on Years 1-3's efforts piloting the course at schools in Colorado, Indiana, Utah and Texas. The curriculum highlights an EV design challenge, StoryMaps, plus teacher professional development (PD), and it has been expanded to include additional ASPIRE-related resources in one open access hub.
- Successfully implemented a research program for high school students (Youth Engineering Scholars of Electric Vehicles (YES-EV)).
- Strategic partnerships established with three international labor and trade organizations and one technical community college.
- Successful student cohort model resulting in student professional development, including full-time hires, conference panel invitations, and networking opportunities.

National & International Attention

ASPIRE is bringing international attention to key developments, including technological innovations from wireless charging to smart charge management, to community engagement. Highlights include:

- ASPIRE organized the 8th biennial Conference on Electric Roads and Vehicles (CERV) in Park City, UT, which brought together nearly 200 of the top policy makers, industry executives, and research leaders from around the world to discuss real-world results and paths forward from pilots to deployments.
- ASPIRE continues to have strong presence on panels, presentations and events at the annual meeting of the National Academies Transportation Research Board in Washington, D.C.
- ASPIRE has established collaborative relationships with the Midwestern and pacific northwestern regions of the Laborers' International Union of North America (LiUNA) and the American Federation of Labor and Congress of Industrial Organizations (AFL-CIO) with engagement on coordinated technology solution and training program development around ASPIRE technologies.



Broad ecosystem of an energy economy anchored around transportation electrification and its interdependencies with electric utility from generation to load.



ASPIRE's Chief Commercial Officer, Michael Masquelier (left) on a CERV panel discussing the latest updates to intelligent connected autonomous vehicles.

Pilot Projects

ASPIRE has raised nearly $70 million in funding for pilot demonstration projects that expand its testbed resources beyond university programs to real-world scenarios in public settings and end users. These pilots are in place in Utah and Indiana — with others in development in Florida, Nebraska, and beyond — all gaining national and international attention in the media.

Trusted Guide For State Policy & Investment

- In 2023, the State of Utah designated ASPIRE as the lead research institution for statewide strategic planning for transportation electrification during the legislative session (Senate Bill 125). The Utah Electrification Initiative works with a steering committee composed of state agencies, electric utilities, and transit agencies who collaborate with ASPIRE on the electrification planning to lower costs while improving infrastructure. The state provides $2.1 million per year to ASPIRE support this initiative.
- In connection with its statewide responsibility, ASPIRE is developing an urban multimodal corridor electrification plan for Utah. This plan is being crafted in partnership with more than 20 partners including the state's leading utility and transit agency, national labs, and key state government agencies. The project is co-funded by the U.S. Department of Energy (DOE) and the State of Utah.
- ASPIRE is providing professional guidance to state agencies and roadway owners and operators in Utah, Indiana, Michigan, Nebraska, Pennsylvania, and Florida on pilot projects for electrified roadways and associated technologies.
- ASPIRE has achieved a first in the world achievement toward international standards on in-road wireless charging by leading pilot deployment and testing of four dynamic wireless charging systems in Utah for the Society of Automotive Engineering (SAE). These systems include solutions leading to pilot deployment from ASPIRE and three industry partners.

Scaling Public-Private Partnership (P3) Pilots

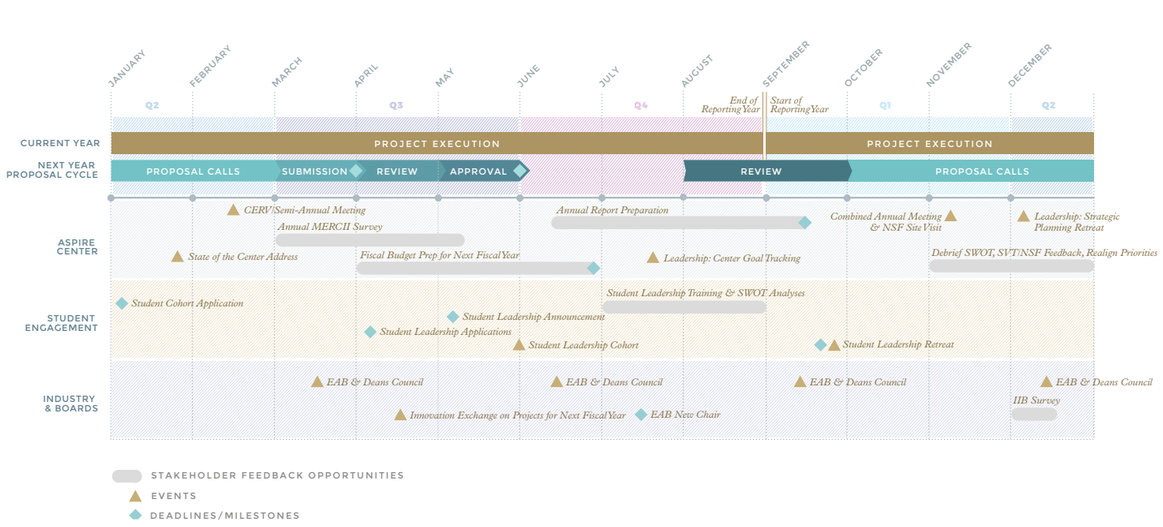
- **INDOT Pilot:** ASPIRE's pilot out of Purdue with the Indiana Department of Transportation (INDOT) is one of the nation's first public-private partnership (P3) deployments demonstrating dynamic wireless power transfer on a public highway. This project brings together state leadership, industry, and ASPIRE researchers to test and showcase the feasibility of charging electric vehicles while in motion — paving the way for scalable, real-world deployment of electrified roadways.
- **Utah Inland Port Living Lab:** At the Utah Inland Port, ASPIRE is bringing together state agencies, utilities, industry leaders, and labor groups to demonstrate next-generation charging solutions. By combining megawatt-level stationary charging with dynamic wireless power transfer (DWPT), the project is testing scalable models for electrified freight that address infrastructure, business, and air quality goals.
- **Software Development:** ASPIRE's Reliability Dashboard is a software tool to provide advanced visualization and management of fleet assets and charging infrastructure. This tool enables smart operation and maintenance, helping industry and community partners improve reliability, efficiency, and planning for electrified transportation systems, and is already being deployed by the two largest transit agencies in Utah.

More on ASPIRE's pilots and deployments can be found on pg. 75.

Strategic Plan

As the Center continues to grow in size and scope, it has become increasingly important to revisit and clarify leadership roles, responsibilities, and accountability structures. In Year 5, the leadership team addressed these areas to better reflect ASPIRE's expanded vision and ensure continued effectiveness. In addition, the development of clear onboarding and offboarding procedures has become a key priority, supporting smooth transitions and strengthening institutional continuity. ASPIRE remains committed to advancing innovation through purposeful collaboration, and we welcome continued partnership in shaping the future of electrified transportation.

ASPIRE'S ANNUAL CONTINUOUS IMPROVEMENT CYCLE



Year 5 Key Objectives & Outputs:

Incorporate Stakeholder Feedback

Implemented feedback from Year 4 Site Visit to plan Leadership Strategic Planning Retreat, which informed improvements to our project proposal, planning, and selection processes — enhancing transparency and strategic alignment across the Center.

Strengthen Strategic Planning Frameworks

Enhance the project proposal and selection process for alignment with Center goals and partner priorities: The Year 5 proposal process included input from the Center's research area leads and our industry partners and provided valuable feedback to the project teams.

Operationalize the Logic Model

Refine and apply the logic model to guide Center activities and track progress across projects: The Center's assessment team has become integrated into all Center operations to ensure efficiency and accordance with the logic model.

Clarify Leadership Structure

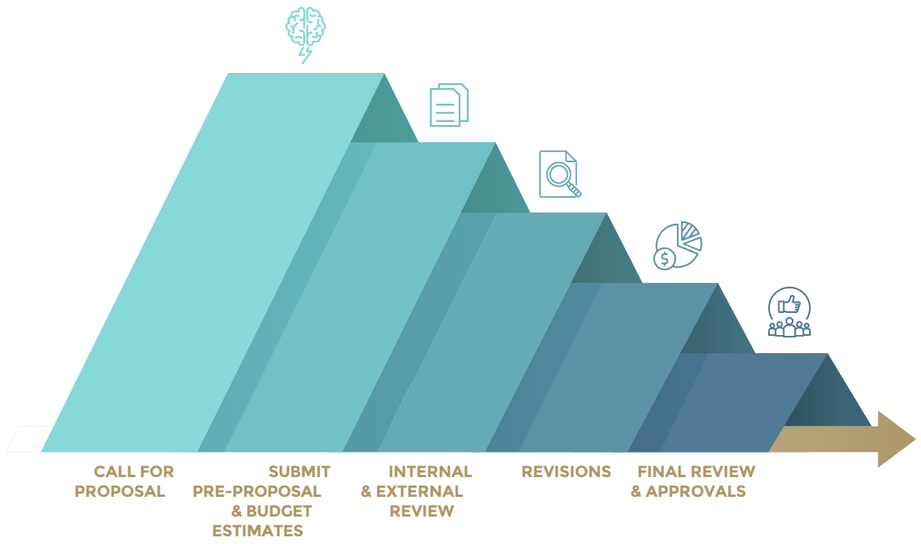
Define roles, responsibilities, and accountability measures to support a growing, multidisciplinary organization: As the Center continues to grow, leadership will monitor how the needs of our participants, stakeholders and deliverables are being met and assess any need to update our organizational system accordingly. Additionally, it is critical that ASPIRE continues to incorporate expertise from various disciplines and capabilities and evaluate how to integrate those perspectives into the Center's research strategy.

Institutionalize Transition Processes

Establish formal onboarding and offboarding protocols to ensure operational efficiency: A collaboration between project management, campus directors and assessment has refined the transition process to maintain a streamlined and accurate database of participants status and collect feedback to improve the experience of Center participants.



A guest of ASPIRE's Technology Showcase examines the Falcon electric class 8 truck.



CALL FOR PROPOSALS

- Leadership reevaluates center goals, priorities & requirements, and creates proposal call
- Leadership assigns general budget guidelines to project areas for the call for proposals
- Project management team release proposal call and budget templates

SUBMIT PRE-PROPOSAL & BUDGET ESTIMATES

- Faculty across Center organize cross-disciplinary and cross-campus teams and develop and submit pre-proposals with budget estimates, project overview, project milestones with alignment to center goals and task descriptions

INTERNAL & EXTERNAL REVIEW

- Proposals are reviewed by leadership
- Industry & Innovation Board members and external stakeholders participate in proposal review survey

REVISIONS

- Leads from project proposals receive feedback, coordinate with their project teams, then submit full proposals that include associated project plans, task milestones with alignment to project milestones full budgets and full project scope
- Center leadership coordinates iterative process to refine and/or merge proposal components with the project leads to align with Center budgets and priorities

FINAL REVIEW & APPROVALS

- Leadership performs final review and approval of project proposals, finalizes next year Center budgets, submits budgets to NSF and additional sponsors, and provides project awards to faculty across the campuses for the projects.

Proposal Process

The leadership team has taken concrete steps in Year 5 to strengthen internal review mechanisms, increase the selectivity and strategic alignment of internal funding decisions, and formalize performance metrics for proposal evaluation.

Performance metrics:

- *Alignment with center goals*
- *Industry/external partner involvement*
- *Proposals advancing center testbeds or research goals*
- *Proposals addressing Year 5 strategic priorities*

We now systematically collect and share reviewer feedback with proposers. This feedback serves multiple functions:

- **Improves Proposal Quality:**
  Review comments, highlight strengths and areas for improvement, guiding teams on future submissions to ASPIRE or external agencies.
- **Supports Team Formation:**
  Identifies skill gaps or partner needs, prompting the addition of collaborators across institutions, disciplines, or with industry connections.
- **Promotes Mentorship:**
  Junior faculty benefit from constructive guidance, with senior researchers and research leads available to help revise proposals and encourage re-submission.

While ASPIRE's internal funding rate was high in early years to catalyze activity across institutions, Year 5 proposals were critically reviewed and filtered by research area leads and industry partners to identify potential merit, feasibility and contribution to center goals.

Scan this code to connect with us!

Strategic Pillars

Convergent Research

The early 20th century opened the development of the transportation and electric utility infrastructures that continue to serve as the backbone of modern society. Although in large part established in tandem, they have remained, even today, largely decoupled. ASPIRE, since its inception, has been focused on developing a transformative coupling of these infrastructures to form an integrated system that is far superior. Superior for fleet operators looking to reduce total cost of ownership of their vehicles. Superior for the utility operators, who look for new markets and technologies that help balance and support their networks during peak loads. Superior for communities looking to reduce air pollution and reduce the potential dependence of transportation systems on rare-earth materials sourced outside the United States.

Year 5 witnessed a big step toward infrastructure coupling. Eighty-five ASPIRE-developed transmitters were deployed in the Indiana Pilot on US231/52. The coils leverage ASPIRE's fundamental research on using symmetrical component analysis to optimize the design of 3-phase wireless power transfer (WPT) transmitters and receivers. An ASPIRE measure, the 'sequence-coupling factor (SCF)' was indeed developed to quantify coil quality. One of the key questions answered in the Indiana Pilot this year was whether a target SCF could be maintained through a multi-stage electrified roadway fabrication and installation process. The answer was a resounding yes, as all eighty-five coils met, with the vast majority well below, the target <5% SCF. ASPIRE also broke the record for wireless power transmitted on a US roadway (>200 kW). Several ASPIRE industry partners, including AECOM, P.C. Krause and Associates, and Cummins Inc. have been played key roles in the development of the Indiana Pilot success.

Across the country, at Utah's Inland Port, ASPIRE is in the process of demonstrating their vision of the service station of the future, where MW-level electric power will be delivered across vehicle classes. Here, the team is in collaboration with Kenworth, WAVE, Rocky Mountain Power, and the local unions to not only install MW-class stationary chargers at the Inland Port, but also look to implement efficient, controllable ties to the grid that leverage ASPIRE's unfolding circuit topologies. ASPIRE is also working with industry partner Electreon to deploy their DWPT system on the port roadways. The Electron installation as a 2nd DWPT pilot and enables ASPIRE to evaluate the integration of stationary, semi-dynamic, and fully dynamic wireless power transfer technologies to balance multiple performance objectives, including financial feasibility, impact on air quality, etc. In addition, in Year 5 USU has been supporting technology transfer through development of WPT standards with the Society of Automotive Engineers (SAE) and in particular configuring the EVR to enable SAE Standards-based testing. The SAE testing has helped facilitate ASPIRE's CFX DWPT Pilot development by enabling early testing of the ENRX high-power DWPT system at the EVR.

As colleagues view construction activities, a question often raised is whether ASPIRE has moved beyond fundamental research. The answer is of course, no. Looking toward the ASPIRE roadmaps, it is clear there are many fundamental questions to address. In Year 5 these have included how ASPIRE's charging approaches will impact battery lifetime and cost, what impact will electrified roadways have on the utility distribution network, what impact will service stations of the future and electrified roadways have on electrified transportation adoption rates, and what construction techniques/materials can be used to minimize the cost of ERs. A goal in addressing these is to push the technologies forward so that in years 10-20 of ASPIRE, we will move society from pilots measured in fractions of a mile, to interstate instantiations operating not only across our nation, but across many nations. ASPIRE's efforts on workforce development is placing our transportation and utility industries as leaders in the coupling of infrastructures.

Electrification Workforce Development (EWD)

The Electrification Workforce Development team has always understood that ASPIRE personnel would never be able to personally deliver all the different types of training at different levels that will be needed to support a workforce that can design, build, and maintain a nationwide infrastructure for electric vehicles. Especially considering the role of EWD in transitioning to a post-NSF-funding future, the EWD team has been working to position ASPIRE to influence workforce development through multiple strategies — developing workforce readiness directly, partnering and recognizing workforce development from other sources, and modeling the workforce development ecosystem.

Developing workforce readiness

ASPIRE has had extraordinary success in pre-college curriculum development. As we look to develop workforce readiness in other parts of the EWD ecosystem, even train-the-trainer approaches will require a more substantial commitment than ASPIRE personnel can support alone, so we have begun to engage with others who will conduct train-the-trainer activities.

In addition to ASPIRE's existing Research Experience for Undergraduates (REU), new funding has been secured for an international research opportunity. The Cultural Awareness and Research Experiences for Electric Vehicles (CARE-EV) International Research Experience for Students (IRES) project prepares students to engage in research on a global scale that utilizes core international partner the University of Auckland (UoA) in New Zealand. This objective is accomplished through an international partnership between ASPIRE and the UoA, where students will participate in innovative exploration centered around convergent research projects on high- and low-power wireless EV charging infrastructure that will enable future EV charging stations and in-motion charging through electrified roadways.

Partnering and recognizing workforce development from other sources

Following feedback to deepen engagement on university campuses and with industry members, ASPIRE leadership have retooled the Student Leadership Council (SLC) for Year 6 as the Council of Presidents. Members of this newly formed Council will participate in a Student Leadership Retreat during the first quarter. In addition, we are developing an enhanced Industry Engagement Cohort track, which will be extended in duration and is slated for spring. *(See Annual Improvement Cycle on pg. 15 for more.)*

The Center is also introducing digital badges for both Undergraduate Research and Industry Engagement. These credentials will be shareable and can be linked directly to students' LinkedIn profiles, providing greater visibility for their achievements. We plan to design digital badges for Entrepreneurship, Leadership, and Professional development, coinciding with a certificate program and badging system to address key skills gaps as identified by our innovation ecosystem.

Modeling the workforce development ecosystem

Projects such as the national system of railways, the interstate highway system, and the internet were enabled by radically different technology pathways and business models, but they all resulted in national infrastructures that drove economic development — they've also been targeted by ASPIRE researchers to decipher lessons to inform ASPIRE's vision.

Partnership with the Indiana Department of Transportation (INDOT) on a project to map stakeholder engagement in Indiana's electrification ecosystem and study infrastructure readiness assessment will address the fundamental question: What policies, coordination mechanisms, and regulatory frameworks must INDOT and other government agencies establish to support Indiana's rapidly evolving electrification ecosystem while ensuring safety, reliability, and economic competitiveness?

In conjunction with Project 4: Pathways, EWD is creating a workforce readiness level (WRL) rubric that can be used to evaluate the workforce skills and personnel needed to make various technologies a reality. This framework is a big step forward in modeling workforce needs and will better integrate EWD across ASPIRE in the coming year.

Innovation Ecosystem

In Year 5, ASPIRE's innovation ecosystem expanded significantly, adding 10 new members and growing to nearly 70 total, while deepening collaboration across industry, government, and academic sectors. Technology transfer advanced through an active IP pipeline, including 39 issued patents and a growing number of filed patents and disclosures. Industry and stakeholder engagement were strengthened through high-impact events, including Industry & Innovation Day, as well as expanded participation in national conferences and international partnerships. Together, these milestones reinforce a robust feedback loop between ASPIRE's research and its ecosystem. This year's efforts have laid critical groundwork for ASPIRE's evolution into a self-sufficient center, marking a pivotal step toward long-term resilience and growth.

Ever Growing Engagement

The Year 4 Industry & Innovation (IIB) Day was the largest and most successful IIB Day to date, with over 300 attendees and nearly 50 industry and innovation members in attendance. ASPIRE was able to connect with the ecosystem and expand on all of our many achievements from Year 4.

TRB Conference

ASPIRE faculty and students participated in the 2025 Transportation Research Board (TRB) conference, the largest transportation related conference with over 13,500 attendees. ASPIRE's Innovation Director, in partnership with NAPA, presented to a committee.

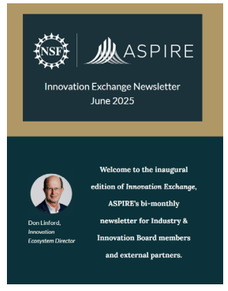
Student Leadership Council (SLC) Cohort Trip

The 2025 SLC Cohort trip to Raleigh and Atlanta presented students with the opportunity to connect with IIB members and be exposed to real-world industry challenges, emphasized a spirit of entrepreneurialism, and supported long-term talent development within ASPIRE's ecosystem.

Industry Presentation Highlights

Dallas-Fort Worth Airport, one of ASPIRE's innovation members, featured ASPIRE in its April Wisdom Wednesday series to explore electrification and infrastructure innovation. Over 100 attendees joined ASPIRE's presentation and discussed opportunities for future collaboration. ASPIRE joined PennDOT, Clean Cities Pennsylvania, and Pittsburgh Technology during the Pennsylvania Turnpike's Earth Week panel to discuss how collaboration and innovation can accelerate progress toward shared goals.

External Newsletter Launch



The launch of ASPIRE's inaugural bimonthly newsletter enhanced communication with external partners by providing consistent updates on research progress, member highlights, and ecosystem initiatives. This new channel has strengthened relationships, increased visibility into ASPIRE's impact, and created new opportunities for engagement and collaboration.

TECHNOLOGY TRANSFER

39	17	1
PATENTS ISSUED TO ASPIRE	PATENT DISCLOSURES IN THE PIPELINES	SPIN-OUT COMPANY *(OPTIMIZED KINETICS)*

Stakeholder Engagement & New Partnerships

8th Conference on Electric Roadways and Vehicles (CERV)

ASPIRE's seminal biennial international conference drew nearly 200 participants from industry, government and academia representing an almost 60% increase from the previous conference.

Alliance for Automotive Innovation (AAI)

ASPIRE has been invited to be part of the inaugural Academic Advisory Board for AAI. Center leaders will provide academic expertise on technology, safety, environmental policy, and workforce initiatives.

University of Tokyo (UoT)

ASPIRE supported a funding application submitted to the Japan Science and Technology Agency (JST) to fund an international academic exchange between the UoT and ASPIRE students and faculty.

Mitsubishi Research Institute (MRI)

A strong international partnership, ASPIRE supports MRIs efforts to further the expansion of inductive charging, including onsite visit with ASPIRE pilot stakeholders.

ASPIRE Agency Pilot Working Group (AAWG)

Formed as an outcome of the 2024 Industry & Innovation workshops, the AAWG unites nine agencies, both ASPIRE members and non-members, to collaboratively drive innovation in dynamic wireless power transfer (DWPT) for heavy-duty vehicles.

New Industry & Innovation (IIB) Members

INDUSTRY

Leading provider of advanced pavement preservation products.

Startup company focused on workforce development and is an ASPIRE industry member.

LAUREL GROUP
insightful • transformative • enduring

Startup consulting firm specializing in infrastructure solutions.

Startup company delivering AI-driven roadway intelligence.

INTERNATIONAL

Tier One global automotive technology supplier.

Leader in energy management and automation, providing integrated solutions for self-sufficiency.

Leading engineering consulting firm providing technical expertise across various sectors.

INNOVATION

National nonprofit organization dedicated to advancing transportation solutions.

User-fee system that operates 294 miles of roadways.

INTERNATIONAL

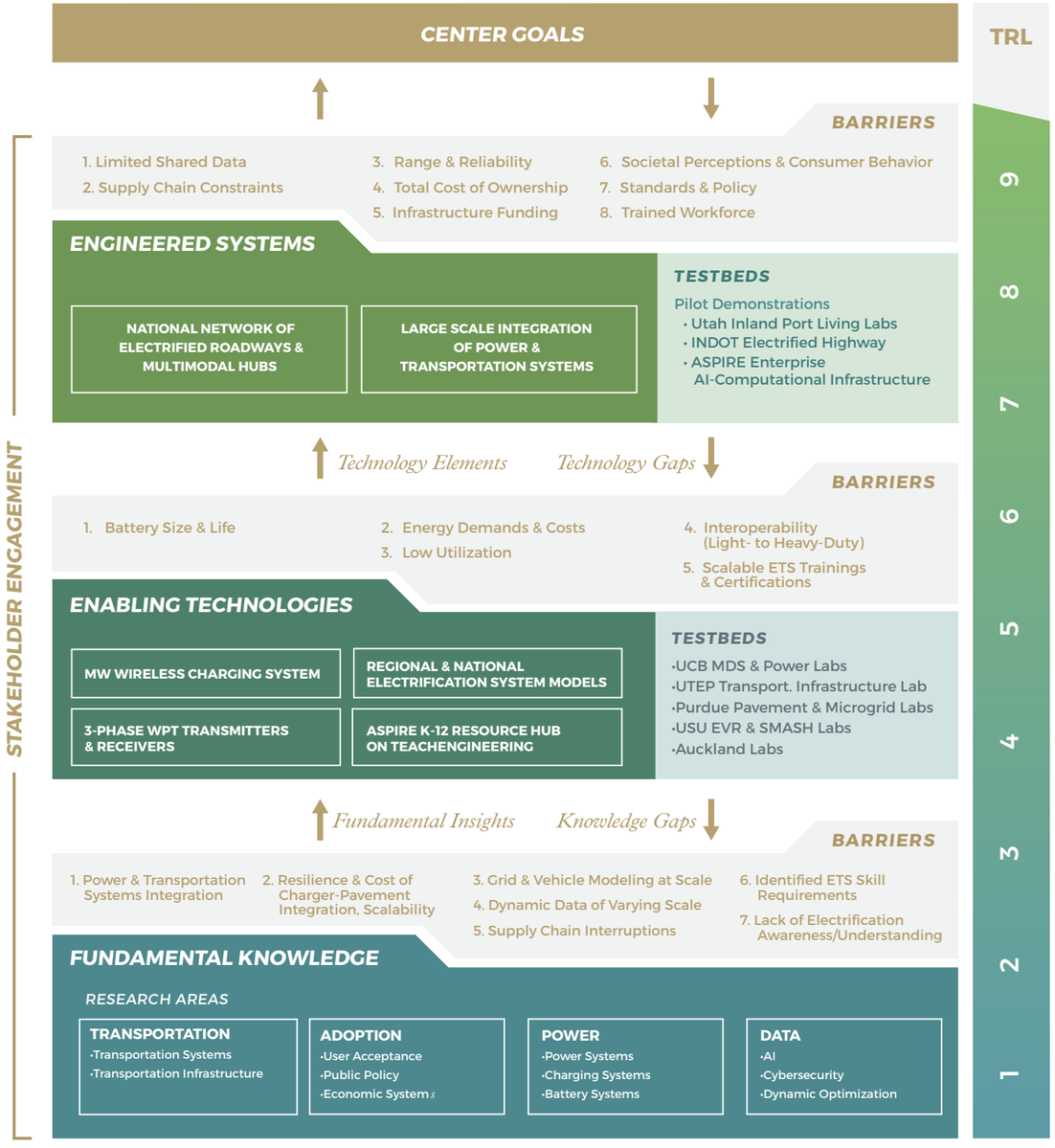
CONCRETE MASONRY & HARDSCAPES ASSOCIATION

Trade association representing U.S. and Canadian producers and suppliers in the concrete masonry and hardscape industry.

Student leaders from across ASPIRE's campuses attend Industry-integrated cohort trips where they meet mentors and see electrification efforts firsthand.



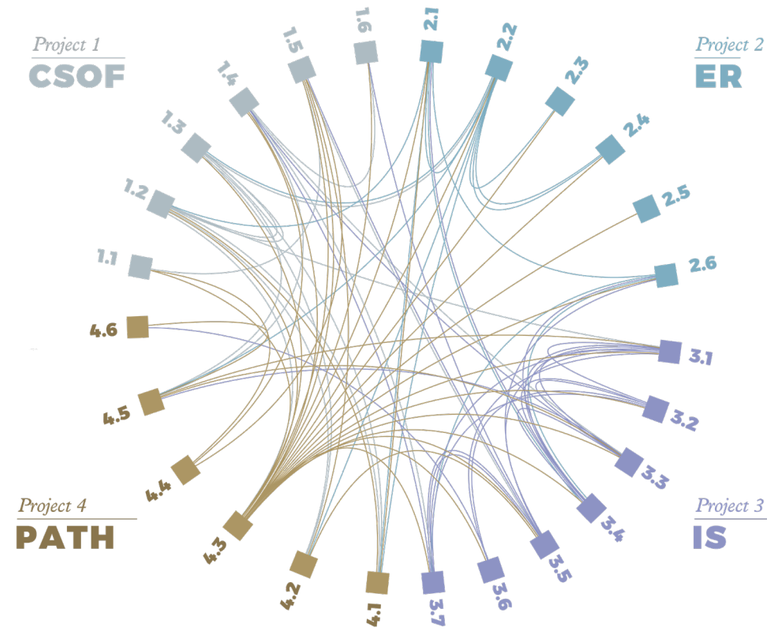
ASPIRE 3-PLANE STRATEGIC PLANNING CHART



ASPIRE's 3-plane Strategic Planning Chart *(above)* defines the Center's convergent research efforts across three planes: Fundamental Knowledge, Enabling Technologies, and Engineered Systems. With ASPIRE's "moonshots" setting the goal posts, efforts in the lower planes form scaffolding, refined and validated through testbeds and stakeholder inputs.

See the Projects section to see the 3-Plane Strategic Planning Chart in action.

PROJECT CONVERGENCE



CONVERGENT RESEARCH OUTCOMES

Feasibility Analysis – Developed economic models to establish feasibility of electrified roadways. Established that the economic viability of ERs is contingent on the number of heavy-duty vehicles. (*P2, P3*)

EV Adoption and Usage – Established and assessed data of adoption rates, public perception, and usage patterns of EVs. Data is leveraged to assess economic viability of charging infrastructure. (*P1, P2, P3*)

Technical Feasibility of Charging Solutions – Coupled electrical, thermal, structural models and testbeds developed to design and assess ASPIRE's (and partners') stationary and dynamic charging solutions. (*P1, P2*)

Engaging Policymakers – Presented ASPIRE's ubiquitous charging vision and approaches to state and federal departments of transportation, lawmakers, and industry leaders. Led to the enhancement of the EVR, now the center of ER technology demonstrations in the U.S., and the development of pilots in multiple states. (*P1, P2, P3, P4*)

Engaging Infrastructure Builders – Through EVR and pilot project developments, transferring ASPIRE technologies to roadway construction industry, which is leading to simpler, more cost-effective infrastructure enhancement. (*P1, P2, P3, P4*)

Public Outreach – Through a multitude of media outlets, engaged the public on the EV infrastructure needs and solutions, reaching more than 1 billion people. (*P1, P2, P3, P4*)

Educational Outreach – Resources, including classroom and laboratory curriculum and demonstrations, have been created for students from K-12 through graduate school. These have been leveraged within ASPIRE's YES-EV and REU programs. (*P1, P2, P3, P4*)



Management & Organization

ASPIRE Headquarters, Logan, UT

ASPIRE is headquartered at Utah State University and operated through strategic partnerships with core partners Purdue University, University of Colorado Boulder, University of Texas at El Paso, and the University of Auckland New Zealand. Additional affiliated partners include Colorado State University, Cornell University, University of Colorado Springs, University of Utah, and Virginia Tech. Global partnerships with industry, state agencies, and non-profits include more than 60 companies and organizations across industries related to transportation and electric utility, as well as critical strategic partnerships with four national labs: Idaho National Laboratory, National Renewable Energy Laboratory, Oak Ridge National Laboratory, and Argonne National Laboratory. Detailed information, including the names, titles, departments, and organizations for all leadership and staff members, as well as advisory boards, and IIB members can be found in the "Leadership, Boards, and IIB Members" section at the end of this report.

Roles & Responsibilities

A large focus in leadership's Year 5 strategic planning retreat reviewed important processes and Center personnel structures to ensure efficiency and streamlined communication. There was special attention paid to the roles of the Strategic Pillar directors (formerly REDI directors), research area leads, and project leads. As defined in the meeting, the Pillar directors are responsible for providing strategic oversight and setting priorities for the research teams to align with their proposals and task descriptions. Research area leads work with the Pillar directors (Convergent Research, Electrification Workforce Development, and Innovation Ecosystem) to steer projects to meet the goals set by directors and Center leadership. Additionally, area leads are crucial in helping to identify how the projects' work can be realized through publications, grants and other Center-wide activities. The project leads oversee the implementation of these efforts in the individual projects, tasks and milestones. The project leads are also responsible for ensuring the project team completes the outlined work in the appropriate timeframe. The project management team supports the research teams and encourages cross-institutional collaboration. The project managers attend project meetings, track all relevant project metrics to ensure appropriate progress is being made and approve any changes to scope or resources through change of request forms and quarterly reports.

More on future plans for ASPIRE's roles and responsibilities can be found in the Self-Sufficiency Plan section on pg. 79.

Campus Highlights

Utah State University (USU)

At the heart of this research enterprise is ASPIRE's state-of-the-art Electric Vehicle & Roadways (EVR) facility which serves as a one-of-a-kind national testing ground for electrified infrastructure and has attracted collaborators from around the world.

Student Engagement

ASPIRE at Utah State University (USU) is transforming the educational journey of its students through hands-on experiences, national recognition, and career-focused learning in electrified transportation. Former USU ASPIRE student Marium Trasheed won the prestigious IEEE Industry Applications Society's Ph.D. Thesis Contest, a testament to the program's academic excellence. USU Undergraduate researcher William Bouck presented his study on EV adoption among gig drivers at the 2025 Research on Capitol Hill, highlighting Utah State University's student contributions to public policy conversations. Students also benefit from immersive experiences — such as touring Oldcastle Infrastructure's pre-cast pavement facility in Ogden, UT — and gain global exposure, with students like Johanna Mayfield competing in the UAE Electric Vehicle Grand Prix. ASPIRE Graduate student Sajid Hasnat was awarded the Marketing & Strategy department as well as the Jon M. Huntsman School of Business' Outstanding Graduate Researcher of the Year award. The USU ASPIRE Student Association fosters a strong sense of community through events like campus luncheons and team-building tournaments, enriching student life at Utah State.



Faculty Engagement

Faculty at Utah State University are at the forefront of electrified transportation innovation through ASPIRE's interdisciplinary research and national leadership. A key highlight was the 8th biennial Conference on Electric Roads and Vehicles (CERV), hosted in Utah and organized by Utah State faculty in collaboration with international faculty from the University of Auckland. This major international event brought together 200 participants from 14 countries and over 100 organizations, establishing Utah State as a central hub for global transportation dialogue. Faculty have also represented ASPIRE at premier events like the Advanced Clean Transportation (ACT) Expo and the Society for Consumer Research Annual Conference.

Community Engagement & Outreach

ASPIRE's work at Utah State University extends far beyond campus, delivering substantial benefits to communities across the state of Utah. Through the Utah Electrified Transportation Initiative's regional listening tours, ASPIRE engages local policymakers, residents, and industry stakeholders to co-develop transportation solutions tailored to Utah's rural and urban communities. ASPIRE also plays an active role in Utah's statewide policy discussions by leading the Utah Electrification Initiative. This includes participating in events such as the Utah Association of Counties' Building Utah and Legislative Management Conferences to present innovative ideas in electrified mobility. The center works closely with Utah State University Extension, leveraging its vast network to deliver public learning and outreach programs statewide.



University of Texas at El Paso (UTEP)

ASPIRE at University of Texas at El Paso (UTEP) has made major stride in the research related to electrified roads, specifically asphalt roads that makes up more than 90% of the paved roads in the U.S. Our newly operational model accelerated testing facility allows to integrate the numerical modeling with experimental data.

Student Engagement

Student Leadership Council (SLC) representatives from UTEP have been extremely active in the overall governance of the SLC from the beginning. Our student-oriented teaching faculty recruited last year as the student advocate, is successfully coordinating the UTEP ASA activities within and among UTEP student organizations.

Faculty Engagement

In the last five years, the number of ASPIRE's UTEP faculty and research staff engaged in research has increased from six to 15. Several of the added members are currently in the leadership positions. One of the recent PhD students has transitioned to a full-time Research Scientist.

Community Engagement & Outreach

ASPIRE's community engagement work at UTEP focuses on developing and disseminating informational and educational resources to and for the local community — particularly in under-resourced areas. Efforts have included developing educational materials (including those targeting K-Gray audiences), creating informational flyers about EV-related technology and research taking place at UTEP and other ASPIRE-affiliated campuses, and other resources for potential careers in electrified transportation systems.

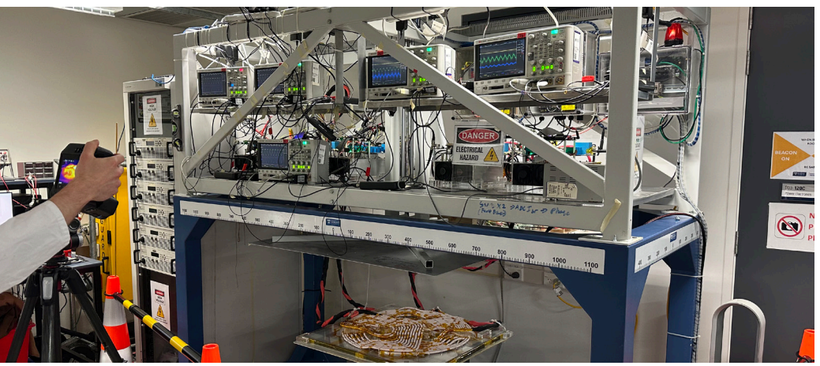
To encourage seamless transition of students from community college to four-year college, we have offered paid research assistantships to three El Paso Community College through ASPIRE funds.

University of Auckland

The University of Auckland, as the only fully international collaborating member of the ERC, is committed to advancing Center Goals despite receiving no direct funding from ASPIRE. The university's researchers collaborate through a New Zealand Government MBIE Endeavour Research project led by Prof. Grant Covic. This project unites multidisciplinary teams across various departments and centers within the Faculty of Engineering and the Faculty of Business and Economics, working towards innovations in wireless charging and electrified transportation.

The UoA MBIE Endeavour Research Team collaborates with GNS Science, a New Zealand Crown Research Institute, and the Victoria University of Wellington Robinson Research Institute. The Accelerated Pavement testing facility, sited at Downer NZ's (a large civil construction industry partner based in Australasia) Asphalt Mix manufacturing plant, has been further enhanced for accelerated testing of integrated wireless pad–pavement systems to enable extended pavement testing. This collaboration with a world leading infrastructure company coupled with multiple international academic visitors this year is helping Auckland position ASPIRE for ongoing research partnerships in electrified transportation.


University of Auckland



Student & Faculty Engagement

ASPIRE's faculty and students at Auckland University in New Zealand had an excellent year with over 30 publications in prestigious society journals and conference proceedings. Presentations on ASPIRE-related research on Wireless Roadway Electrification were made by the Auckland research team to industry and technical conferences over the last year in New Zealand, Australia, Korea, Japan, Italy, Portugal, Netherlands, Norway, Sweden, Czech Republic, Germany, and Poland.

The design, modeling and testing of wireless inductive pad typologies at increasing power level and complexity have continued to developed along with methods of designing long-term, durable surrounding asphalt pavements, and two Ph.D. degrees were awarded to ASPIRE doctoral candidates.

Starting in Year 6, the University of Auckland is excited to host ASPIRE's first international Research Experience for Undergraduates.

Purdue University

From the Center's first real-world demonstration of Dynamic Wireless Power Transfer (DWPT) on a public highway to a successful integration of undergraduate through post-doc research, ASPIRE researchers at Purdue are advancing the development and testing of wireless charging technologies, contributing campus expertise and facilities to accelerate the transition from lab-scale innovation to real-world deployments.

Student & Faculty Engagement

ASPIRE's faculty and students at Purdue had a great year with multiple grants awarded and publications in prestigious society journals, national awards received, degrees awarded, and — most notably — the completion of construction and beginning of testing of the dynamic wireless power transfer system embedded on a major public roadway in West Lafayette, Indiana. The public/private partnerships emerging as a result of the Indiana Pilot and REU/REM programs, are helping Purdue position ASPIRE for long-term leadership in electrified transportation.

Two state-of-the center meetings were held on Purdue campus during Year 5 (on September 13, 2024, and April 1, 2025). ASPIRE faculty and students were asked to present about their background and interests and provide their Year 5 progress to-date plus their plans for Year 6. Purdue also hosted the ASPIRE leadership retreat on May 6-7, 2025, with over 30 ASPIRE leaders attending.


Purdue University

University of Colorado — Boulder (UCB)

Student Engagement

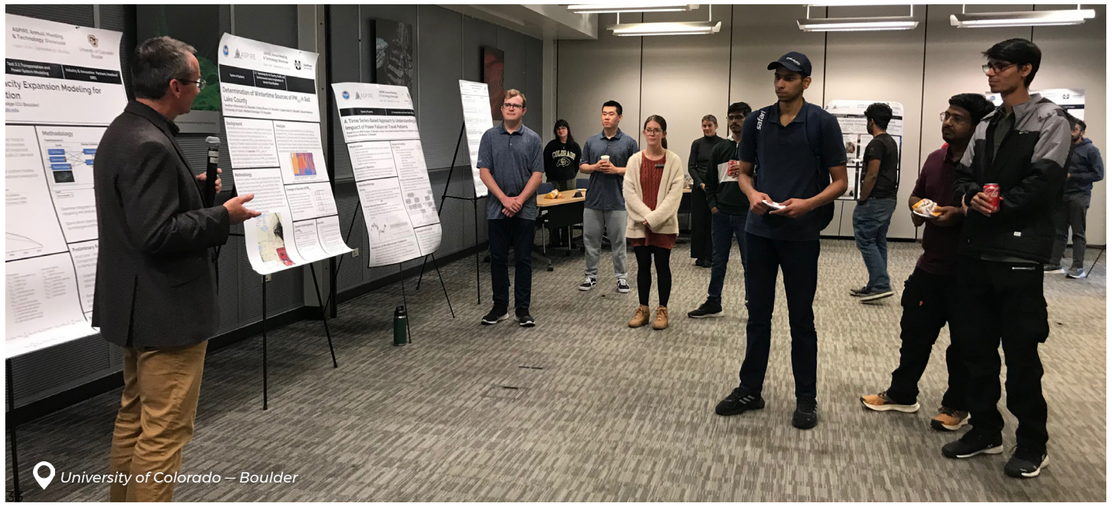
UCB has more than 40 graduate students and undergraduate students who actively participate in Center research projects. Students at UCB are consistently represented in student leadership positions within ASPIRE. Spencer Paulissen is a new SLC representative. He, together with several other students at UCB, organized the student poster session as part of the Annual Meeting in Year 4. He also led the efforts in Year 5 to boost UCB student engagement through several ASPIRE Student Association recruitment events on campus, research expo, and ASA-hosted student social events. Through our pre-college team's work, we further engage other students on campus and K-12 students — both locally and nationwide.

Faculty Engagement

UCB's ASPIRE faculty members actively participate in Center activities with cross-campus collaborations. In Year 5, UCB organized a research expo to showcase our research results and engage with external and multidisciplinary faculty members. We have hosted multiple visits by academic and industrial partners, given conference talks/tutorials, and visited leading institutions on electrified transportation.

Community Engagement & Outreach

In Year 5, we continue to explore local partnerships and pilot projects for electrified transportation, including ongoing discussions of the regional shared EV charging, maintenance, and workforce training facility and the new efforts of electrified and advanced train development in Colorado. A survey in the Colorado Front Range has been expanded to two other regions to study travel disruptions due to power outages. Building upon a field study of air quality in Salt Lake County, we are partnering with an initiative through the State of Utah to inform the state's strategic vehicle electrification efforts. The ASPIRE UCB team also participated in the NSF STEM Day organized by CU Science Discovery, which engages K-12 students and teachers in STEM and connects public audiences with NSF STEM research.





Cornell University

Student Engagement

Cornell University's ASPIRE Student Association (ASA) is active in enhancing student experiences through various activities, including talks on electrified transportation and networking events.

The group recently organized a presentation day featuring student talks on topics related to power electronics and wireless power transfer. In addition, they arranged educational visits to the local transit authority's depot and to the factory of an electric forklift manufacturer.

Cornell students are also engaged in the Student Leadership Council (SLC), where they've been able to participate in cohort trips to companies and national labs, which have provided valuable insights into the transportation and electrification industry. A number of Cornell students also attended four power electronics and wireless power conferences (ECCE 2024, APEC 2025, WPTCE 2025, and COMPEL 2025), which gave them the opportunity to present their research to the wider community. One Cornell student also received a Best Presentation Award at APEC 2025 for a paper on the first 10-kW+ capacitive wireless charging system.

Faculty Engagement

Cornell faculty are deeply involved in collaborative research within ASPIRE, particularly in the development of high-performance capacitive wireless power transfer (WPT) systems. They work closely with researchers from Utah State University, the University of Texas at El Paso, and the University of Auckland, contributing to significant advancements in WPT technology.

Cornell faculty also teach modules in the multidisciplinary course "ASPIRE 101: Electrified Transportation Systems," sharing expertise in WPT. By teaching the theoretical and practical skills needed to develop power electronic technology, these courses train an engineering workforce critical for the growth of electrified transportation.

Community Engagement & Outreach

Cornell's ASPIRE team has increased the visibility of their research by presenting at conferences such as the Asphalt Paving Conference and the Wireless Power Technology Conference and Expo. The Cornell ASA maintains an active social media presence to share information and achievements and participates in Cornell's ClubFest to attract new members. The team's partnership with Suit-Kote Corporation for testing WPT systems with asphalt samples further demonstrates their commitment to community and industry engagement.

Colorado State University (CSU)

At Colorado State University (CSU), ASPIRE researchers produce detailed modeling efforts while also engaging the next generation. The Energy Institute's new mobile classroom — a 2024 Ford Lightning pulling the 28-foot mobile classroom trailer — brings hands-on learning about electrification directly to K–12 schools across Colorado, expanding awareness and sparking interest in electrification careers.

Student, Faculty & Community Engagement

ASPIRE funding has catalyzed impactful research and innovation activities at CSU, enabling the engagement of a part-time research scientist and supporting the development of high-impact projects. Notably, ASPIRE involvement directly contributed to two successful DOE-funded proposals: one advancing the commercialization of battery reconditioning technologies, and the other, an STTR award supporting a startup spun out from CSU and the ASPIRE initiative. Together, these projects have supported an additional two part-time research scientists and strengthened CSU's position as a leader in electrified transportation research.

The research conducted under ASPIRE has resulted in two publications in high-profile journals within the Nature portfolio, further underscoring the quality and relevance of the work. Collaboration with ASPIRE partner institutions has remained strong, fostering a culture of cross-institutional innovation. CSU continues to build on this momentum through ongoing collaborative proposal efforts and aims to grow its contributions to the ASPIRE mission in the years ahead.



University of Colorado — Colorado Springs (UCCS)

The University of Colorado Colorado Springs (UCCS) is building strong momentum in ASPIRE's research and workforce development mission, with students and faculty deeply engaged in battery-focused projects. Students contribute through funded research positions, leadership roles, and hands-on participation in poster and technical presentations, helping to prepare the next generation of engineers for the electrified transportation industry. Faculty mentorship and weekly research meetings provide a foundation for meaningful student development and technical advancement in battery modeling and control methods. UCCS also engages the local community through outreach events that inspire high school students to pursue STEM pathways while showcasing ASPIRE's cutting-edge research. The university continues to strengthen connections with external partners, leveraging ASPIRE accomplishments to expand industry collaborations and secure additional funding. Moving forward, UCCS aims to deepen its research contributions, broaden its outreach, and enhance its student pipeline to meet the needs of an evolving workforce.

Virginia Tech

Virginia Tech contributes to ASPIRE's vision by advancing research in vehicle cybersecurity and autonomy while building strong student engagement and workforce preparation. Undergraduate and graduate students play an active role in research, contributing to projects and leadership through the ASPIRE Student Leadership Council and Student Association. Faculty collaborate extensively with colleagues at ASPIRE partner institutions, supporting multi-campus initiatives and aligning research with industry needs. Beyond campus, Virginia Tech engages with professional and industry audiences through presentations, technical discussions, and committee service, sharing expertise in cybersecurity, electrification, and freight. These efforts highlight the university's commitment to bridging academic research with real-world application. Looking ahead, Virginia Tech will continue developing long-term research opportunities with broad impact, securing grant funding, and deepening collaborations across the ASPIRE network to address industry challenges and prepare the future workforce in transportation electrification.

University of Utah (UoU)

The University of Utah plays a key role in advancing ASPIRE's mission through collaborative research, community outreach, and contributions to statewide planning. Faculty members support multi-institutional projects, including supervisory roles for PhD candidates at partner universities, while students engage through the ASPIRE Student Leadership Council. The university has taken a lead role in measuring and analyzing air quality in Salt Lake City, deploying sensors to better understand pollution patterns and inform solutions. Findings from these efforts will be shared with the public to strengthen community awareness and engagement. In addition, the university contributes to Utah's electrification plan, ensuring research informs policy and infrastructure development. Looking ahead, the University of Utah will continue expanding its leadership in air quality monitoring, electrification, and collaborative research while pursuing new funding opportunities to sustain and grow its impact.



At UCB's Engineering Camp, students got hands-on experience building EV MicroKarts.

Project 1:
Charging Stations of the Future

Project 2:
Electrified Roadways

Project 3:
Integrated Systems

Project 4:
Pathways

Pilots
& Testbeds



Project 1: *Charging Stations of the Future*

Charging stations equipped with different technologies — including wired and wireless solutions — are critical to both charging infrastructure and the widespread adoption of electric vehicles (EVs) of all class sizes, from light- to heavy-duty. This project performs convergent fundamental research required for widespread adoption under various scenarios to produce societal impacts.

Project Impacts

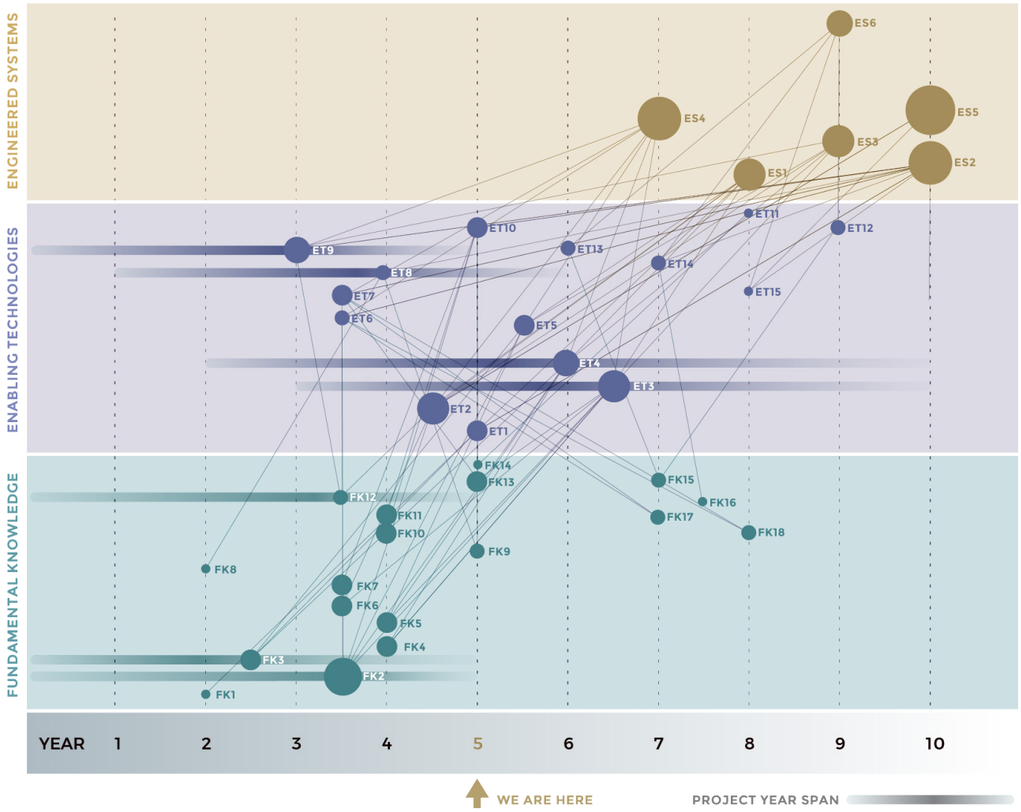
- **Eliminating range anxiety** by planning and developing expansions and improvements of charging networks.
- **Demonstrating effectiveness and reliability** of high-power charging systems.
- **Increasing grid resiliency and security** by working with and integrating solutions beyond charging stations.



P1: CHARGING STATIONS OF THE FUTURE TRL

YEAR 5 DELIVERABLE	NEXT STEPS	TRL
MW inductive wireless power transfer system.	*Field deployment and demonstration with UPS using it for the fleet operation.*	9
Medium voltage grid tied AC-DC power converter.	*System level experimental validation of the converter operation with full voltage and full power.*	8
Battery modeling & control toolbox.	*Collect feedback from beta testing with industry partners and further improve it.*	7
GIS-based framework/dashboard for informing EV charging station location decisions, implemented in two case study locations.	*Apply methods and compare results in other regions and states.*	6
Unfolder-based AC-DC power converter hardware with regulated output current.	*File the IP and the developed AC-DC power converter operating with charger units.*	5
Experimental results from hardware prototype to demonstrate the working of proposed universal bidirectional AC/DC grid interface for a fast-charging station with embedded energy storage.	*Experimental loss characterization; completion of controller validation; initiate revision of hardware prototype.*	4
Experimental data to show the improved density of high-frequency isolation transformers.	*Hardware validation of isolation transformer performance in power stage of converters.*	3
		2
		1

P1: 3-PLANE 10 YR STRATEGIC PLANNING



Fundamental Knowledge Efforts

FK-1 Developed and implemented open-circuit voltage (OCV) estimation, hysteresis modeling, new optimization methods to improve model accuracy, and physics-based single particle model (SPMe) of the battery equivalent circuit model toolbox.

FK-2 Developed control strategies to eliminate sector distortion, detailed loss modeling, zero-voltage switching analysis, and small-signal modeling of T-type LCL resonant converter for unfolder-based high-power wired and wireless charging systems.

FK-3 Developed topologies, modeling, control strategies, DCX, and MV-isolated planar transformer for MV grid tied AC-DC power converter for charging stations.

FK-4 Volume-optimized design of AC/DC interface, and innovative versatile control solutions for universal AC/DC charging interface.

FK-5 Topology, design, modeling, and control of unfolder-based multiport AC-DC system for grid, energy storage, renewable, and charging station integration.

FK-6 Development of an accelerated SiC MOSFET aging test hardware platform that collects aging data for the SiC MOSFETs used in the MW wireless charger.

FK-7 Developed a new microscopic traffic flow algorithm and other different models to generate DWPT load demand profiles for large-scale networks, and studied the impact of those loads on the distribution grid.

FK-8 Development of an economic/finance analysis toolbox for assessing the economic viability of various investment partnerships relating to charging stations.

FK-9 Developed EV charging station accessibility (proximity or gap) calculation and location decision frameworks.

FK-10 Demonstrated quantitatively the benefits of an increase in EV adoption across the US using measures such as VMTs and station accessibility that directly related to reduced GHG emissions and widespread electrification.

FK-11 Developed smart charging management solutions including a power scheduling and cost optimization of a charging station with grid, PV, and BESS using SARSA reinforcement learning, and energy packet reservation and optimization systems for reducing energy cost and peak demand.

FK-12 Development of a transient CFD model to simulate the heat transfer and phase change of the PCM, simulations on hybrid PCM with heat sink for MW-level wireless charger, and immersed cooling solutions using the dielectric fluid for high-power chargers.

FK-13 Developed direct duty control strategy to eliminate DC bias in DAB without DC blocking capacitor.

FK-14 Physics-based models based model predictive control of fast battery charging and the impact on battery aging.

FK-15 Topologies, modeling, optimized design, control, and immersed cooling of high-power-density AC-DC and DC-DC power converters.

FK-16 Reliability and resilience of the distribution grid considering high penetration rate of EV charging infrastructure and distributed power generation.

FK-17 10 mega-watt level multi-modal charging station hub location decision framework development considering power grid, traffic, economics, accessibility, utilization, and costs.

FK-18 Machine learning and AI algorithms for minimizing total EV charging costs using data collected from real-world charging stations.

Enabling Technologies Efforts

ET-1 Packaged different battery models in a software toolbox and developed a user-guide and instructional materials for general use by ASPIRE participants.

ET-2 Development of mega-watt inductive wireless power transfer technology.

ET-3 High-power-density AC-DC and DC-DC power converters for EV charging.

ET-4 Medium voltage (MV) grid tied AC-DC power converter.

ET-5 Universal AC-DC charging topology to enable single-phase and three-phase versatility.

ET-6 Development of methodologies to analyze potential short- and long-term impacts of large-scale charging system on electric power distribution grid.

ET-7 Developed an algorithm for DER-integrated grid operations under extreme weather events incorporating DWPT, and a priority load control approach to mitigate impacts from large-scale charging loads.

ET-8 Development of tools for EV charging finance analysis, location decision, and accessibility evaluation.

ET-9 Passive, hybrid, and active thermal management technologies for wireless high-power EV charging systems.

ET-10 AI-driven smart charging management with microgrid integration.

ET-11 Model predictive control for fast EV charging.

ET-12 Magnetics design, modeling, control, and protection of medium voltage (MV) grid tied AC-DC power converter.

ET-13 Single-phase and three-phase universal AC-DC charging systems.

ET-14 Models and methodologies to analyze the impact of charging infrastructure at the moon-shot level on distribution grid reliability and resilience.

ET-15 AI-based smart charging management solutions for EV charging and on-site resource dispatch considering different user needs, charging loads prediction, different energy price mechanisms, grid status/limits, V2G, and grid support functionalities.

Engineered Systems Efforts

ES-1 Li-ion battery modeling toolbox set for EV and battery energy storage system.

ES-2 Planning decision tools to inform charging station location decisions and site designs (including grid status, traffic conditions, utilization, financial, economics, societal impact, infrastructure process, permit steps, landscaping etc.).

ES-3 MW wireless charging system for heavy-duty trucks.

ES-4 AC-DC grid interface for high-power charging stations.

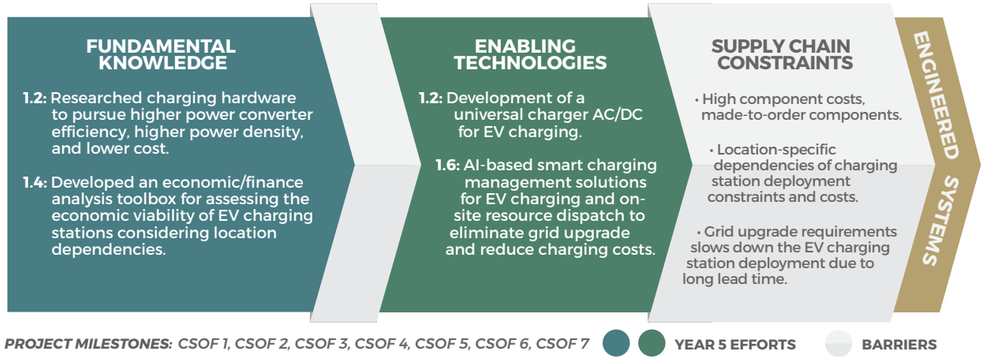
ES-5 Charging station operation, smart management, and maintenance tools.

ES-6 Design and simulation of a 10 mega-watt level multi-modal charging station hub.

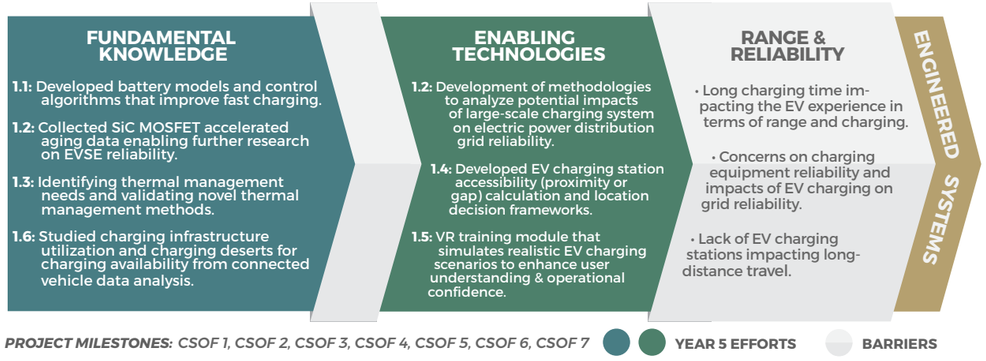
Barriers & Responses:

In line with our process of tackling problems top-down from our Center Goals, our efforts in Year 5 were focused on overcoming the following barriers, as seen on the Engineered Systems level of our 3-Plane Strategic Planning Chart (pg. 25). In Year 5, tasks (listed below) collaborated to address these barriers, and their efforts align with project milestones (also listed below, with additional details found in Appendix VII).

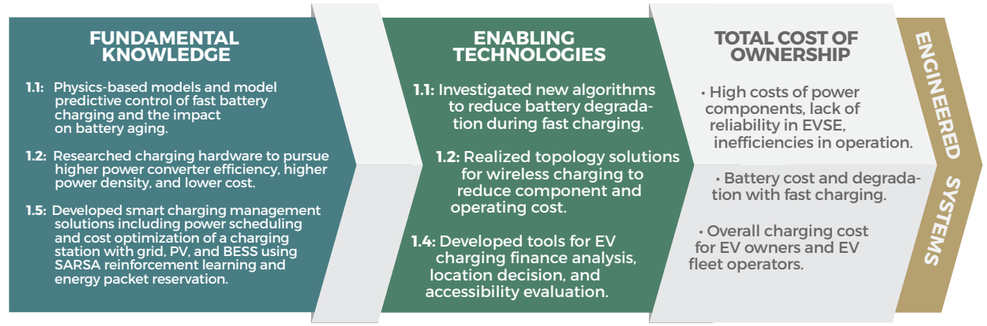
Supply Chain Constraints



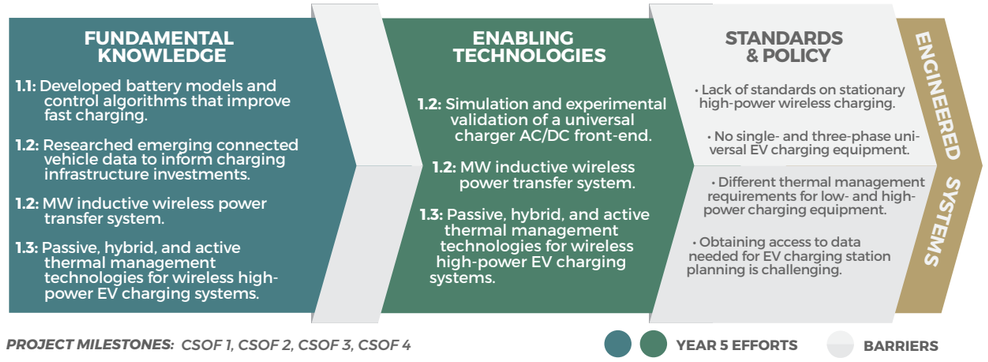
Range & Reliability



Total Cost of Ownership



Standards & Policy



PROJECT 1: CSoF TASKS

1.1: Modeling, State Estimation & Life-Aware Model-Predictive Controls of On-Vehicle Battery Systems

1.2: Advancing Charging Technologies

1.3: Thermal Modeling, Management & Storage for High-Powered Charging Infrastructure

1.4: Design, Planning & Implementation of EV Charging Infrastructure

1.5: Charging Station Virtual Reality Visualization & Smart Management

1.6: Connected Vehicle Data Analytics for Charging Stations of the Future

Looking Ahead

Building on the foundation of the first five years, CSoF's next phase will focus on enabling real-world, large-scale charging solutions that support ASPIRE's system-level moonshots — such as large-scale power-transportation integration and the first 1,000 miles of electrified roadways and multi-modal hubs. These efforts are designed to accelerate economic growth, workforce readiness, energy efficiency, and energy security for the nation.

Key Objectives for Years 6-10 Include

- Advancing high-performance charging hardware and strategies to deliver **low-cost, reliable, and ultra-fast EV charging** — targeting an 80% charge within 10 minutes across vehicle classes.
- Designing and deploying **multi-megawatt, multi-modal charging station hubs** that integrate on-site PV, battery energy storage, and diverse vehicle classes, while reducing operating costs for both station owners and EV users.
- Developing **smart charging management technologies** that lower charging costs, optimize grid interaction, and reduce or eliminate the need for utility upgrades at scale.
- Creating **planning and decision-making frameworks** to guide charging station siting, design, and investment, considering traffic patterns, grid capacity, economics, and accessibility.
- Expanding **cross-disciplinary research and education** to prepare the next-generation engineering workforce and support industry adoption.

Representative Technical Milestones

- **480 V, 1 MW inductive wireless charging** with single-stage AC–AC conversion.
- **480 V, 350 kW modular dc fast charger** development.
- **4.16 kV medium-voltage (MV) grid–tied, 560 kW dc fast charging.**
- **Physics-based models and AI-driven algorithms** for predictive battery charging control, reducing aging while enabling ultra-fast charging.
- **Resilience and reliability models** to evaluate distribution grid impacts of large-scale charging infrastructure.

Together, these objectives and milestones will bridge the gap from proof-of-concept demonstrations to **engineered systems ready for large-scale deployment**, supporting ASPIRE's broader mission to transform transportation electrification.



The ASPIRE and Kenworth co-developed Falcon electric class 8 truck will be powered via the world's first 1 MW wireless vehicle chargers.

Project 2:
Electrified Roadways



In 2023 about 1.2 million electric vehicles (EVs) were sold in the U.S., corresponding to about 7.6% of new vehicle sales — nearly a 50% increase from the roughly 800,000 EVs sold in 2022. Continuing this trajectory, EV sales are projected to make up 50% of new vehicle sales by 2030.

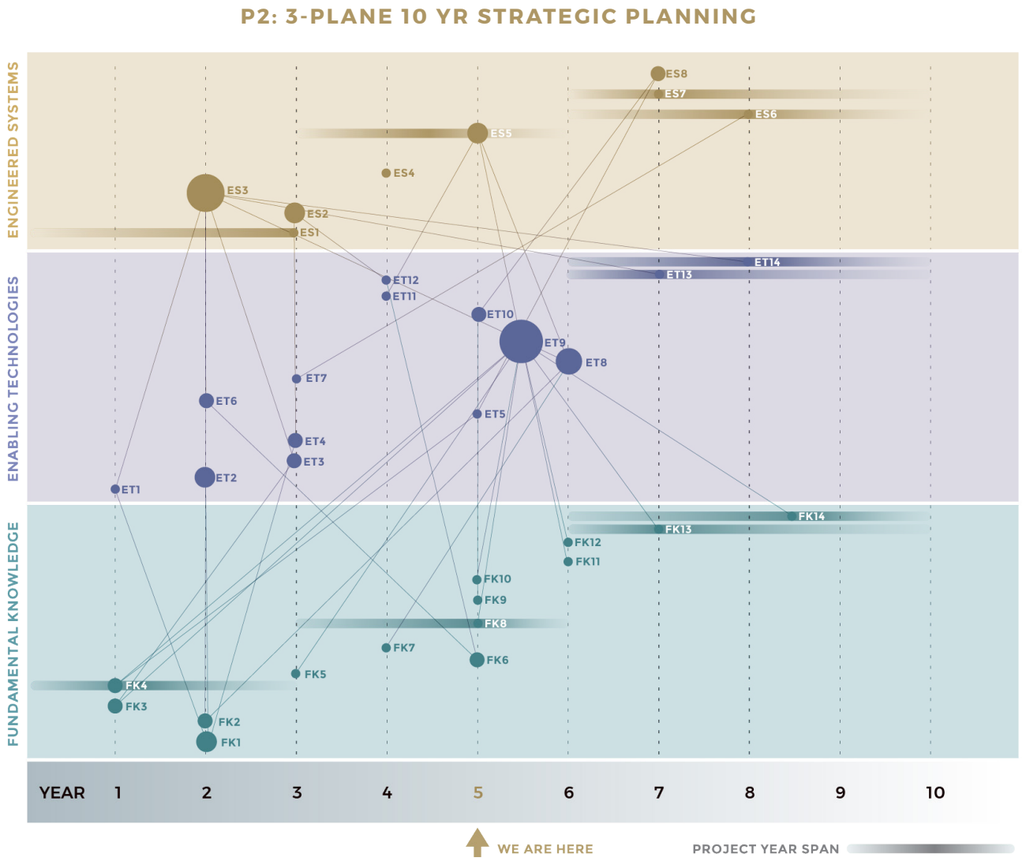
In support of these aims, the goal of the electrified roadways (ER) project is to push the performance frontier of roadway embedded dynamic and semi-dynamic wireless charging.

Project Impacts

- **Reducing vehicle's battery size** therefore reducing the weight, cost, & environmental impact.
- **Lowering the high-demand on charging stations.**
- **Eliminating range anxiety** by increasing access to charging — specifically, while driving.

P2: ELECTRIFIED ROADWAYS TRL

YEAR 5 DELIVERABLE	NEXT STEPS	TRL
Three-phase transmitter and receiver for wireless power transfer system.	*Broader deployment in multiple pilots.*	9
		8
		7
		6
Durable pavement materials to accommodate wireless power transfer components.	*Continue moving from testbeds to pilot deployments.*	5
Capacitive wireless power transfer system.	*Deploy in a larger testbed.*	4
Misalignment detection scheme for three-phase wireless power transfer.	*Evaluate detection scheme in a controlled pilot environment.*	3
Usable asset management framework applicable to electrified roadways with wireless power transfer capability.	*Work with transportation agencies to guide refinements for a practical, scalable, and responsive implementation.*	2
		1



Fundamental Knowledge Efforts

FK-1 Developed high-fidelity coupled structural-thermal finite element models for pavement embedded inductive wireless power transfer (WPT) systems.

FK-2 Identified critical parameters (material properties, layer thicknesses) that have significant impact on pavement distresses.

FK-3 Developed custom integral-based and finite-element-based models for inductive WPT system design and validated it using finite element (FE) based models.

FK-4 Developed loss and thermal models for capacitive WPT systems.

FK-5 Utilized multi-objective optimization approaches to maximize magnetic coupling and minimize sequence interaction in 3-phase inductive WPT systems.

FK-6 Developed Double-Encryption with Signature (DoES) scheme for authentication and physical layer security for communications between electric vehicles and electrified roadways

FK-7 Studied Engineered Cementitious Composites (ECC) as durable concrete mixture for electrified pavements.

FK-8 Developed approaches to ensure interoperability between DWPT tx and rx topologies.

FK-9 Developed immittance network based power scaling approach for dynamic capacitive WPT systems.

FK-10 Developed fundamental techniques leveraging partial inductance to optimize performance of low-cost PCB-based Litz-coil geometries for vehicle assemblies.

FK-11 Evaluated performance of different epoxy materials as coatings for embedded components through water diffusion tests and low-velocity impact tests.

FK-12 Integrated dynamic inductive WPT system into concrete and asphalt pavements and tested by conducting 65,000 passes at Accelerated Pavement Testing (APT) facility.

FK-13 Characterized multi-physics coupling in layered composite protection systems.

FK-14 Established design-property relationships for additively manufactured composite insulation materials.

Enabling Technologies Efforts

ET-1 Developed MATLAB based custom finite element (FE) tool for structural analysis and design of electrified pavements.

ET-2 Developed a fiber reinforced concrete mix design for electrified roadways.

ET-3 Developed and tested a full-scale 11-kW inductive wireless charging system embedded within asphalt.

ET-4 Designed passive thermal management system using phase change material.

ET-5 Developed 2-kW capacitive wireless charging system.

ET-6 Developed secure approach utilizing ARM TrustZone to turn commercial off-the-shelf smartphones into secure cellular-vehicle-to-everything radios (CV2X) that use LTE network.

ET-7 Developed Transportation Asset Management (TAM) tool to evaluate long-term benefits of electrified roadways.

ET-8 Incorporated high-power dynamic inductive WPT into pavement modeling tool to predict behavior of concrete and asphalt electrified roadways.

ET-9 Developed 230-kW, 79-90 kHz dynamic inductive WPT system.

ET-10 Developed 44-kW capacitive wireless charging system.

ET-11 Developed drone-based thermal imaging system to evaluate thermal performance of electrified roadways.

ET-12 Developed RFID-based approach to align vehicles with electrified roadway wireless charging coils.

ET-13 Developed low-cost, rapid additive manufacturing process workflows for producing lightweight, multi-layered protective composites.

ET-14 Demonstrated small-scale pavement section fabrication and in situ validation of composite protection layers.

Engineered Systems Efforts

ES-1 Reconfigurable indoor in-motion inductive wireless charging testbed.

ES-2 Outdoor in-motion inductive wireless charging test track at the EVR.

ES-3 Accelerated Pavement Test (APT) facility with concrete and asphalt electrified pavement sections.

ES-4 Indoor in-motion capacitive wireless charging testbed.

ES-5 Indiana Department of Transportation 1/4 mile Dynamic Wireless Power Transfer Testbed (DWPTT) P3 Pilot on US 52/231.

ES-6 Central Florida Expressway (CFX) dynamic wireless charging pilot.

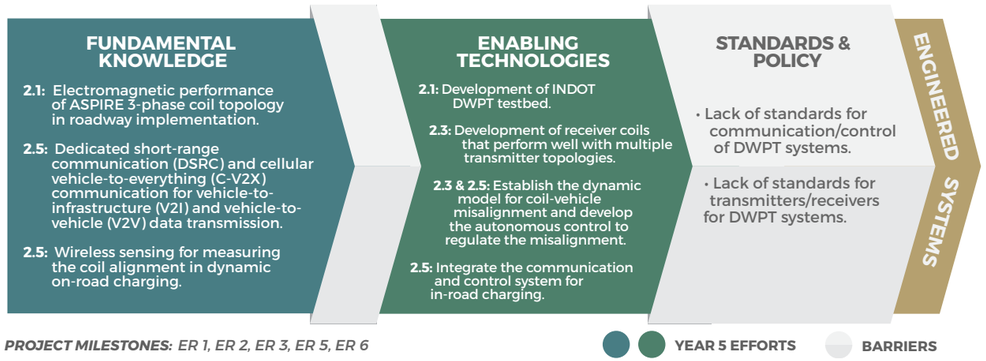
ES-7 Utah Inland Port Living Lab dynamic wireless pilot for heavy-duty vehicles.

ES-8 Dynamic capacitive wireless charging system pilot demonstration.

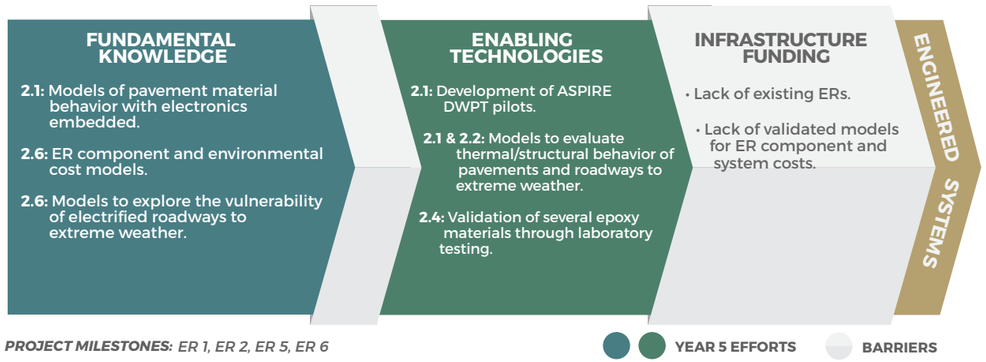
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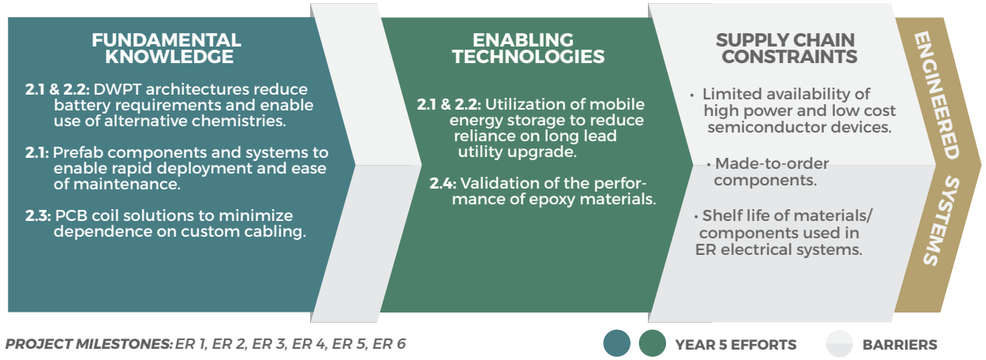
Standards & Policy



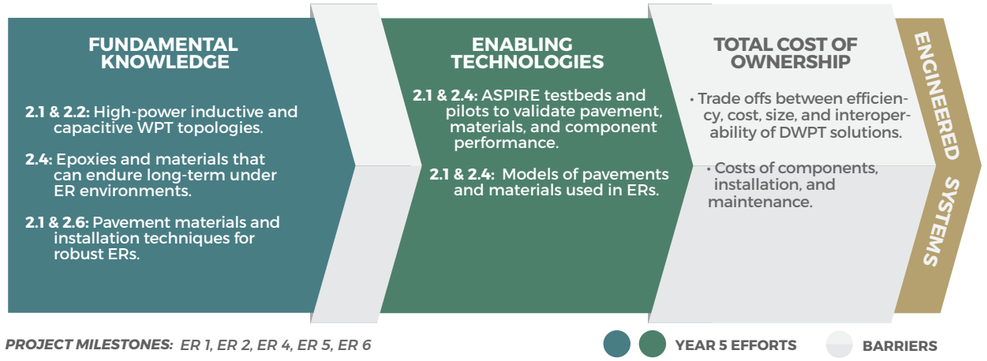
Infrastructure Funding



Supply Chain Constraints



Total Cost of Ownership



PROJECT 2: ER TASKS

2.1: Design Considerations for High Performing Embedded DWPT Systems

2.2: Coupled Thermal/Mechanical Modeling & Evaluation of Electrified Pavement Systems

2.3a: Improving Accuracy of Copper Loss Modeling in High Power Magnetics

2.3b: Interoperability of WPT Systems

2.4: Evaluation of Potential Electrical Threats to Electrified Pavements Components

2.5: Modeling, Communications, Networking Infrastructure & Protection for Secure & Smart Electrified Roadway Charging

2.6: Performance & Resilience of ERS Transportation Asset Management

Looking Ahead

By delivering power wirelessly through the pavement, ER technology can reduce vehicle costs, extend range, and accelerate EV adoption. This innovation also aligns with broader transportation trends in connectivity, autonomy, and ridesharing, creating the potential for fewer vehicles on the road, lower emissions, reduced transportation costs, and significant job growth.

Over the next five years, ER research will move beyond proof-of-concept demonstrations to robust, real-world pilots that pave the way for large-scale deployment. These pilots — including the INDOT DWPTT, the Central Florida Expressway (CFX), and Utah Inland Port's Living Lab for heavy-duty freight — will validate performance, cost, durability, and interoperability at scale.

Key Objectives for Years 6-10 Include

- Advancing **robust in-pavement wireless power transfer systems** capable of high-power (200 kW-scale) dynamic charging for multiple vehicle classes.
- Developing **durable pavement designs and construction practices** for asphalt and concrete that integrate fault-tolerant power electronics while maintaining long-term road performance.
- Demonstrating **interoperable charging systems** across varied ground clearances (15–20 cm) and multiple vehicle classes.
- Ensuring **safety and interference compliance** with established EMI/EMC standards in real-world conditions.
- Creating **secure communications and control architectures** to support autonomous vehicle alignment, charging coordination, and integration with roadside sensing and cloud systems.
- Establishing a **transportation asset management framework** to guide large-scale deployment, maintenance, and cost management of electrified roadways.

Representative Technical Milestones

- Proof-of-concept **in-pavement charging prototypes** with roadside cabinet power electronics in both asphalt and concrete construction.
- **Deep-seated inductive charging systems** integrated into pavement with thermal modeling and health monitoring.
- **High-power capacitive WPT systems** with miniaturized, low-cost power electronics for compact charging pads.
- **Composite protective materials** developed via additive manufacturing for lightweight, durable roadway integration.
- **Edge-cloud control frameworks** enabling real-time distributed charging management and vehicle-lane coordination.

Together, these objectives and milestones will advance ER technology from concept validation to **engineered systems ready for at-scale deployment**, driving societal impact through electrified transportation, lower costs, and a stronger workforce.



The INDOT pilot construction also leveraged local expertise, such as Indiana's own White Construction, to install the nation's first wireless power transfer technology in a federal highway.

Project 3:
Integrated Systems (IS)

ASPIRE's Project 3 (Integrated Systems, or IS) studies the integration of electric vehicles (EVs) and EV charging infrastructure (EVCI) — including electric roads — into transportation systems, electric power systems, the economy, the environment, policymaking, and society. We help ASPIRE and its partners understand, measure, monitor, model, optimize, and evaluate these complex systems and their interactions, addressing critical theoretical and practical challenges in these domains. The heart of this project's research portfolio is the development of tools to:

- Model integrated transportation–power systems for decision-making around electric roads.
- Advance solutions for optimizing the operation of EV fleets (trucks, buses, and more).
- Provide enhanced techno-economic and lifecycle evaluation capabilities of electrification technologies, including those being developed in ASPIRE's Projects 1 and 2.

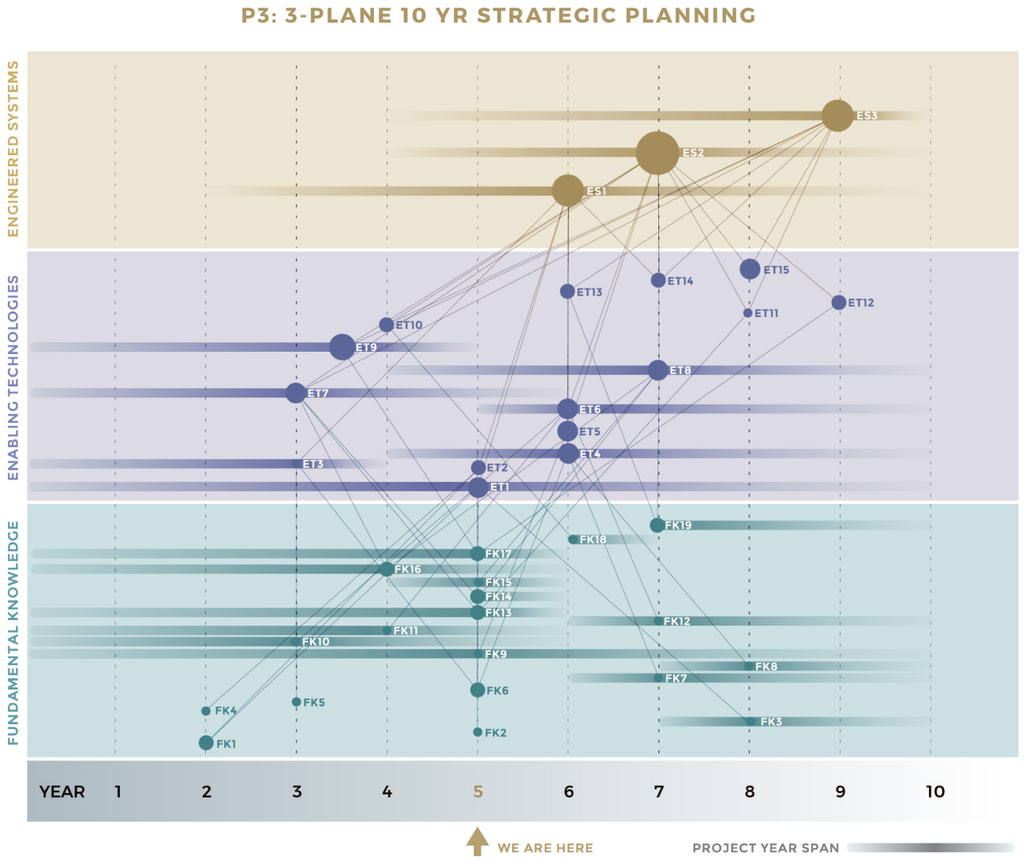
Other tasks within the IS project support these efforts through innovative monitoring and modeling of air quality, as well as cutting-edge work on EV adoption, economic trends, and policy influences. These efforts are achieved through basic and applied research, working closely with academic, industrial, governmental, and community partners.

Project Impacts

- **Advancing models to support electric roads.**
- **Innovating operations for electric vehicle fleets.**
- **Developing smart, real-world simulations & tools.**

P3: INTEGRATED SYSTEMS TRL

YEAR 5 DELIVERABLE	NEXT STEPS	TRL
ASPIRE Transit Reliability Portal, providing real-time system reliability information about electric buses, chargers, state-of-charge, and charging-events.	*Integrate historic data to provide a real-time cost savings feature, to highlight smart charge management. Partner with additional transit agencies.*	9 / 8
Multi-pollution air quality sensor system sensor system network with real-time data visualization.	*Demonstrate utility of the network around transportation systems in Salt Lake County.*	7 / 6
Power system capacity expansion model (PowerExpansion).	*Functional testing through relevant case studies. Expansion of data to include commercial vehicle profiles. Expansion of support for different OS and compilation to executable/application. GUI development for end-user interaction.*	5
Public tool for evaluating the life cycle costs of DWPT.	*Apply model to specific routes. Find case study partner.*	4
A suite of data-driven models of EV adoption and utilization across spatial and temporal scales—capturing residential charger diffusion, public charging access, and usage behavior.	*Refine models with new data from more states. Partner with utilities, public agencies, or mobility firms to validate findings, co-develop targeted interventions, and test deployment/policy strategies using real-world data.*	3 / 2 / 1



Fundamental Knowledge Efforts

FK-1 Cost and emissions comparisons of EV charging systems: DC fast charging, DWPT, and battery swapping.

FK-2 Nationwide evaluation of freight truck charging needs to inform DWPT deployment.

FK-3 Quantified risks to electric transportation systems, and assessments of system and subsystem reliability and resilience.

FK-4 Electric roadway feasibility calculator.

FK-5 Deployment of low-cost air pollution sensors in diverse communities.

FK-6 Apportionment of air pollution to transportation and other sources, and at small spatial scales.

FK-7 Robust networks of air pollution monitoring devices (and data infrastructure) in multiple regions.

FK-8 Refined estimates of air pollution and human health impacts from transportation electrification scenarios.

FK-9 Innovative surveys on EV adoption, charging behavior, preferences, and perceptions, across vehicle classes and population segments.

FK-10 Fundamental modeling of EV adoption by vehicle class, and identification of causal effects.

FK-11 Identification of EV trends and sentiments in social and traditional media.

FK-12 Insights from natural experiments on the impacts of changes to EV-related policies.

FK-13 DC-OPF and planning models for optimal microgrid capacity planning over a 20+ year operational period.

FK-14 Framework for enhancing transportation planning and demand forecasting models to represent electric transportation systems.

FK-15 Macroscopic cell transmission model (CTM) and state-of-charge (SOC) model of DWPT traffic flows.

FK-16 Processed power grid data for a small-signal stability analysis and transmission network upgrades with DWPT loads.

FK-17 Optimization algorithms for single vehicle and multi-vehicle energy-aware planning.

FK-18 Strategies for pricing and billing electric roadway charging usage.

FK-19 Key insights from ASPIRE pilots for electric roadway management and fleet operations.

Enabling Technologies Efforts

ET-1 Enhanced techno-economic analysis (TEA) and life cycle assessment (LCA) tools for electrified transportation systems.

ET-2 Cost and emissions tool for dynamic wireless power transfer (DWPT).

ET-3 State and regional models of air pollution impacts of transportation electrification scenarios.

ET-4 High-resolution models of the air pollution and human health impacts of transportation electrification.

ET-5 Econometric models of EV adoption, charging behavior, preferences, and perceptions, at various spatial scales.

ET-6 Policy-sensitive models of cross-market EV adoption and evolving consumer preferences.

ET-7 Transportation models at multiple scales, coupled with electric roadway controls.

ET-8 Enhanced transportation planning models, generating DWPT load demand for power grid integration.

ET-9 Enhanced EV aggregation models for electricity markets.

ET-10 Integrated economic tools for optimizing DWPT revenues and electricity market operations and pricing.

ET-11 Transmission and capacity expansion models for electricity grids.

ET-12 Enhanced CARLA simulation model with EVs and linkages to socio-economic data.

ET-13 AI-driven EV fleet management tools, for modeling, scheduling, monitoring, and managing fleet operations.

ET-14 Backend systems for the online ASPIRE Data Service, including cloud storage and modular APIs.

ET-15 AI-enabled data, communications, and analytic tools — linked to ASPIRE pilots — to monitor the use and performance of electrified transportation systems and their impacts.

Engineered Systems Efforts

ES-1 Integrated high-level multi-system models of the electrified transportation ecosystem, for strategic decision-making and evaluation.

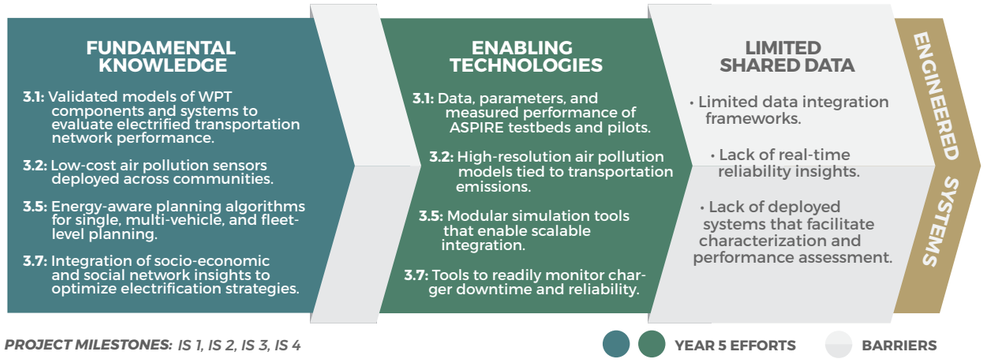
ES-2 Joint modeling tools of electric power systems and transportation systems, for planning, optimization, and simulation.

ES-3 Advanced algorithms for the efficient control and operation of charging stations, electrified roadways, and EV fleets, including management of electricity grids and transportation networks.

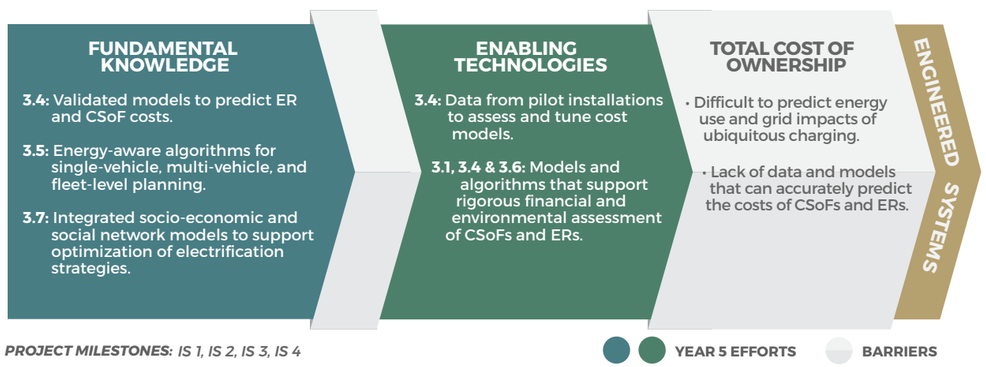
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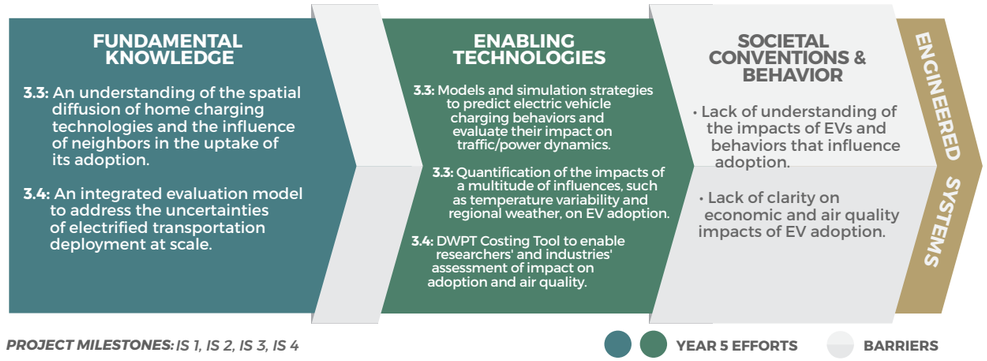
Limited Shared Data



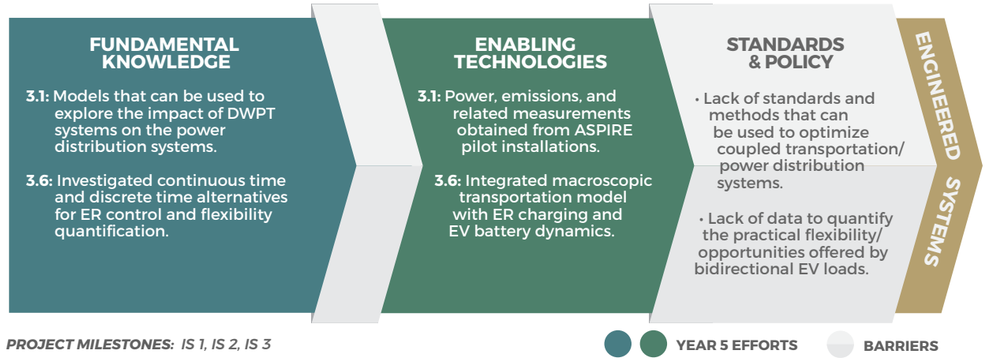
Total Cost of Ownership



Societal Conventions & Consumer Behavior



Standards & Policy



PROJECT 3: IS TASKS

3.1: Power & Transportation Simulator

3.2: Air Quality & Health Implications of Electrification

3.3: Adoption of Electric Vehicles & Transportation Systems

3.4: Optimization of Electrification Solutions through Integrated Techno-Economic & Life-Cycle Assessment

3.5: Combined Simulation Framework for Mass Charger Utilization

3.6: Environmentally Aware EV Charging Integration in Energy Systems

3.7: Empowering Urban Electrification with CARLA-Charge Framework

Looking Ahead

The Integrated Systems (IS) project is ASPIRE's anchor for bringing together technologies, infrastructure, and policies into cohesive, real-world solutions. By modeling, optimizing, and evaluating the interactions among EVs, charging infrastructure, transportation networks, electric power systems, and broader social and economic factors, IS ensures that ASPIRE's research translates into deployable, scalable, and societally impactful systems.

Looking ahead, IS will expand its focus on supporting **deployment of electrified roadways and dynamic wireless power transfer (DWPT)** while also advancing fleet electrification strategies for transit and freight. These efforts provide the insights needed to guide technology deployment, grid planning, policymaking, and industry adoption, helping maximize the benefits of transportation electrification.

Key Objectives for Years 6-10 Include

- Advancing **robust in-pavement wireless power transfer systems** capable of high-power (200 kW-scale) dynamic charging for multiple vehicle classes.
- Advancing **integrated planning, optimization, and simulation tools** that connect transportation systems with power systems, electricity markets, and DWPT operations.
- Developing **decision-support tools for fleet operators** (buses, trucks, and logistics providers) to optimize charge scheduling, monitoring, and fault detection, leveraging AI and real-world pilot data.
- Creating robust **evaluation models for electrified transportation systems (ETS)** that incorporate lifecycle costs, emissions, adoption trends, and resilience to natural hazards, cyber risks, and market disruptions.
- Establishing the **business case for electrified roads**, including strategies for financing, construction, and long-term maintenance, informed by ASPIRE pilot data.
- Expanding **air quality and human health modeling** to capture the societal impacts of electrified transportation at local and regional scales.
- Building **policy-sensitive models of EV adoption** based on surveys, behavioral data, and econometric analysis to help stakeholders anticipate and shape market trends.
- Training a **next-generation workforce** in cross-disciplinary systems integration through hands-on participation in testbeds, pilots, and collaborative industry projects.

Representative Technical Milestones

- **Joint transportation–power system models** for simulation, planning, and co-optimization of DWPT and electrified fleets.
- **AI-enhanced decision-support tools** for EV fleet operations with commercialization potential for industry partners.
- **Risk and resilience frameworks** that quantify vulnerabilities (e.g., wildfire, flooding, cyber threats) and integrate mitigation costs into system planning.
- **High-resolution air quality models** linked to electrification scenarios to support public health decision-making.
- **Policy and adoption models** grounded in behavioral data, informing strategies for utilities, DOTs, and policymakers.

Together, these objectives and milestones ensure that ASPIRE's engineered systems — such as electrified roadways and large-scale charging hubs — are designed, deployed, and managed with **economic viability, technical reliability, and societal benefit** at the forefront.



Students work at the UTEP Concrete Testing and Hot Mix Asphalt Lab.



Project 4: *Pathways*

Project 4 (Pathways) has aimed to cultivate and strengthen a skilled engineering workforce through ongoing cross-institutional and transdisciplinary collaborations. The Pathways project is laying the groundwork to actively shape a workforce prepared for the ongoing challenges of U.S. transportation electrification. With a widespread availability focus, Pathways strives to develop replicable and scalable "K-trades-22" pathways that encompass secondary education, post-secondary education, trades, and other certifications via education, training, research, community awareness, and industry partnerships to recruit, retain, and retrain a workforce in electrified transportation systems.

Throughout Year 5, Project 4 has achieved many milestones that reflect our efforts to fulfill these goals including curriculum development, student training/mentorship, community outreach, and partnership building, among others. Efforts from this project cultivate and strengthen the engineering workforce through ongoing cross-institutional and transdisciplinary collaborations.

Project Impacts

- **Cultivating informed engagement** around EVs and ETS-related technologies.
- **Providing training & education** for tomorrow's electrification of transportation workforce.
- **Bridging opportunity gaps** across a myriad of communities in the pursuit of electrified transportation.

Workforce Readiness Level Framework

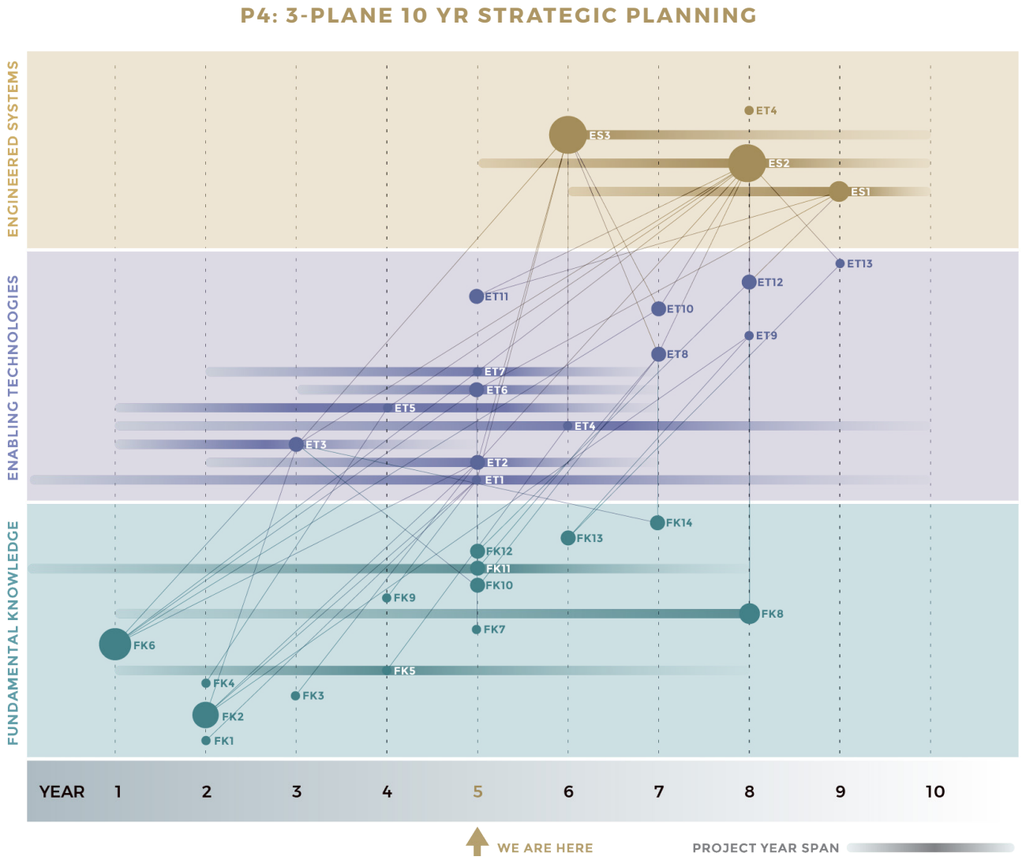
The Pathways Project plays a central role in advancing transportation electrification by cultivating a workforce equipped to meet the evolving demands of the electric transportation sector. While Technology Readiness Levels (TRLs) offer a robust framework for evaluating the maturity and deployment readiness of technological innovations, they do not account for the concurrent development of the human capital necessary to carry out and scale these innovations. To address this critical gap, the Pathways Project plans to complement the TRLs used by Projects 1-3 by operationalizing a Workforce Readiness Level (WRL) framework (pg.72). Developed by researchers at MIT, the WRLs are a structured framework that describes the progressive development of a workforce in parallel with the maturation of an emerging technology. Gaps exist in the TRL model that makes the WRL model more desirable for the Pathways Project:

- TRLs assume that readiness begins with technological advancement, omitting the foundational stages of public awareness, K–22 education, and community involvement that are essential to developing a robust and inclusive future workforce.
- The TRL framework presents innovation as a sequential and largely technical process, whereas workforce readiness is iterative, cyclical, and embedded within broader ecosystems of outreach, training, and institutional capacity building.
- While TRLs emphasize technical validation, they do not reflect how research informs education and training systems, nor how community-informed research can enhance the relevance of workforce initiatives.
- As technologies evolve, so too must the systems of education, training, and community engagement that support their implementation. TRLs fail to account for this parallel evolution, making them insufficient for guiding investments in human capital.

In its current formatting, the MIT WRL framework provides a good starting point to reflect the progress and trajectory of efforts and deliverables from the Pathways projects, however it does not fully reflect the scope, range of stakeholders, or educational continuum targeted by the Pathways Project. In response, an adapted WRL framework — designed by the Pathways team — will be piloted in Year 6 to more appropriately align with the ASPIRE mission and the needs of a maturing electrified transportation ecosystem. Still, the WRL framework provides a more appropriate lens to measure project progress, set goals, and identify key deliverables as it captures the progression from early awareness and foundational education to advanced workforce training and industry alignment. Unlike models that focus solely on postsecondary training or employment outcomes, the WRL framework captures the full continuum of workforce maturation; from early-stage awareness and foundational education to advanced technical training and alignment with industry-specific competencies. As a result, our efforts directly benefit key stakeholders:

- **For Researchers**, the WRL framework provides a structured methodology for translating scientific and engineering findings into scalable educational resources and workforce development interventions.
- **For Industry Partners**, it establishes a coherent pipeline of learners and emerging professionals whose competencies evolve in parallel with technological advancements.
- **For Community and Education Stakeholders**, the framework delineates a transparent and accessible pathway for engagement, beginning with exposure to emerging technologies and culminating in advanced training opportunities.

By using the WRL framework, we can better align our project goals with real-world workforce demands and stakeholder expectations, ensuring that our efforts contribute meaningfully to both workforce development and the broader adoption of electrified transportation technologies.



Fundamental Knowledge Efforts

FK-1 Explored literature for STEM curriculum approaches to support teacher development.

FK-2 Constructed professional development content guided by literature on student workforce development needs.

FK-3 Created content for EV research using experiential learning activities for high school research projects.

FK-4 Piloted a cross-institutional internal mentoring program.

FK-5 Engaged with industry to develop an opportunity to host ASPIRE student visits

FK-6 Explored literature to identify social implications of transportation of electrification.

FK-7 Coordinated a community engagement surveys and leader/liaison interviews using subject matter expertise and literature on community engagement and technology deployment

FK-8 Identified outside institutional and organizational partnerships relevant for electrified transportation research and deliverables.

FK-9 Analyzed pilot data feedback from previous CED program.

FK-10 Review of survey data from previous REU program professional development activities.

FK-11 Engagement with Industry and Innovation members to gain understanding of workforce needs.

FK-12 Reviewed technical education literature to support the development of technical training programs

FK-13 Review of Workforce Readiness Levels.

FK-14 Engagement with international partner University of Auckland to identify opportunities for international student engagement.

Enabling Technologies Efforts

ET-1 Curriculum supporting the development of K-12 teachers and students engaged in formal and informal learning strategies centering STEM and electrified transportation through the Creative Engineering Design (CED) curriculum.

ET-2 Program development for informal learning strategies centering STEM and electrified transportation through the Youth Engineering Scholars of Electric Vehicles (YES-EV) program.

ET-3 Exposing students to ASPIRE related research and professional development to support their academic and professional growth through the ASPIRE Research Experience Program.

ET-4 Exposed students to electrified transportation industries and nonprofit organizations with the development of the Student Leadership Cohort Visitation Trips.

ET-5 Utilized the ASPIRE Mentoring program to address students needs and progression through their undergraduate and graduate degrees.

ET-6 Community Perception and Engagement surveys to ascertain communities understanding, concerns, and support of electrified transportation systems..

ET-7 Curriculum supporting undergraduate and graduate students engagement and knowledge in policy and societal implications of electrified transportation though the Transportation Policy course.

ET-8 International Research Experience Program in partnership with the University of Auckland.

ET-9 Technical Training Certification Program.

ET-10 Transportation Policy Class:

(1) Updated curriculum to reflect changes in academic literature as well as changes in the policy environment

(2) Recruit students from ASPIRE-affiliated campuses to expand reach of course.

(3) Use course evaluation data to improve course design, content, and student outcomes.

ET-11 Produced and distributed a workforce information booklet identifying relevant, growing careers, skills needed, and local pathways to required training.

ET-12 Map Utah's landscape of training providers and pathways into relevant careers; identify pathway gaps relative to industry needs.

ET-13 Center Mapping of Workforce Readiness tools — linked to ASPIRE pilots — to monitor the use and performance of electrified transportation systems and their impacts.

Engineered Systems Efforts

ES-1 Community-informed approach to infrastructure development supporting Electrified Transportation Systems.

ES-2 Holistic workforce and education development that considers multiple professional pathways with a common interest of electrified transportation.

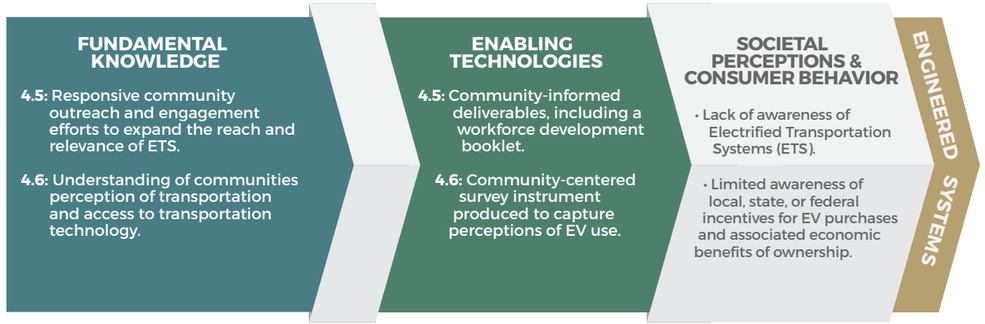
ES-3 Curriculum and outreach frameworks designed to increase awareness and adoption of electrified transportation systems.

ES-4 Develop career guidance software that maps explorers' profiles and interests to relevant training options and careers [a vision, not a promise; requires resources and commitment from other projects].

Barriers & Responses:

In line with our process of tackling problems top-down from our Center Goals, our efforts in Year 5 were focused on overcoming the following barriers, as seen on the Engineered Systems level of our 3-Plane Strategic Planning Chart (pg. 25). In Year 5, tasks (listed below) collaborated to address these barriers, and their efforts align with project milestones (also listed below, with additional details found in Appendix VII).

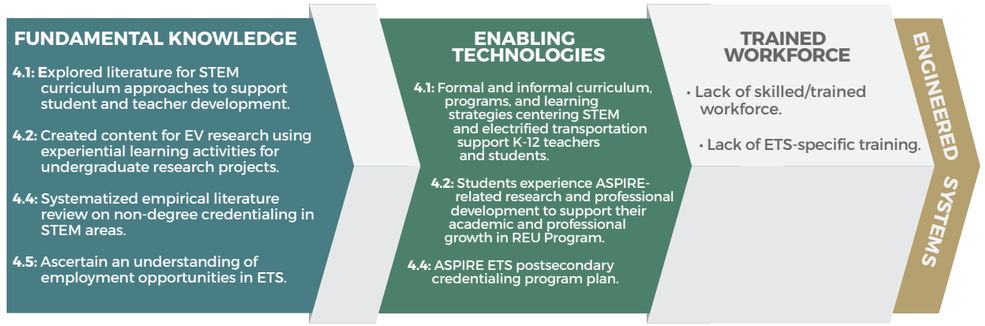
Societal Perceptions & Consumer Behavior



PROJECT MILESTONES: *PATH 5, PATH 6*

YEAR 5 EFFORTS BARRIERS

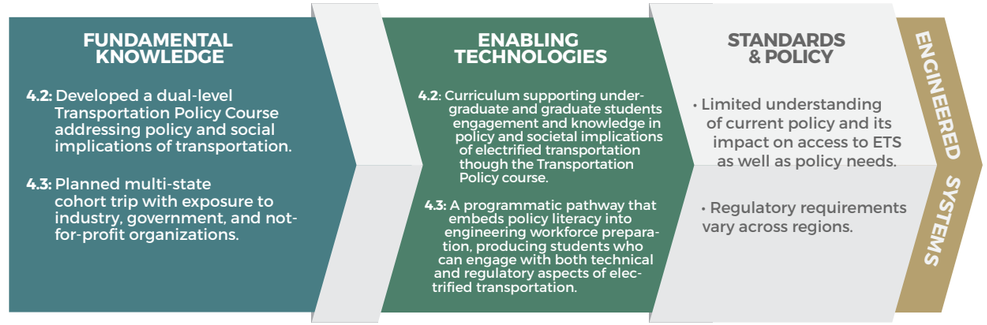
Trained Workforce



PROJECT MILESTONES: *PATH 1, PATH 2, PATH 4, PATH 5, PATH 6*

YEAR 5 EFFORTS BARRIERS

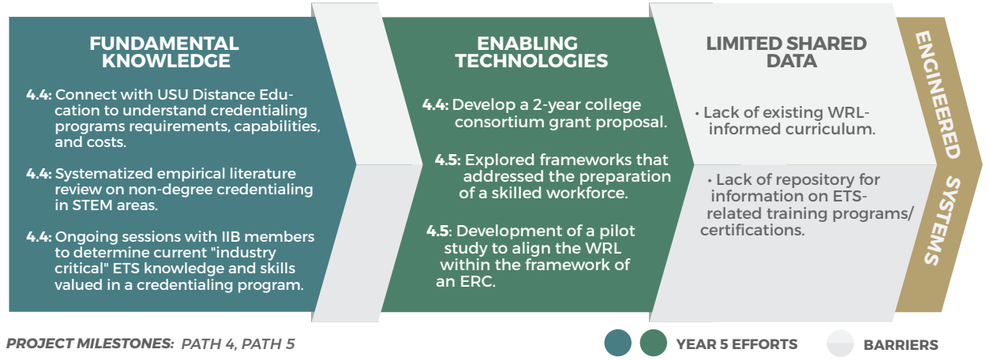
Standards & Policy



PROJECT MILESTONES: *PATH 2, PATH 3*

YEAR 5 EFFORTS BARRIERS

Limited Shared Data



PROJECT MILESTONES: *PATH 4, PATH 5*

YEAR 5 EFFORTS BARRIERS

PROJECT 4: PATH TASKS

4.1: Pre-College Curricula, Engagement & Professional Development

4.2: REU, Higher Education Curricula & Engagement

4.3: Student Engagement & Center-Wide Mentorship

4.4: Community College & Post-Secondary ETS Pathway Credentialing

4.5: Community Engagement & Governance

4.6: Social Systems & Impact Research

Looking Ahead

By expanding replicable K–22 pathways, technical training, workforce certifications, and global research experiences, Pathways strengthens both the human capital and the public trust needed to scale this transformation through technical capacity, accelerated workforce readiness, and support of electrified transportation technologies in industries.

Looking forward, Pathways will expand its role as a national model for integrating human capital development with technology deployment by introducing the **Workforce Readiness Level (WRL) framework** alongside the technology readiness framework already in use. This dual framework will provide ASPIRE and its partners with a structured way to measure both technological maturity and workforce preparedness, ensuring alignment between innovation and the people needed to implement it.

Key Objectives for Years 6-10 Include

- Developing and scaling **technical training and certification programs** to establish consistent workforce competencies that align with industry needs and policy frameworks.
- Expanding **international research experiences** (e.g., University of Auckland partnership) and REU programs that prepare a diverse cohort of students with technical, professional, and cross-cultural skills.
- Enhancing **K–22 curriculum and outreach programs** (including YES-EV and other early engagement initiatives) to broaden awareness, shift perceptions, and inspire the next generation of engineers and technicians.
- Conducting **longitudinal studies and community perception surveys** to assess the effectiveness of programs and guide continuous improvement.
- Implementing the **WRL framework** through interviews, surveys, and mapping of ASPIRE deliverables to both WRL and TRL milestones.
- Supporting **industry partnerships** that create on-ramps from technical certification through higher education, building replicable and scalable pathways into electrified transportation careers.

Representative Technical Milestones

- Launch of an **ASPIRE-led certification program** for electrified transportation infrastructure workforce skills.
- Deployment of **international REU opportunities** and continued expansion of domestic REU programs.
- Development and pilot of a **WRL interview** protocol tested across ERCs, followed by structured evaluation with agencies and industry partners.
- Expansion of the **YES-EV program** and integration of EV-related curriculum into K–12 classrooms.
- Ongoing **assessment of program outcomes** through longitudinal REU tracking and community perception surveys.

Together, these efforts will ensure the workforce is not only technically prepared but also supported by consistent standards, scalable pathways, and community engagement — laying the human foundation for widespread deployment of electrified transportation systems.

TRL & WRL ALIGNMENT CHART

	TRL	WRL LEVEL	WRL DESCRIPTION
10	*n/a*	*Mature implementer workforce*	*Education pipelines institutionalized; workforce routinely trained, certified, and hired directly from institutions*
9	*Actual system proven through successful mission operations*	*Scaled implementer workforce*	*Technicians hired at scale; roles standardized; career pathing begins*
8	*Actual system completed and qualified through test and demonstration*	*Initial implementer workforce*	*Entry-level technologists begin work; training programs widely adopted*
7	*System prototype demonstration in an operational environment*	*Transition innovator/ implementer workforce*	*Shift from innovation to implementation; job training formalized and scalable*
6	*System/subsystem model or prototype demonstration in a relevant environment*	*Specialist innovator workforce*	*Workforce grows with specialist roles; skills align with specific industry demands*
5	*Component and/or breadboard validation in relevant environment*	*Generalist innovator workforce*	*Private sectors are involved; pilot training with feedback; versatile,cross-cutting roles*
4	*Component and/or breadboard validation in laboratory environment*	*Transition creator/ innovator workforce*	*As technology is prepped for commercial potential, interdisciplinary team skills emerge*
3	*Analytical and experimental critical function and/or characteristic proof of concept*	*Applied creator workforce*	*Proof-of-concept developed by researchers; initial skill-building activities begin*
2	*Technology concept and/or application formulated*	*Specialized creator workforce*	*Exploration of tasks, skills, and fields from prior/ related technologies; career awareness*
1	*Basic principles observed and reported*	*Initial creator workforce*	*Academic researchers begin exploring what workforce skills/fields may be relevant*

Pilots & Testbeds

Hardware Testbed

The Electric Vehicle & Roadway (EVR) research facility serves as both the hardware testbed for the Center and ASPIRE's headquarters. The EVR, critical to the testing and evaluation of fully integrated grid-vehicle hardware systems, is complemented by the construction this year of the ASPIRE Living Lab. The Utah Living Lab, located on land leased by ASPIRE within the northwest quadrant of the Utah Inland Port, is immediately adjacent to the Union Pacific Intermodal Terminal in Salt Lake City — which supports freight movement regionally throughout the state. Together these sites are key to the testing and public demonstration of technology and provide not only real-world applications but also opportunity for real-world use.

Year 5 Enhancements

Additional features and assets have been procured to further broaden ASPIRE's capabilities at these sites, including at the Living Lab:

- 2MWhr/0.5C of energy storage 0.25 miles of 100+ kW dynamic wireless in-road charging infrastructure
- 2 x 75kW static wireless chargers
- 1 MW static wireless charging infrastructure
- Site smart energy management system
- 500 kW grid interconnection.

At the EVR more infrastructure was added to support deployment testing and research considerations including:

- 1MWhr/1C of energy storage for smart energy management
- 1 MW wireless charging infrastructure
- DER management and ecosystem reliability software implementation
- Electrical infrastructure for outdoor test trench applications
- Installation of the ASPIRE-Purdue 3-phase 200 kW dynamic in-road charging system

With these enhancements to the EVR and the Living Lab, ASPIRE has supported standardization testing with the SAE and industry partners advancing forward interoperability and commercialization options for wireless power transfer systems and smart control and response of electrical infrastructure. ASPIRE has also been at the forefront for communication of charging infrastructure needs, utilizing its powerful modeling, simulation, and planning software with traffic, vehicle, and ownership adoption datasets to better understand the future needs of electrification. The Hardware Testbed, including the Living Lab, add to these datasets real-world implementation inputs, and have been impressive education and communication tools for public outreach, industry member interactions, and government to increase understanding and needs for the nation to be competitive in the advancements of electrified transportation.

Software Testbed

ASPIRE's software testbed integrates power, transportation, and mobility systems into a unified computational ecosystem, and in Year 5 ASPIRE developed a more robust suite of AI-enabled tools, digital twins, and predictive control systems deployed for real-world environments. The primary objective for the testbed is the development of models and tools for benchmark transportation and power system modeling. These evolving models can analyze both the rollout of charging technology and the power distribution requirements for infrastructure and are critical to ASPIRE's planning efforts and its comprehensive impact on existing systems. Simulations for both end-state and transitionary analysis of electrified transportation will use a mixture of actual and synthetic (but representative) datasets. Regional roadways and power networks for this testbed have been collected through open-source data generation tools and innovation board partners. Challenges persist in data availability for accurate simulations, but key geographic areas have been identified that contain sufficient overlap between available data in the power system and transportation domains, and advancements have been realized this year with additional partner agreements providing controlled access through ASPIRE's secure data management portal. In tandem with the broader testbed framework development, ASPIRE continued development of baseline case studies. Transportation data together with power system planning has informed the impact of roadway electrification, thereby facilitating improved estimates for economic and environmental impacts at multiple spatial scales — leading to better collaboration with partners and ultimately additional RFPs and demonstration projects.

Core Capabilities

- **AI-Enabled Energy Management Systems (EMS):** At the EVR, ASPIRE has deployed predictive EMS tools that integrate transformers, Bayesian models, and reinforcement learning agents to manage unscheduled EV charging. These systems dynamically curtail or shift load, preventing peak penalties while ensuring reliable charging for public and fleet applications.
- **Digital Twins for Cities and Corridors:** AI-enhanced digital twins of Salt Lake City and Logan combine traffic simulation, energy forecasting, and emissions modeling. These platforms evaluate infrastructure investments and policy scenarios, supporting state and community decision-makers with data-driven planning tools.
- **Terrain-Aware Energy Prediction:** Using real-world telematics, ASPIRE developed AI models that predict EV energy consumption across elevation changes, traffic conditions, and rural corridors. This work informs charger placement strategies and real-time route optimization for transit fleets and passenger vehicles.
- **Reinforcement Learning for Infrastructure Deployment:** Policy gradient algorithms embedded in MATSim simulations identify cost-optimal charger deployment with market-driven utilization estimates. This tool has been applied at state-highway scales to reduce investment while maintaining user accessibility.
- **Charger Congestion Modeling:** Through CARLA-based simulations, ASPIRE uses reinforcement learning agents to replicate how drivers select chargers under congestion and limited availability. The results inform pricing, signage, and routing strategies for high-demand corridors.

Computational Infrastructure

ASPIRE carriers out these efforts with a dedicated software and AI infrastructure, and in Year 5 computing infrastructure was added at the EVR:

- 4 real-time ingestion servers capturing >100 live chargers, vehicle telematics, and EMS systems.
- A 16-node Kubernetes cluster (896 cores, 2 TB RAM) supporting scalable analysis, web services, and decision-support tools.
- High-performance edge machines deployed in vehicles and facilities for real-time inference and EMS integration.
- Cloud/hybrid compatibility for scalable deployment with partners and national labs.
- Custom-developed lightweight LLM variants and pipelines optimized for reinforcement learning integration and token-processing, enabling unified AI workflows across simulation, decision-support, and control tasks.

These platforms serve as critical convergence points within ASPIRE, connecting fundamental research, enabling technologies, and community engagement to guide the transition to widespread transportation electrification.



Key Testbed Applications

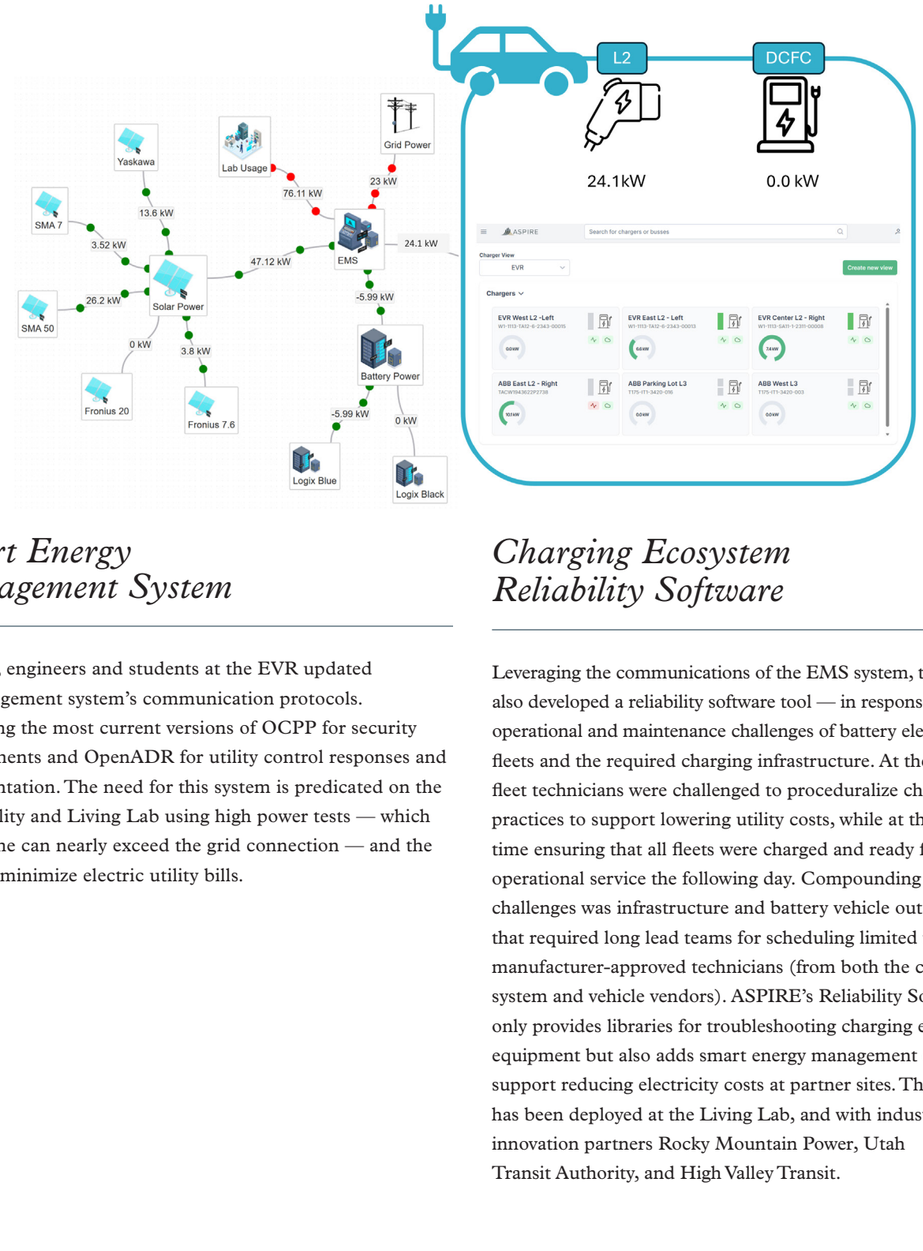
For Center development, the testbeds serve primarily to:

- Provide necessary space, configurability, equipment to validate hardware prototypes for demonstration and testing
- Staff professionally trained personnel and administration required to move testing beyond core fundamental research and support development, demonstration, and deployment projects
- Showcase results and operate demonstrations for industry and innovation liaising
- Offer an environment for workforce development among students and be an information conveyor of education and career opportunities to the community
- Research to roadway — connect prototype research projects to pilot installations
- Maintain and continuously improve super-computing capabilities for infrastructure planning and requirements to support the Center's mission

CATALYST FOR P3 DEMONSTRATIONS

ASPIRE connects research concepts to proposals and public-facing deployments. As a crucial resource for communicating the message and vision of the Center, the EVR has hosted many current and investigatory industry and innovation partners. ASPIRE recognizes the societal impact of research completed within the EVR's walls is far reaching. However, perhaps even more impactful is the training and development that each student gains and will carry with them from participating in the research. For this reason, the qualified EVR engineering staff strive to provide career-preparing applied learning experiences for each student.

Testbed Results



Smart Energy Management System

In Year 5, engineers and students at the EVR updated the management system's communication protocols. Integrating the most current versions of OCPP for security improvements and OpenADR for utility control responses and implementation. The need for this system is predicated on the EVR facility and Living Lab using high power tests — which at any time can nearly exceed the grid connection — and the desire to minimize electric utility bills.

Charging Ecosystem Reliability Software

Leveraging the communications of the EMS system, the EVR also developed a reliability software tool — in response to operational and maintenance challenges of battery electric bus fleets and the required charging infrastructure. At these sites fleet technicians were challenged to proceduralize charging practices to support lowering utility costs, while at the same time ensuring that all fleets were charged and ready for operational service the following day. Compounding these challenges was infrastructure and battery vehicle outages — that required long lead teams for scheduling limited trained manufacturer-approved technicians (from both the charging system and vehicle vendors). ASPIRE's Reliability Software not only provides libraries for troubleshooting charging ecosystem equipment but also adds smart energy management controls to support reducing electricity costs at partner sites. This software has been deployed at the Living Lab, and with industry and innovation partners Rocky Mountain Power, Utah Transit Authority, and High Valley Transit.

Pilots: *Development, Demonstration, & Deployment Activities*

Furthering crucial research and testing of electrification technologies, the Testbed Team continues to work with industry and innovation partners to install demonstration and pilot systems in the EVR test track and beyond.

Utah Inland Port Installments:

The Northwest Quadrant of the Utah Inland Port has been selected for pilot wireless power transfer (WPT) installations. ASPIRE is leading efforts to identify optimal sites, select technologies, coordinate permitting, and oversee construction and demonstrations. In collaboration with Salt Lake City, ASPIRE has navigated permitting processes, submitted design documents, and engaged stakeholders. Dynamic in-road and stationary WPT systems have been successfully built, demonstrated, and integrated with grid connections, energy storage, and smart energy management. This project site is a vital step toward zero-emission freight and directly supports a number of ASPIRE partner initiatives such as: UDOT Phase 2 NEVI program, RMP Make Ready infrastructure program, the pending ASPIRE SuperCharge site, and the UDEQ Clean Ports and Clean Trucks programs, which have secured $170 million in federal funding and offer incentives covering up to 90% of the cost for new heavy-duty electric trucks.



Electreon install at the ASPIRE Living Lab in Salt Lake City, UT. The 2MWhr site energy storage in the background.

1 MW Kenworth FALCON Pilot:

To reduce freight-related emissions, ASPIRE partnered with Kenworth and UPS to launch two zero-emission routes using a battery-electric Class-8 Kenworth truck powered by two 1 MW wireless chargers. Routes run from Salt Lake City to Logan and Salt Lake City to Provo, testing performance over steep terrain and in cold climates. The WPT system, developed by ASPIRE at USU, will be deployed at the EVR in Logan and the ASPIRE Living Lab at the Utah Inland Port. The pilot will span at least 3 months and 10,000 miles. Construction at the Inland Port site is nearly complete. Infrastructure, including asphalt, concrete, transformers, and grid connection. The installation was complete and energized in Spring 2025, including two 1 MWh Sonnen battery packs were commissioned and integrated with ASPIRE's Energy Management System, allowing remote control. The battery packs are mounted on mobile skids for easy relocation. Remaining tasks include fencing, canopy installation, gates, soil grading, and a mobile break room. Both sites are ready to receive the 1 MW chargers once fabrication is complete.



The Falcon charges at the 1 MW wireless charger at the EVR.



Sonnen 1C battery packs that enable MW-level charging delivered to the EVR.



ASPIRE conducted thermal inspection of the INDOT DWPT testbed pilot on U.S. 231/52 in Indiana.

INDOT Pilot:

Construction to update a portion of the existing West Lafayette US 231/US 52 highway, near INDOT's West Lafayette office, began April 2024. The quarter-mile strip was fitted with 85 ASPIRE-developed transmitters. These coils leverage ASPIRE's fundamental research on using symmetrical component analysis to optimize the design of 3-phase wireless power transfer (WPT) transmitters and receivers. One of the key tests of the Indiana Pilot this year confirmed that all 85 coils were able to meet at target sequence-coupling factor (SCF), with several well below the target of <5% SCF, demonstrating the durable quality of the coils. ASPIRE also broke the record for wireless power transmitted on a U.S. roadway (>200kW). Several ASPIRE industry partners, including AECOM, P.C. Krause and Associates, and Cummins Inc., have played key roles in the development of the Indiana Pilot success.

WPT Demonstrations Support (MDOT, FDOT, NDOT):

ASPIRE is actively supporting the development of testing and performance data for wireless power transfer (WPT) systems to inform current recommendations and future research. In Year 5, ASPIRE collaborated with AECOM to assist the Florida DOT in developing an RFP for WPT installations at the SunTrax facility, providing test procedure recommendations and committing to planning, installation review, and data analysis. ASPIRE also supported evaluation of Electreon's dynamic and static WPT systems deployed by MDOT in the Detroit area. Additionally, ASPIRE began working with Felsburg Holt & Ullevig (FHU) and NDOT to develop an RFP for a dynamic charging lane as part of I-80 corridor improvements near Lincoln, Nebraska.

Data Management & Secure Web Services Portal:

ASPIRE's data and web services deliver curated, secure access to real-time and historical data from internal and external sources. These services support research, simulation, and field implementation by integrating diverse data streams into ASPIRE's system-of-systems simulator. The web services layer also connects hardware components in Testbed 1, enabling ASPIRE-developed technologies to be deployed in pilot projects. This year, ASPIRE advanced development of a secure data portal to manage the growing volume of datasets supporting software testbed development and infrastructure planning. Enhancements to data management processes and security features have been essential to ensure reliable access and protection of sensitive information. By enabling direct queries of models and simulation outputs, these tools ensure research is actionable, fosters collaboration across the ERC, and accelerates progress toward electrified transportation solutions.



Integration of the ENRX commercial DWPT system to the Kenworth T680 at the ASPIRE EVR.



At the EVR, ENRX is validating their DWPT technology in both asphalt (pictured) and concrete.

Electreon Dynamic Charging Pilot:

ASPIRE partnered with Electreon, an ASPIRE IIB member, to install a dynamic wireless charging system for port drayage and short-haul fleets at the Utah Inland Port. The quarter-mile system is strategically located on the public ingress/egress road to the Union Pacific Railyard. Drawing on lessons from Electreon's previous installation at the EVR, the teams have refined both technology and installation processes. ASPIRE also acquired a fully electric Class 6 Kenworth K270E truck, currently being upfitted with an Electreon receiver pad for use with the system, along with a Class 8 Kenworth T680E for expanded applications.

EVR as Designated SAE Testing Location:

ASPIRE, working together with industry partners, technology manufacturers, OEM's, and transportation agencies have, and will continue to install WPT systems at the EVR to support advancements and provide detailed input for SAE Standards J2954/2 (WPT for Heavy-Duty Electric Vehicles) and J2954/3 (DWPT for Light- and Heavy-Duty Vehicles). SAE has designated the EVR as the main location for this real-world testing to occur. This year, technology from four additional industry partners were tested at the EVR site, providing more data to support the development of interoperability WPT standards.

Central Florida Expressway:

In Year 5, the EVR ASPIRE team worked with ENRX (ASPIRE IIB Partner) to provide further review, design, and planning for the installation of the ENRX system on the CFX tollway. During the summer of 2024, a 40-meter length of the ENRX system was installed at the EVR track. This was the first ever embedment of this system into a concrete roadway which provided real-world feedback on construction/installation procedures for the future installation in Florida. Commissioning of the system at the EVR was completed this year. The receiver pad was also mounted to the Kenworth T680E semi-truck at the EVR for use during this commissioning. USU and UTEP teams will perform multiple assessments on the concrete DWPT system, during its testing at the EVR. These tests will provide valuable data for thermal, strain, power transfer, and magnetic emissions modeling for wireless power transfer systems at scale. Furthering the industries understanding for electrified roadways.

Stadler Battery-Electric Trainset:

ASPIRE is partnering with Swiss manufacturer Stadler to develop and deploy the Battery FLIRT — a lightweight, battery-powered two-car trainset based on Stadler's diesel FLIRT. This will be the first passenger train in the U.S. to demonstrate electrified public transit without overhead infrastructure, enabling zero-emission travel across extended routes. While Stadler focuses on trainset design and construction, ASPIRE is leading efforts in modeling multi-modal charging infrastructure, workforce development, and assessing economic and air quality impacts. These insights are informing ASPIRE's Utah Electrification Initiative and long-term infrastructure plans for 2030, 2040, and 2050, advancing the feasibility of electrified, multi-modal transportation systems.

Stadler rendering of the battery-electric FLIRT trainset.



Utah Electrification Initiative:

ASPIRE holds the lead role and is responsible for the advancement of the Utah Electrification Initiative, a statewide effort to accelerate the deployment of zero-emission transportation infrastructure. Through technical modeling, stakeholder engagement, and strategic planning, ASPIRE is helping shape Utah's long-term electrification roadmap for 2030, 2040, and 2050. This year the team has evaluated multi-modal charging needs, and identified high-impact corridors, economic and environmental benefits, and produced an annual report to the state legislature. These efforts support the integration of zero-emission technologies across freight, transit, and passenger systems, and align with federal and state funding opportunities, all informed by an expansive and active industry advisory board.

Digital Twin Simulations of Deployment Sites:

ASPIRE has developed an AI-enhanced digital twin of the Living Lab deployment site in Salt Lake City to support infrastructure planning and policy evaluation. This platform integrates traffic simulation, energy forecasting, and emissions modeling across urban, residential, highway, and rural environments. Using the CARLA simulation environment, ASPIRE can virtually install roadway infrastructure and simulate vehicle interactions, providing both data-driven insights and visual demonstrations of how electrified systems can be deployed. This year, Class 8 vehicle dwell time analysis — powered by GEOTAB data — has guided infrastructure siting for heavy-duty freight applications. These digital twin tools are essential for aligning real-world deployment with environmental and economic goals, while supporting state and community decision-makers with actionable planning resources.



Attendees of ASPIRE's annual EVR Open House experience the CARLA digital twin simulation of the Living Lab area in Salt Lake City, Utah.



Self-Sufficiency Plan

Growing into the ASPIRE nonprofit

ASPIRE has been wildly successful in its first five years at expanding its funding portfolio by engaging with stakeholders and aligning with opportunities for direct societal impact. This has led to external revenue received or announced exceeding five times NSF's investment in ASPIRE to date, placing ASPIRE well on track to its goals for self-sufficiency. However, challenges have developed in managing and maintaining the growth within the structures of the university, creating risk for the future. The decision has been made to transition ASPIRE into a new nonprofit entity as the corporate face and front door of ASPIRE. The nonprofit will be wholly owned by USU and connected to each of the partner universities through Cooperative Agreements, similar to the way USU is tied to the partner universities today. This approach has been discussed in detail with ASPIRE leadership, partner universities, and USU senior leadership, and it was unanimously approved in September 2025 to move forward by USU's Board of Trustees.

Following the feedback from the last site visit, the leadership team has pursued new options for the corporate structure of ASPIRE through strategic planning with ASPIRE's leadership councils, multiple workshops with professional consultants, and guidance from USU's administration and legal counsel. This will establish a self-sustaining nonprofit organization that positions the Center as the nation's most trusted guide for electrified transportation — the "NASA of transportation electrification." This nonprofit will strengthen partnerships with universities, states, federal agencies, national labs, and industry to accelerate a practical and coordinated transition. By coupling financial stability with broad societal reach, the ASPIRE nonprofit ensures that the Center's foundational research and innovation ecosystem will continue to thrive.

The new corporate structure will provide ASPIRE with greater agility in pursuing revenue sources and responding to stakeholder needs. Funding sources include industry sponsorship and contracts for research and services, intellectual property revenue, philanthropic donations, and state and federal government support, including expansion into defense and security programs. The ASPIRE team and its partners will leverage the next five years as a transition period, building the foundation for the nonprofit while maintaining and expanding operations, in other words, building the plane while flying it.

ASPIRE has set a target growth rate of 10%, including a plan to raise an additional $150M by Year 10 of ASPIRE in 2030. This includes an additional $50M in university research, $50M in P3 pilots and deployments, $25M in expanded professional services, and $25M in donations and memberships. Additionally, ASPIRE's efforts with P3 pilots and stakeholders to showcase and incubate technologies will generate for-profit ventures for ASPIRE and its university partners including technology licensing, start-up companies, and joint ventures with industry partners.

Relationship with University Partners

The ASPIRE nonprofit will serve as the corporate hub of the Center. It will manage the brand of ASPIRE and all of its operations, and it will take lead on all "beyond research" efforts, including technology and workforce development, demonstration, and deployment activities. The transition to the nonprofit will flip the current model, from a faculty-led research program with a growing number of support staff, to a professional staff-led program with direct ties to faculty-led university research.

ASPIRE will continue to be tied at the hip with university partners through cooperative agreements with institutional commitments. Universities will serve as:

- The primary source of research and college graduates, and the source of technical breadth and depth through facility expertise.
- Regional hubs that connect local and regional stakeholders into ASPIRE's ecosystem, leading to regional pilots and deployments.

ASPIRE will continue to provide financial support to maintain the engagement of faculty and student researchers, Campus Directors, and ASPIRE Student Associations (ASAs).

Opportunities for Giving

We invite you to join us at this critical time as we transition ASPIRE to the next tier of national impact on the path to the nation's intelligent electrified transportation system! Opportunities for giving include:

- **Industry Transformation:** Help us lead the nation to a brighter future with lower cost transportation, improved air quality, economic growth, and grid resiliency. ASPIRE will champion "moonshot" grand challenges, including the first 1000 miles of intelligent electrified transportation systems, P3 pilots leading to advanced technology deployment, standards development, and convening of industry, government, and academia leading to industry and government commitments and policy.
- **Research Advancement:** Help us attract, recruit, and retain the very top talent to our university partners and to the mission and vision of ASPIRE.
- **Workforce Development:** Help us to build the workforce of tomorrow through strategic efforts, including student leadership and clubs, student-industry engagement and ASPIRE's pathways programs
- **Community Engagement:** Help us to actively listen, learn, and involve our regional communities in the process as we transform the transportation and electric utility industries.

Core Roles and Activities Driving ASPIRE into the Next 5 Years

To support the transition to a self-sufficient nonprofit, ASPIRE has grouped its activities into six categories. Each represents both existing strengths and clear paths for growth:

- **Research Convener & Driver:** Connects research funding with university partners and delivers technology solutions to industry through roadmaps, grand challenges, policy influence, and collaborative events.
- **Technology Developer & Provider:** Translates research into large-scale demonstrations, supporting faculty and industry partners with engineering staff, testbeds, and P3 pilots (e.g., USU, Purdue, Electreon, ENRX, Kenworth, Cummins).
- **Engineering, Testing & Training Services:** Provides specialized engineering services, standards support, consulting, training, and prototype evaluation. Currently managing five contracts with seven pending.

AI Tools, Systems Planning & Data Services: Offers advanced modeling, planning, and data management for electrified transportation and grids, with projects including Utah's statewide planning program and Rocky Mountain Power pilots.

- **Market & Community Advocate:** Champions electrification through conferences, policy briefings, community engagement, and communications.
- **Workforce & Talent Developer:** Builds pathways from K–12 to technical colleges and universities, develops curricula, pre-apprenticeships, and mobile training units.

Together, these roles will enable self-sufficiency for ASPIRE financially while extending impacts across research, technology development, workforce, industry, and community engagement.



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CMHA Concrete Masonry & Hardscapes Association
CONEXUS INDIANA
cté
DFW Dallas Fort Worth International Airport
Hill Air Force Base
FORTH
HEAL UTAH Healthy Environment Alliance of Utah
INL Idaho National Laboratory
IAPA Illinois Asphalt Pavement Association
ILCPA Illinois Concrete Pavement Association
Indiana Department of Transportation INDOT
IMTA Indiana Motor Truck Association Since 1934
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UAPA "Paving the future"
Utah Clean Cities Clean Fuels • Clean Strategies • Clean Air
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UTA
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1.1 Executive Summary

ASPIRE is an NSF ERC that pursues innovative infrastructure and systems solutions to guide society on the best past forward to electrify the transportation sector.

The Center launched at a critical moment in U.S. history. ASPIRE's work emphasizes the crucial role of developing and implementing electrified transportation systems (ETS) in shaping a better future for generations to come. Our fundamental research and workforce development efforts are catalyzing practical transitions to widespread electrification in transportation with seamless integration of interconnected intelligent systems infrastructure. With the ultimate goal of enhancing the quality of life for all, Center goals include improving air quality, as well as increasing economic opportunity and access to advanced, affordable transportation.

ASPIRE is the first center of its kind to take a holistic approach to addressing these challenges by creating a seamless, ubiquitous charging experience for all users and vehicle classes. The Center's team serves as a trusted guide for society, and as a champion for inclusive pathways for participation in the workforce required to sustain widespread vehicle electrification. Building on the successes of Years 1-4, the themes of 2025 were:

- Launching ASPIRE technologies beyond research into scalable pilots
- Advancing the next generation of fundamental research
- Engagement with active industry & innovation members, community, & stakeholders.

As ASPIRE enters its 6th year — a renewal period — the Center advances from early development into a proven pattern of sustained growth, maturity, and impact. To date, ASPIRE has contracted close to **$138M total funding with an additional $36M awarded for the next 3–4 years.** A $15M expansion of its headquarters and electric vehicle and roadway (EVR) systems testbed, along with pilots in Indiana, Florida, and Utah have expanded the Center's capacity for systems level-research, development, demonstration, and validation. The EVR is already being leveraged by industry partners and the Society of Automotive Engineers (SAE) for technology characterization and the development of new standards for static and dynamic wireless charging of electric vehicles.

ASPIRE's research progresses rapidly, swiftly moving from initial exploration to the application of fundamental discoveries. Initial explorations conducted in the first four years are now advancing to pilot demonstrations in 2025 and beyond. While these technologies advance into society, we continue to conduct fundamental research to understand to improve these systems in real-world scenarios through testing, simulations, and models, and to seed the next generation of enabling technologies for future systems pilots. This research is driven by industry and societal needs, focusing on critical areas such as cybersecurity, algorithms and protocols for intelligent connected systems, software planning and real-time operations tools, and materials and packaging.

The next few years will be very exciting and impactful for ASPIRE. Stakeholder engagement will continue to expand beyond research and into reality with suppliers, fleets, national industry, labor associations, and local, state, and tribal governments. Under this national framework, ASPIRE will continue to achieve breakthrough advancements across multiple disciplines — advancements targeting gaps and barriers identified through continuous stakeholder engagement.

1.2 Continuous Improvement

From its inception, ASPIRE has embraced a culture of continuous improvement, treating both formal assessment data and informal feedback as opportunities to refine operations, strengthen engagement, and deliver greater impact. Over the first five years, this has led to significant organizational enhancements, such as redesigning student cohort programs to increase inclusiveness and creating a Center-wide Code of Conduct that guides collaboration across campuses. We have also expanded communication channels through a streamlined annual report process, a glossy public-facing version for broader visibility, and the launch of regular newsletters tailored to internal and external audiences. Student engagement has been further prioritized through targeted sessions and expanded mentorship structures, supported by the creation of new staff positions focused on people, culture, and engagement. Industry and Innovation Board (IIB) practices have evolved to improve visibility and connectivity, including the introduction of LinkedIn engagement strategies. Together, these efforts reflect ASPIRE's commitment to learning from experience, acting on feedback, and building structures that advance both the Center's mission and the success of its members.

1.3 SWOT Response of NSF Site Visit Report Summary

Concern: Need clearer articulation of gaps, barriers, and project evaluation criteria.

Year 5 Efforts in Response:

- Updated technical roadmaps tied to industry needs and IIB guidance.
- Introduced structured gap analysis during Fall 2024 planning cycle.
- Increased transparency by documenting and sharing project evaluation criteria with stakeholders.

Concern: Collaboration across campuses not fully realized; pathways unclear.

Year 5 Efforts in Response:

- Deployed common electrification-focused curriculum across three campuses.
- Expanded multi-campus programs (REU, REM, redesigned Tech Talks) to create shared student experiences.
- Began planning coordinated lab rotations and internships across institutions and internationally.
- Strengthened workforce pathways through partnerships with trade unions, technical colleges, and industry.

Concern: Unclear how safety, resilience, and security are integrated into pilots.

Year 5 Efforts in Response:

- Embedded safety reviews in pilot permitting; advanced FOD and exposure testing.
- Partnered with Utah and INL to align resilience and cybersecurity research with deployments.

- Incorporated resilience/security requirements (e.g., DoES encryption, grid modeling) into pilot standards.
- Working with SAE to translate safety and security findings into practice.

Concern: Missed opportunities to connect electrification with mobility behavior and adoption shifts.

Year 5 Efforts in Response:

- Expanded engagement with communities, K–12, and tribal governments, including the pilot of statewide electrification communications in the Utah Electrification Initiative's bimonthly newsletter.
- Added adoption and behavioral modeling into Integrated Systems tools for mobility/charging choice prediction.
- Positioned workforce pathways and policy engagement as drivers of societal transformation.
- Expanded framing infrastructure pilots in context of transit integration (Reliability Dashboard used by UTA and High Valley Transit), coordination with freight and fleet operation entities, to reduced reliance on single occupant/personal EVs rather than larger scale and quantity opportunities.

1.4 Convergent Research Summary

ASPIRE integrates the REDI areas across four projects: Charging Stations of the Future (CSoF: Project 1), Electrified Roadways (ER: Project 2), Integrated Systems (formerly Systems of Systems, now IS: Project 3), and Pathways (Project 4). Together, the projects are aimed at establishing a ubiquitous charging network that enable the battery size/cost, eliminate range anxiety, and reduces emissions. Key transformative accomplishments span hardware innovations (high power static and dynamic wireless power transfer for EVs), software and systems integration (battery modeling, vehicle-grid power management models, techno-economic and life cycle assessment), expanded participation and workforce development initiatives, and research for identifying barriers to EV adoption to inform policy and decision makers to accelerate the transition to electrified transportation.

1.4.1 Key Achievements:

- **Advanced Charging Innovations:** Developed planning tools and Smart Charge Management algorithms that shaped federal NEVI program specifications, pioneered >1 MW wireless charging for heavy-duty trucks, and deployed pilots at the Utah Inland Port and EVR testbed.
- **Electrified Roadways Leadership:** Designed and deployed the world's first high-power, three-phase DWPT system for Class 8 trucks in partnership with INDOT and Cummins, with durable roadway materials extending lifespans to 30–50 years.
- **Integrated Modeling & Policy Impact:** Delivered first-of-their-kind techno-economic, lifecycle, and transportation asset management models that guided national and global electrification planning, including Utah's statewide strategic plan for intelligent electrified transportation.

- **Education & Workforce Development:** Expanded a global suite of electrification-focused learning tools reaching 3.3M+ teachers and students, launched international REU programs, and built K–12 and higher-ed pathways that connect students to industry and research careers.
- **Cyber & Systems Integration:** Advanced secure vehicle-roadway communications (DoES encryption) and open-source models for DWPT and grid integration that optimize coil placement, travel demand, and EV charging with market pricing.

1.4.2 SWOT Response: Convergent Research NSF Site Visit Report

Overall, ASPIRE's convergent research has been highly rated in the past. ASPIRE remains committed to deepening convergence and integration, improving methodological rigor, and ensuring research continues to deliver unique, high-impact results. Ongoing strategic planning will address suggested improvements while leveraging ASPIRE's recognized global leadership in electrified transportation systems research and societal impact.

1.4.2.1 Convergent Research (Center-Wide)

Year 5 Efforts:

- Maintain and expand cross-disciplinary collaboration across all ASPIRE campuses, integrating insights from engineering, social sciences, and policy studies to ensure research aligns with societal impact goals.
- Strengthen training and best practices for communication and collaboration across disciplines, ensuring researchers can reconcile tools, techniques, and concepts outside their specialties.
- Develop a high-level research roadmap with clear priorities to guide convergence, balance short-term practical needs with long-term scientific pursuits, and ensure progress toward transformational societal impact.
- Continue documenting and disseminating cross-disciplinary results through high-quality publications, conferences, and industry engagement, addressing prior concerns about scientific output visibility.
- Highlight the Integrated Systems (IS, formerly Systems of Systems (SoS)) team's contributions to system integration, socioeconomic analysis, and energy transition planning, reaffirming the global impact of ASPIRE's IS research.

1.4.2.2 Research Thrust/Project 1 – Charging Stations of the Future

Year 5 Efforts:

- Continue advancing high-power MW fast chargers and physics-based battery modeling integrated across Projects 1 and 2.
- Apply validated multi-campus models and tools to optimize charging station deployment, incorporating socio-economic and community feedback for statewide planning.
- Maintain active dissemination of research through tech talks, publications, and industry engagement, supporting adoption and stakeholder confidence.

1.4.2.3 Research Thrust/Project 2 – Electrified Roadways

Year 5 Efforts:

- Refine multi-physics modeling for pavement and embedded charging infrastructure, integrating electromagnetic, thermal, and structural performance data.
- Enhance validation and monitoring using real-world pilot sites, drone data acquisition, and state DOT partnerships to ensure operational reliability.
- Continue exploring tradeoffs for dynamic wireless power transfer deployment at various depths and pavement types, leveraging unique expertise to inform national deployment strategies.

1.4.2.4 Research Thrust /Project 3 – Integrated Systems (formerly Systems of Systems (SoS))

Year 5 Efforts:

- Based on Year 4 feedback, leadership evaluated potential integration of social, behavioral, and other assessments into Thrusts 1 and 2 while maintaining IS as a standalone research effort if strategically advantageous. It was determined that IS would benefit from continued thrust status, allowing deeper convergence with projects 1, 2, and 4.
- Strengthen modeling of transportation systems, power systems, and multi-infrastructure interactions, emphasizing bi-directional feedbacks and system-level integration.
- Expand methodological rigor in optimization, system dynamics, and game-theory-based approaches to address interdependencies between EV adoption, grid stability, and infrastructure performance.
- As mentioned above, a Year 5 priority was development and implementation of internal processes for project prioritization, evaluation, and alignment with overall Center objectives to ensure resource efficiency and research impact.

1.4.2.5 Research Thrust/Project 4 – Pathways

Year 5 Efforts:

- Expand and standardize ASPIRE Student Associations (ASA) and REU/REM programs across all campuses, promoting cross-campus collaboration and equitable student engagement.
- Develop interdisciplinary curricula bridging engineering with social sciences, humanities, and business, fostering holistic understanding of electrified transportation challenges.
- Enhance participatory action research (PAR) and community engagement approaches to ensure inclusive stakeholder input, representative data, and sustainable outcomes.
- Leverage ASPIRE research testbeds as experiential learning platforms, providing hands-on training aligned with industry needs and societal impact objectives.

1.4.2.6 Testbeds SWOT Response: NSF Site Visit Report

Hardware Testbed

Year 5 Efforts:

In Year 4, the EVR was ranked a high-quality testbed, providing a robust environment for both internal research and industry collaboration. In Year 5, this continued to be the case, with the EVR providing the Center a platform to showcase infrastructure progression, support research, and facilitate data-driven modeling. Expanding its footprint at USU, the facility evaluates internal and external dynamic wireless power transfer (DWPT) technologies, including systems from Electreon, ENRX, Purdue, and the Falcon 1 MW battery-electric truck. With 1.5 MW grid connection, 128 kW solar power, and 200 kWh of battery storage (with 1 MWh additional in procurement), the EVR enables demonstrations of power management, electrified transportation solutions, and renewable integration. The testbed also supports pilot installations, such as the 1 MW WPT system at Utah Inland Port, allowing lessons in constructability, costing, and operational performance to inform future research and system-of-systems modeling.

Software Testbed

Year 5 Efforts:

In Year 4, the Center's Full-Scale City-/Intercity Simulator/software testbed was considered low-quality, reflecting its early-stage development but high potential to enhance future research capabilities. Reviewers suggested rescoping toward corridor- or segment-level digital twins to complement physical testing, enabling evaluation of wireless charging technologies under varied traffic and climate conditions. In Year 5, ASPIRE pivoted, leveraging access to real-time data in the state of Utah to scale computational infrastructure. A software-based city-scale co-simulator was developed for this policy/consulting P3 Pilot, which will be instrumental as transportation and power systems to evaluate electrification strategies cannot be physically tested at scale.

ASPIRE's full-scale simulator and computational testbed integrate power, transportation, and mobility systems into a unified environment that supports technology validation, infrastructure planning, and real-world deployment. In Year 5, ASPIRE advanced this framework by developing a robust suite of AI-enabled tools, digital twins, and predictive control systems that extend testbed capabilities into real-world environments. These evolving models analyze both the rollout of charging technology and the power distribution requirements of infrastructure, enabling simulations of end-state and transitionary pathways to electrified transportation. Regional roadway and power network datasets — sourced through open data generation tools and secured partner agreements — are now supported by ASPIRE's data management portal, providing an increasingly representative foundation for scenario analysis and planning. Together, these advancements have strengthened the testbed's ability to benchmark transportation and power system integration and to inform future deployment strategies.

More on ASPIRE's computational infrastructure can be found in the Testbeds narrative.

1.5 Engineering Workforce Development Summary

ASPIRE's Electrification Workforce Development (EWD) team is building the engineering workforce needed to design, construct, and maintain nationwide electrified transportation systems. This includes degreed engineers as well as technicians, skilled trades, educators, and managers whose roles intersect with engineering and electrification. The EWD approach centers on creating interconnected career pathways that prepare individuals with three core competencies: systems-of-systems thinking, transdisciplinary expertise, and 21st-century professional skills such as innovation, ethics, leadership, and communication.

1.5.1 Key Achievements:

- **Forging partnerships with trade unions** (AFL-CIO and IBEW in Utah), technical colleges (Weber State University's EV-automotive credential program), and industry (Stellantis).
- **Expanded Student Opportunities** for undergraduates and high school students and teachers (REU/REM) and launching a rural mobile electrical training program and deepening the coordination with ASPIRE's Student Engagement Committee.
- **Growing Industry Involvement** by piloting industry engaged cohorts, and new credentialing initiatives, including digital badges and certificates in engineering entrepreneurship and industry-specific skills.
- **Strategically Scaling** an advisory board to scale efforts that can be replicable nationally for cultivating a skilled electrification workforce aligned with industry, infrastructure, and community needs. EWD also advanced high school and community engagement through events, teacher professional development, and outreach in previously unreached neighborhoods.

1.5.2 SWOT Response: Engineering Workforce Development NSF Site Visit Report

In Year 4, ASPIRE's Engineering Workforce Development was ranked as high quality. This is in large part due to ASPIRE's EWD program being guided by a clear strategy: preparing a workforce to design, build, and maintain a nationwide electrified transportation system. Recognizing ASPIRE cannot meet every workforce need directly, the Center employs a three-part approach:

(1) Developing workforce readiness through curricula, training, and student engagement.

(2) Partnering with universities, industry, trades, and labor organizations to extend training reach.

(3) Modeling the workforce ecosystem to anticipate future labor and skill demands. These strategies are tightly aligned with the Center's convergent research vision and its transition toward long-term self-sufficiency.

In efforts to address feedback to expand beyond degree-seeking credentials, EWD is transitioning from being purely "Engineering"-focused to a broader "Electrification" career development approach. This includes deepening partnerships with trades and unions, technical schools and apprenticeship/on-the-job training programs, and developing ASPIRE's own

certifications and licensures to prepare the next generation's workforce, regardless of whether they're pursuing a traditional, four-year degree or beyond.

Year 5 Efforts include:

Progressing REU and Undergraduate Involvement

- **REU program** continues strong recruitment from underrepresented groups.
- Secured **CARE-EV IRES funding** for international research (University of Auckland).
- Expanded engagement through digital badging and ASA/Student Leadership Council.

Curricular Development

- Interdisciplinary ETS and equity courses integrate ASPIRE research into classrooms.
- Cross-disciplinary collaborations (e.g., Landscape Architecture + EV charging station design).
- Planned certificate and digital badge programs in **entrepreneurship, leadership, and professional development**.

Stakeholder Interaction

- Student engagement with **Industry & Innovation Board (IIB)**, internships, and cohort travel.
- Pilot/testbed projects generate **safety training resources** for industry.
- Launched **entrepreneurship badge program** to integrate commercialization training.

Industry Partnerships

- Expanded collaboration with **industry, trades, and labor organizations** to identify skills needs.
- Industry surveys inform competencies and training design.
- Partnership with **INDOT** to map electrification ecosystem stakeholders and readiness.
- WRL rubric development to align skills evaluation across partners.

Student Participation

- Strong student involvement across campuses via SLC; initiated transition to **Council of Presidents** in Year 6.
- Planned **student engagement coordinators** at each campus for equitable access.
- Faculty/staff actively engaged; efforts recognized and supported by institutions.

1.6 Innovation Ecosystem Summary

The Innovation Ecosystem serves as a hub for collaboration, technology transfer, and market adoption within the electrification space. The Innovation Ecosystem plays a central role in

advancing the Center's mission and preparing for a self-sufficient model beyond NSF funding by maintaining and expanding a strong industry and innovation membership base, expanding stakeholder partnerships, fostering a culture of entrepreneurship, and enhancing engagement with the broader transportation and energy sectors. Efforts are continually placed on refining long-term strategies and actively engaging with the broader ecosystem through individual meetings, public events, campus and testbed visits, government demonstrations, industry exhibits, and keynote addresses at national and international conferences.

1.6.1 Key Achievements:

- **Industry & Government Engagement:** Expanded relationships with OEMs, supply chain partners, technology providers, and municipal and state agencies, accelerating pilot project planning and implementation with an Industry and Innovation Board representing nearly 70 organizations.
- **Academic Collaboration:** Grew the research network with international university partners (The University of Tokyo) by sharing infrastructure, testbeds, and advanced data modeling tools.
- **Technology Advancement:** Enabled technology integration and refining system modeling. To date, the Center holds 39 patents, with 17 more in the pipeline. *(More details on TRLs can be found in each project's narrative section.)*
- **Policy & Public Awareness:** Elevated national visibility for electrified transportation through outreach to policymakers, community organizations, and trade associations.
- **Innovative Thought-Leader:** Convened experts to drive sector dialogue. The Center hosted its 8th biennial Conference on Electric Roads and Vehicles (CERV) conference, bringing together more than 200 global leaders in charging, electrified roadways, and vehicle-grid integration, and presented at key industry events such as the Transportation Research Board Annual Meeting, the 2025 Advanced Clean Transportation (ACT) Expo, and the Intelligent Transportation Society (ITS) Conference.

1.6.2 SWOT Response: Innovation Ecosystem NSF Site Visit Report

ASPIRE's stakeholder engagement is high-quality, connecting academic research to real-world systems through deep partnerships, feedback loops, and growing inclusivity. Planned refinements (feedback systems, cross-campus equity, entrepreneurship support, engagement rubrics) will strengthen alignment with market and societal needs. In Year 5, the Industry and Innovation Board has grown to nearly 70 members, including expanded partnerships with international academic institutions and industry representatives. ASPIRE's Innovation Ecosystem is functioning as a high-quality translational hub: building membership breadth, enabling technology transfer, fostering entrepreneurship, and creating pathways for sustainable societal value.

Year 5 Efforts include:

Pathways to Innovation

- **Pilot deployments** (Utah, Indiana, Florida) demonstrate real-world pathways from discovery to societal benefit.

- Integration of **workforce, and community input** ensures sustainable, systems-level impact.
- International collaborations (University of Tokyo, MRI) expand global knowledge transfer.

Membership

- **10 new members added in Year 5**; membership diversified to include startups, global Tier 1s (e.g., Denso, Schneider, WSP), agencies, and trade associations.
- Membership growth and retention demonstrate strong ecosystem value; key stakeholders now engaged across value chain.

Partnerships

- Established **ASPIRE Agency Pilot Working Group** uniting 9 agencies for collaborative innovation.
- Strategic partnerships with **AAI, NAPA, AAPA** integrate ASPIRE into broader national innovation agendas.
- Strong ties with local/state/federal agencies enable co-development of pilot projects.

Entrepreneurship

- **Optimized Kinetics spinout** demonstrates commercialization pipeline.
- Entrepreneurship training initiated via **student cohort trips, innovation badges, and IIB collaborations**.
- Growing need acknowledged → planning underway for **Market Creation Institute** and **Tech Incubator**.

Translational Research & Technology Transfer

- **39 patents, 17 disclosures, 1 spinout** with growing pipeline of industry-linked IP.
- Industry partners integrating IP into **public-private pilot projects**.
- Research portfolio spans **TRL spectrum** from foundational to near-deployment, enabling scaling.

1.6.3 Stakeholder Engagement

In Year 4's Site Visit Report, ASPIRE's stakeholder engagement was also rated as high-quality, connecting academic research to real-world systems through deep partnerships, feedback loops, and growing inclusivity. Planned refinements (feedback systems, cross-campus equity, entrepreneurship support, engagement rubrics) will strengthen alignment with market and societal needs.

To continue this trajectory, **Year 5 Efforts Included:**

Identification of Stakeholders

- Comprehensive list spanning **industry, government, academia, community groups, and nonprofits**.
- Engagement includes **DOTs, utilities, ports, trade associations, startups, and Tier 1 suppliers**.

Integrated Feedback Loops

- Iterative engagement through **IIB Day, TechTalks, Student Cohort Trips, and Agency Working Group**.
- Pilot projects (Utah, Indiana, Florida, Michigan, Pennsylvania) create **real-time feedback channels** between research and application.

Continuous Growth

- Membership growth (+10 this year) tracked across sector, geography, and value chain.
- Engagement evaluated via **patents, disclosures, internships, sponsored projects, advisory board realignment, and agency collaborations**.
- Additional metrics under development → plan to formalize rubrics for stakeholder engagement impact in Year 6.

1.6.4 Foreign Collaboration

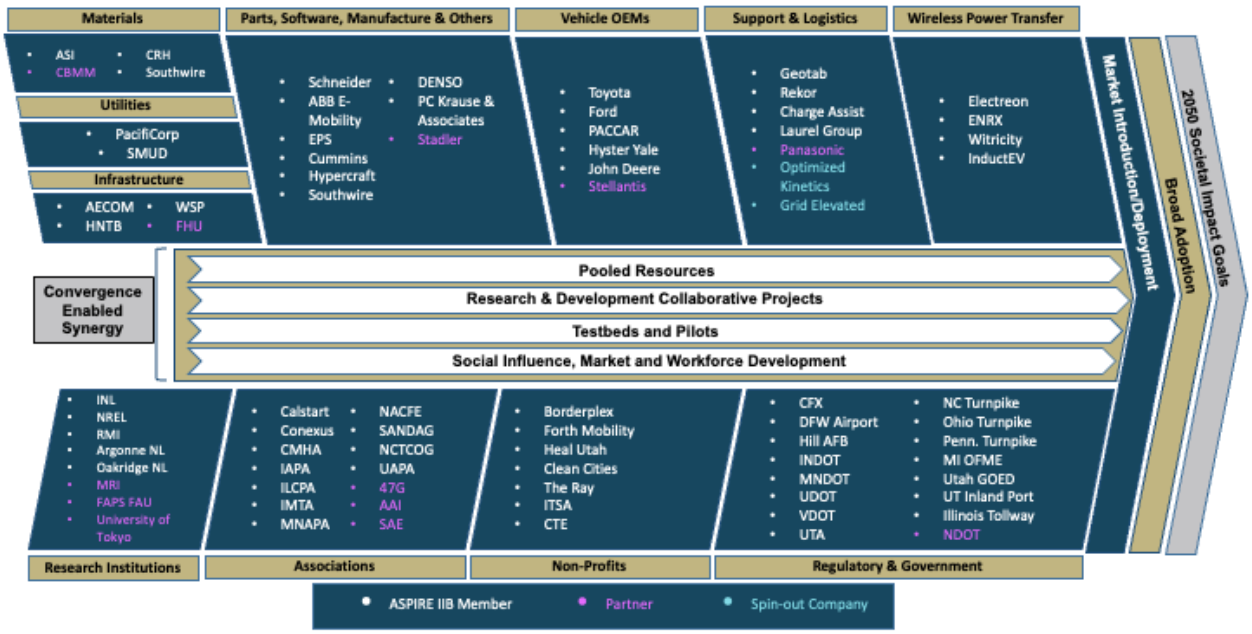
As mentioned above, ASPIRE's innovation ecosystem intentionally integrates international partners to complement and extend the expertise of its domestic collaborators. Partnerships with institutions such as the University of Tokyo and the University of Auckland provide critical perspectives and capabilities that strengthen the Center's ability to address electrification at a global scale. These collaborations contribute advanced infrastructure, modeling tools, and cross-disciplinary expertise that are not readily available within U.S. institutions, enabling comparative research on deployment strategies, grid integration, and public adoption across different societal and policy contexts.

These foreign collaborations align closely with the ERC's vision of building convergent research teams that accelerate the transition to electrified transportation systems. By situating U.S. research in dialogue with international best practices, ASPIRE ensures its work advances not only technical readiness, but also pathways for policy and market adoption across environments.

The partnerships also create significant cross-cultural research and educational opportunities. Joint initiatives such as the Research Experiences for Undergraduates (REU) expansion with the University of Auckland, shared use of electrified roadway testbeds, and collaborative modeling workshops give students and faculty first-hand exposure to global perspectives on engineering, energy systems, and societal adoption. These experiences enhance cultural competency, broaden professional networks, and prepare the next generation of engineers and scholars to lead in an increasingly interconnected electrification landscape.

1.6.5 Value Chain

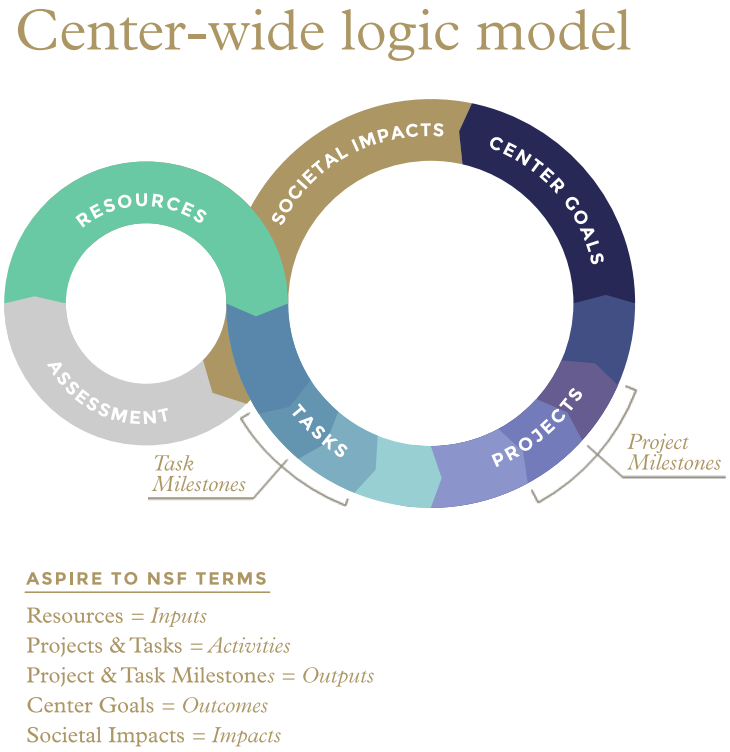
ASPIRE IIB Value Chain



Appendix B

1.1. Strategic Plan

1.2. Logic Model



ASPIRE's strategic planning is built around its logic model, represented in the **Logic Model** figure. The logic model is a systematic and visual representation that outlines the key components and relationships of ASPIRE's project and program management. The tasks and projects are proposed each year by project leads and reviewed by a proposal team to ensure alignment with the upcoming Center Goals. The Center Goals have been designed to bring the Center closer to the Societal Impact Targets. Operationally, all items from Center Resources to Short-Term Center Goals are maintained in the Center's project management tool ClickUp for day-to-day use.

1.3. Strategic Planning Themes

Given the scale and scope of its long-term impact goals, it is evident the societal goals cannot be achieved by the Center alone and that the Center goals for Years 5-10 cannot be achieved in isolation. Center's goals will not be achieved in isolation and require strategic focus and positioning. ASPIRE identified strategic planning themes when it was launched, and these continue to act as guides for making decisions on resource allocation and program development. The themes include ***Convergence and Integration, @Scale, Leveraging,*** and ***Engagement.*** In combination, these will position the Center to amplify all four foundational Pillar components to achieve our societal impact targets. While ASPIRE alone may not be able to achieve societal goals without significant advocacy and policy changes at the federal, state, and local levels, it can serve as a catalyst. ASPIRE has the potential to become the organization that people nationwide look to as an example of how to drive meaningful progress

Convergence & Integration — Convergence across disciplines is central to achieving ASPIRE's mission and long-term impacts. This is achieved through the deliberate formation of project tasks and teams with support from Center leadership. Projects are crafted to align with long-term Center goals, with milestones that can only be reached through dedicated, cross-disciplinary collaboration. Each project is required to engage multiple areas of expertise across the Pillar

components. For example, within Project 4 (formerly Learning & Engagement, now Pathways), an environmental impact task combines technology and social science elements to explore how high school engineering teachers' understandings and pedagogies related to environmental impacts evolve through sustained professional learning experiences.

ASPIRE has also implemented strategies to further encourage convergence and track the impact of these collaborations. This includes the proposal call, quarterly reports track convergence between projects at a frequent interval, project presentations at leadership meetings, tech talks, and pitches to our IIB members. Our project management tool also clearly links mutual dependencies between tasks and projects, reinforcing sustained collaboration among all Center participants.

***@Scale* —** Achieving ASPIRE's mission requires influence at a scale that is not possible through isolated activities. It is not even possible with coordinated efforts that remain within the direct reach of ASPIRE participants. ASPIRE's *@Scale* strategic planning theme is the litmus test for all ASPIRE activities, asking: "Is this scalable?" and "What must be done for this effort to support impact and adoption at scale?" One example of this is the Creative Engineering high-school design course that was piloted in Year 2, expanded in Year 3, and, in Year 4, was launched on the ASPIRE section of TeachEngineering's website for 3M+ science teachers to use. In Year 5, additional resources were added to serve as an educational hub for all education materials related to electrification.

A second example is the ASPIRE Open House held annually now for the past two years at USU and attracting over 400 community members each year. ASPIRE surveys the participants each year to determine how kids' and parents' interest in STEM careers was impacted by the Open House. These findings and details are shared across ASPIRE and will be further developed to support events outside of ASPIRE. The *@Scale* test is intended to help ASPIRE team members prioritize time and effort, especially as the number of requests to participate (in various research opportunities, discussions, outreach events, workshops and conferences, etc.) continues to escalate. Also, in support of the *@Scale* theme, ASPIRE will continue to build and strengthen strategic relationships with key non-profit organizations that have broad scale national and international influence.

***Leveraging* —** The ASPIRE projects are not to be considered narrowly as traditional projects funded by a single source and limited to a predefined scope. Rather, ASPIRE aims to be a long-term strategic platform that supports bringing activities from all funding sources into alignment with the Center's vision, and leveraging all resources to accomplish its mission. This theme is one of the reasons ASPIRE projects have been organized with leads assigned to coordinate tasks, with combinations of core and associated project funding, and with a directive to identify gaps and pursue additional funding. This is a monumental balancing act of moving targets that demands complex data management and significant trust among researchers and partners who share early results and plans across their programs. This trust and balance are critical to the success of ASPIRE and its sustainability model.

This theme requires that core funds be applied to critical paths where outside associated sources are not yet available. Examples include seed funding — particularly involving junior faculty — to fill identified gaps with pathways to leveraged funding, maintain continuity on critical paths during interludes in associated funding, and provide opportunities to supplement associated

projects in ways that directly benefit ASPIRE's goals (e.g., EWD or Innovation components to associated projects, or adding research components that generalize and transition results from an associated project into broader use within ASPIRE). New proposal development is an ongoing, coordinated effort in ASPIRE to leverage new fundamental insights under development, and to secure additional funds for advancing enabling technologies, testbeds, and pilots.

The success of the *Leveraging* theme is evident in the Center's financial progress. To date, ASPIRE has contracted close to $138M in total funding, with an additional $36M already awarded for the next 3-4 years.

Stakeholder & Community Engagement — The targeted industry transformations must be carried out through the strategic stakeholder and community partners who have the necessary resources and influence to realize and carry forward the societal impact targets of the Center. ASPIRE has placed significant effort and resources behind building an exceptional Innovation Ecosystem leadership team with years of experience in the financial industry that will help build the Center's sustainability model. The Center's IIB membership has grown to nearly 70 members, with many additional important relationships and discussions in progress. As one of ASPIRE's strategic planning themes, all efforts and activities are considered through the lens of stakeholder and community engagement, including creative and innovative opportunities that integrate convergent research, EWD (especially with student participation), and IIB members have had meaningful involvement with the Center at the project level wherever possible, and have also given TechTalks and served as guest instructors in the ASPIRE Electrified Transportation Systems course. IIB members are involved in all of ASPIRE's testbeds and pilots on a clear path to beyond pilot deployments and societal impact.

As part of the Risk Management Plan, ASPIRE leadership regularly reviews its stakeholder base and representation on its IIB and EAB to identify any new areas of involvement required to accomplish its mission. In line with this strategic planning theme, ASPIRE positions itself as a trusted guide for the envisioned transformations across the transportation and electric utility industries in support of widespread EV adoption. This requires building a well-informed team among all ASPIRE participants and leveraging stakeholder engagement and strategic partnerships to fully comprehend the barriers, biases, motivations, market developments, and challenges across the entire stakeholder base. This understanding then informs the path forward for new innovation and technology development.

1.4. Project & Team Formation

At ASPIRE, our approach to project and team formation is rooted in the belief that true innovation emerges from cross-disciplinary collaboration and integration. It begins at the leadership level and is carried through to the individual project level. Project teams have found it critical to avoid isolated pockets of research — or even the *appearance* of tiers or silos among campuses and disciplines. Instead, the emphasis is on open collaboration and convergence to gain new insights and lines of thinking. We have actively worked to ensure that our research remains interconnected and synergistic. The structure and scope of Projects 1 and 2, for example, have been significantly shaped by the findings and feasibility analyses from Project 3.

To further reinforce this interconnected approach, ASPIRE has transitioned from a Research Thrusts framework to a more project-based structure, emphasizing a systems-oriented methodology. This strategic shift enhances the integration of electrified roadways within the broader context of transportation and power grid systems while ensuring that equity principles are upheld. Project 3, in particular, serves as the guiding force behind this vision, setting the foundation for a truly integrated and convergent research center.

Project leaders have also taken on elevated roles within the Center and are responsible for team building and fostering a deepening coalescence of effort and thought across disciplines within their projects. The Center's areas of core expertise (research area leads in: Transportation, Adoption, Power, and Data) interface across all Center projects. In this report, the project and task teams — including students, faculty, and staff — are listed at the end of each project's section.

In Year 5, ASPIRE has continued to strengthen its approach to project and team formation by building on the Center's convergent foundation while addressing identified challenges. We are advancing cross-disciplinary collaboration through structured workshops that align terminology, methodologies, and data frameworks across transportation, power, and adoption research. Senior faculty are taking on a greater role in providing strategic vision and mentoring junior colleagues, ensuring sustained leadership capacity as the Center grows. New faculty hires aligned with ASPIRE's mission are expanding expertise and bringing fresh perspectives into the research portfolio. The Communications & Marketing Team, established in Year 4, now plays a pivotal role in sustaining collaboration across projects and campuses, while stakeholder engagement remains central through intentional integration of industry and community partners into project planning. These efforts reinforce ASPIRE's systems-level approach, ensuring that growth enhances — rather than complicates — collaboration, and that team formation remains a strategic driver of innovation.

1.5. Stakeholder Engagement

ASPIRE's stakeholder engagement strategy is designed to ensure that all parties — industry, government, community, and academia — are integrated into the Center's mission and research activities. Engagement occurs through the Industry and Innovation Board, government advisory groups, and structured opportunities for community and workforce input, with intentional emphasis on bidirectional communication so that research outcomes and stakeholder needs remain closely aligned. In Year 5, the Center has strengthened this approach by expanding cross-campus coordination, hosting joint workshops with state and municipal partners to align infrastructure planning with research outputs, and enhancing student-industry connections through pilot site visits and career pathway programs. These efforts reflect ASPIRE's strategic priority to build a robust ecosystem where stakeholders not only advise but actively shape pilot deployments, technology translation, and policy alignment — ensuring outcomes are both technically sound and societally impactful.

1.6. SWOT Response Strategic Plan NSF Site Visit Report

While Year 4's Site Visit Team ranked ASPIRE's strategic Plan as high quality, a significant effort has been placed on improving the **Annual Proposal Call process** and **Ongoing Assessment and Evaluation.**

Proposal Selectivity and Evaluation. The Center has implemented a more rigorous proposal review process to encourage high-quality submissions and align internal funding decisions with strategic priorities. Year 5 proposals were critically reviewed by leadership, research area leads, and external partners, using formal metrics such as alignment with Center goals, involvement of industry/external partners, advancement of testbeds, and contribution to strategic priorities. Reviewer comments are now systematically shared with proposers, which improves proposal quality, supports team formation, and fosters mentorship of junior faculty. This has shifted the internal funding rate away from the near-100% acceptance of earlier years to a more selective and competitive process designed to raise the overall quality of funded research.

Ongoing Assessment and Responsiveness. The strategic plan remains dynamic, with leadership holding annual retreats to incorporate NSF feedback, advisory board input, and stakeholder perspectives into revised roadmaps. This iterative process ensures that ASPIRE continues to focus on research gaps, societal impact, and long-term sustainability while scaling its influence across sectors.

Appendix C

1.1. Management & Organization

ASPIRE's management structure continues to evolve to match the Center's growth in size, scope, and complexity. In Year 5, leadership undertook a strategic planning retreat to refine roles across Strategic Pillar directors, research area leads, and project leads, ensuring clarity, accountability, and alignment with ASPIRE's post-NSF support self-sufficiency goals. Recognizing the NSF's feedback, the Center is exploring complementary frameworks for project selection and evaluation that extend beyond leadership expertise, including external reviews, rotating peer panels, and internal competitions to foster innovation and transparency.

To strengthen cross-campus cohesion, ASPIRE has embedded practices that ensure all campuses contribute visibly to Center-wide priorities. These include structured opportunities for faculty and student collaboration across institutions, joint workshops tied to pilot demonstrations, and the development of shared mentoring models that ensure consistent student experiences regardless of campus. Particular attention has been placed on deepening the integration of Project 3: Integrated System's research portfolio, ensuring that its contributions are both strategically aligned and broadly visible.

Communication and cohesion remain central to ASPIRE's organizational success. The Center continues to refine its meeting cadence and internal communications, while expanding external-facing newsletters, open houses, and virtual engagement formats to connect members across geographies. These efforts are complemented by the Marketing and Communications Team, which now plays an expanded role in fostering trust, transparency, and visibility across internal and external audiences. Through these actions, ASPIRE is not only managing growth but also building a resilient, adaptive organization capable of delivering on its vision for electrified transportation at national scale.

1.2. Methods for Management and Organization

1. Determining which programs/projects are needed to achieve the Center's strategic plan.
ASPIRE identifies projects through a structured planning process that integrates technical roadmaps, industry needs, and societal impact goals. Research area leads and Strategic Pillar directors coordinate with the Leadership Team and Industry & Innovation Board (IIB) to ensure proposed projects align with ASPIRE 2.0 priorities. In Year 5, a structured gap analysis was added to more clearly identify where new projects are needed to achieve the strategic plan.

2. Determining funding allocation to implement the strategic plan.
Funding decisions are made through a combination of leadership team review, roadmap alignment, and guidance from the IIB. Each Strategic Pillar director works with research leads to propose budgets, which are then evaluated for alignment with center-wide priorities, partner balance, and potential for external leverage. Adjustments are made annually based on performance, new opportunities, and evolving external conditions.

3. Assessing the quality and impacts of the programs/projects.
ASPIRE employs an annual project review cycle that includes internal milestone tracking,

quarterly reporting, and cross-pillar integration meetings. In Year 5, additional transparency was introduced by documenting project evaluation criteria and sharing them across campuses. Metrics include technical progress, publications, student engagement, industry partnerships, and contributions to pilots or adoption pathways. Emerging tools such as the Reliability Dashboard also help measure system-level impacts.

4. Role of advisory boards in program/project review & assessment.
The Industry & Innovation Board (IIB), Advisory Boards, and subcommittees play a central role in reviewing project portfolios, assessing alignment with industry trends, and identifying barriers to adoption. Board input is explicitly incorporated into project selection, roadmap refinement, and pilot planning. The boards also provide external benchmarking to ensure the Center's research is responsive and impactful.

5. Identifying associated programs/projects needed to achieve the strategic plan.
Through strategic retreats, roadmap exercises, and external input, ASPIRE identifies complementary programs that extend its core research. Examples include workforce pathways with technical colleges, policy engagement with state governments, and resilience/security collaborations with national labs. These associated programs reinforce the ERC's integrated mission by connecting technical, workforce, and societal adoption dimensions.

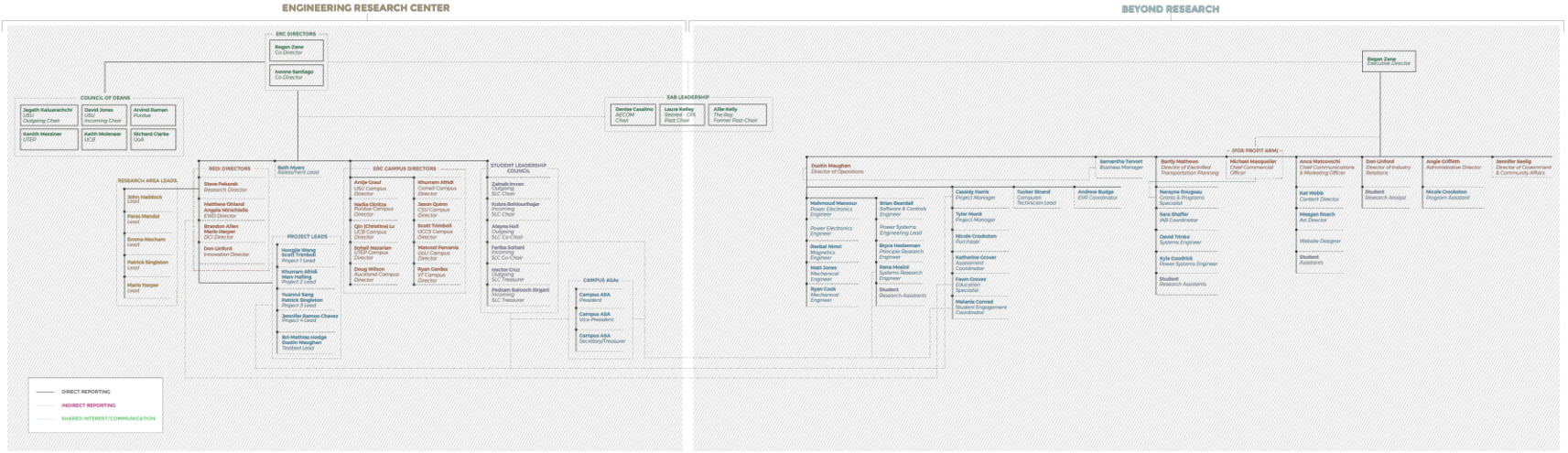
6. Effectively managing the ERC team, including roles of participants from partner and collaboration institutions.
ASPIRE is headquartered at Utah State University but operates as a distributed network across core and affiliated partners. Roles are defined across levels: Strategic Pillar directors set priorities, research area leads coordinate implementation, and project leads ensure milestones are delivered. Partner institutions, including Virginia Tech and Cornell, contribute specialized expertise that is integrated through cross-campus project teams and shared student programs. In Year 5, leadership emphasized more cohesive cross-campus integration, expanded communication channels, and increased engagement of campus directors to ensure consistency across institutions.

More detail on the shifting of Roles and Responsibilities as the Center moves toward Self-Sufficiency Post-NSF Support can be found in the Self-Sufficiency Plan of the project narrative.

1.3. SWOT Response: Management & Organization NSF Site Visit Report

In Year 4's Site Visit Report, ASPIRE was ranked high quality in Management and Organization Infrastructure. As such, efforts in Year 5 have been directed toward setting the Center up for success beyond NSF support, as seen in the rise in consultants brought on, from our nonprofit project manager and new director of electrification strategy.

1.4. Organizational Chart



Appendix D

1.1. Center-Level Risk Management

The risk management approach for ASPIRE contains multiple tiers to address different levels of risk. In addition to the inputs provided by experts within the projects, the team continually monitors and gathers inputs from multiple outside sources — including the EAB, IIB, and the market intelligence group. This enables parallel paths through strategic partnerships in many areas, diversifying risk across possible solutions. The team recognizes that, despite best efforts and careful planning, the future will bring surprises, and the program will have to reevaluate and adapt based on new realities. This has continued to be true in Year 5 as policy, government funding, and industry announcements — combined with supply chain challenges – reshape the vehicle electrification landscape. The ASPIRE team reacted by refining the leadership team and market intelligence focus in monitoring the Center's risks and more fully engaging strategic resources, partners, and research focuses.

The team has further engaged in policy development, beginning to build a coalition across the ASPIRE campuses and governmental policy organizations, and visiting Washington, D.C. to educate legislators and key governmental personnel. The leadership team will continue to keep a close eye on the changing landscape through these mechanisms. In addition, risk management is also reviewed formally on an annual basis by the Leadership Team, and risk assessment at project level is reviewed annually by the project teams. A list of identified risks and their management strategies are identified in the table below.

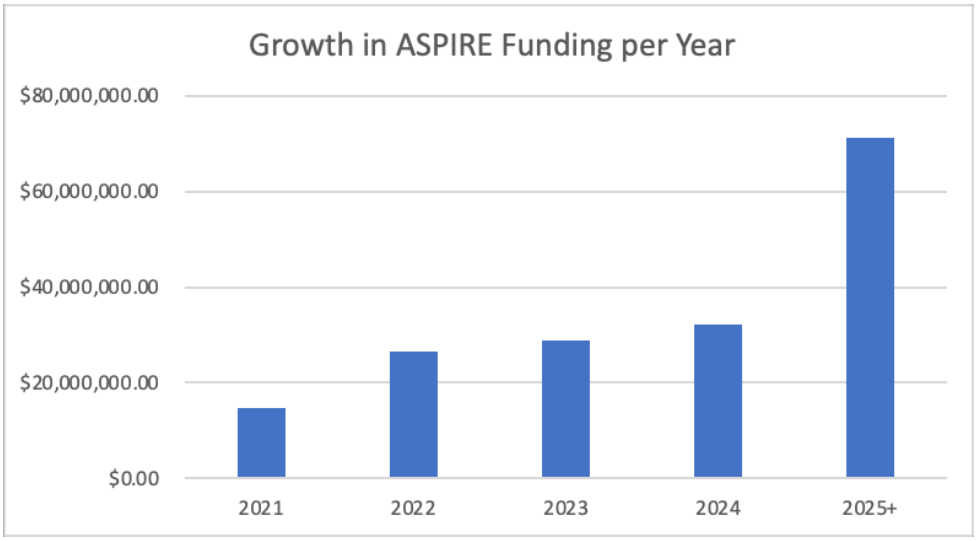
RISK MANAGEMENT PLAN

	Risk Identification							Qualitative Analysis			Monitoring
	Status	ID #	Risk Description (SMART)	Risk Category	Risk Event (threat/opportunity)	Impact Area	Affected WBS process	Probability	Impact	Risk Priority	Status Interval Check
Instructions	**Active**=actively monitored & controlled **Dormant**=risk is not currently a high priority, but may become active in the future. **Retired**=no longer a threat to project objectives.	E1	Detailed description of the risk. Includes information on the risk that is **Specific, Measureable, Attributable, Relevant** and **Timebound**. Describe the consequences of the risk to scope, schedule, budget or quality.	Risk category identifies organizational areas most affected. **Organizational:** organization as a whole / reputation **Strategic:** vision / goals **Financial:** project budgets **Operational:** personnel, resources **Technical:** engineering, specifications, technology **External:** impact to partners/industry	Risk is an uncertain event or condition that, if it occurs, has a positive (opportunity) or negative (threat) on a project. For example; Client product requirements not received	Is the primary impact to the scope, schedule, or budget?	Which WBS element will be modified as part of the response strategy? For example: See schedule for WBS level effected	Assessment of the likelihood of occurrence. Valid entries are Low or High.	The severity of the risk's effect on the projects objectives. Valid entries are Low or High.	**High**: Substantial impact on cost, schedule, or technical. Substantial action required to alleviate issue. **Low**: Minimal impact on cost, schedule, or technical. Normal management oversight is sufficient.	For example: When will action be effected (accountability date)
1	**Active**	**R1**	**Technology integration & scalability barriers** – ensuring MW wireless charging, DWPT, and charging hubs perform reliably under real-world conditions	Technical, Strategic	**Threat** - don't support reliability/operation research **Opportunity** - support research aimed at increasing visibilty of technology for O&M	Schedule	CSoF	High	High	Probability H L X / L H Impact	Annual
2	**Active**	**R2**	**Grid stress and utility readiness** – risk of charging infrastructure exceeding distribution capacity, especially at megawatt levels	Technical, External	**Threat** - don't conduct grid management research **Opportunity** - progress forward smart management research and demonstrations	Scope	IS	Low	High	Probability H L X / L H Impact	Annual
3	**Active**	**R3**	**Economic viability & adoption** – uncertainty in cost-effectiveness of electrified roadways and charging stations, dependent on heavy-duty fleet adoption rates	Finacial, Strategic	**Threat** - insufficient research to reduce recognized constructability infrastructure challenges, creating an low install/adoption ecosystem **Opportunity** - P3 demonstrations with additional constructuability emphasis and strategic infrastructure installs to support adoption	Budget	ER	Low	High	Probability H L X / L H Impact	Annual
4	**Active**	**R4**	**Policy and standards** – misalignment between rapid tech development and policy frameworks at state/federal levels	Organizational, Technical, Strategic	**Threat** - dynamics of state/federal policies **Opportunity** - engage with representatives to ensure proper communication for policy consideration	Schedule	Center / ER	High	High	Probability H L X / L H Impact	Annual
5	**Active**	**R5**	**Workforce readiness** – gaps in skilled labor to design, build, and maintain electrified infrastructure	Operational, External	**Threat** - training programs are not adequately implemented and feedback is not considered for future (8-12, pre-college, trades, etc) **Opportunity** - Industry and external provide input to training gaps and ASPIRE supports development of programs	Schedule	Path	Low	Low	Probability H L X / L H Impact	Annual
6	**Active**	**R6**	**Cybersecurity & resilience risks** – vulnerabilities from EV fleet data, smart grid interconnection, and AI-driven systems	Strategic, Technical, External	**Threat** - data collection is not secured; communication to tech and P3 demonstrations does not follow standards; don't support research to advance security standards **Opportunity** - implement new security protocols on tech development and demonstrate; provide input to standards/development	Scope	IS	Low	High	Probability H L X / L H Impact	Annual
7	**Active**	**R7**	**Funding transition risk** – shift from NSF ERC support to university-owned nonprofit model introduces self-suffiency and revenue variability challenges	Finacial, Organizational, Strategic	**Threat** - ASPIRE does not prepare for transition from ERC funding **Opportunity** - establish ASPIRE entity to support ongoing operations beyond the ERC funding	Budget	Center	High	Low	Probability H L X / L H Impact	Annual
8	**Active**	**R8**	**Public acceptance**- risk that communities or end-users may resist infrastructure, slowing adoption and widening gap in electrification access	Organizational, External	**Threat** - comunication and outreach are not effective or nonexistent; policies discourage electrification **Opportunity** - work with representatives to receive data driven facts, help advance communication of electrification through outreach/conferences/ marketing materials	Schedule	Path	Low	Low	Probability H L X / L H Impact	Annual
9	**Active**	**R9**	**Critical Partnerships -** loss of IIB member support/participation. Membership does not translate to project opportunties	External, Strategic, Organizational	**Threat** - partnerships are not cultivated and don't move research to translational tech **Opportunity** - carefully build relationships and communicate technology opportunities. Utilize Center tools for tracking efforts with industry/partners (HubSpot)	Budget	Center	Low	High	Probability H L X / L H Impact	Annual
10	**Active**	**R10**	**Faculty Retention -** reduction of meaningful participating research faculty	Organizational, Technical, Strategic	**Threat** - as center matures faculty are not aligned with research trajectory or don't understand relation of research to P3 initiatives **Opportunity** - Leadership meets regularly with campus directors/faculty; onboarding for clear goal/objective communications	Budget	Center	Low	High	Probability H L X / L H Impact	Annual

Appendix E

1.1. Institutional Commitment & Resources

ASPIRE is successfully transitioning into a phase of sustained growth, maturity, and impact. As shown in the **Growth in ASPIRE Funding Per Year** figure, the Center has contracted close to **$138M total funding with an additional $36M awarded for the next 3–4 years.** While more than half of the funding is for testbed, pre-pilot, and pilot projects to bring ASPIRE technologies beyond research and into reality, a significant portion is dedicated to research in support of continued breakthrough technology advancements.



1.2. Facilities

ASPIRE's Electric Vehicle and Roadway (EVR) serves as the Center's systems-level testbed. As stated in the Pilots and Testbeds section of this report, capabilities at the EVR have been greatly expanded through 2025 in support of wireless charging and high-power testing systems. In addition, a major expansion of the facility has been completed to provide increased grid and microgrid services, additional equipment and facilities for power transfer vehicle integration, and more installations and opportunities for roadway power transfer applications. The expansion of the new ASPIRE Headquarters facility includes approximately 15,000 ft^2 of student collaboration, office, and reception space, in addition to 10,000 ft^2 of lab space. The facility expansion represents a $15 million commitment by USU and the state of Utah to the continued growth and success of ASPIRE. The new ASPIRE Headquarters facility at USU provides important integrative collaboration space for participants across the USU campus, and for visitors from throughout ASPIRE and its IIB members and stakeholders.

We recognize the participation of all ASPIRE research facilities in our continued collaboration. These facilities include:

- EVR Test Track & Microgrid, USU
- ASPIRE Living Lab, USU (Salt Lake City Inland Port Site)
- SMASH Lab, USU

- Grainger Power Magnetics Fabrication Lab, Purdue
- Fauber Asphalt Research Lab, Purdue
- Accelerated Pavement Testing Facility, Purdue
- Materials Testing Lab, UTEP
- System-level Simulation and Visualization Platform, UCB
- Colorado Power Electronics Lab, UCB
- Wireless Power Transfer Lab, Auckland

1.3. Cross-Campus Communications

Efforts from the Center's communication and marketing team have strengthened ASPIRE's team building, networking, and communication capabilities by utilizing Center-wide tools like ClickUp, Box, Twist for internal collaboration; Mailchimp and Twist for internal communication; and marketing materials, the ASPIRE website, and LinkedIn for external communications and awareness opportunities. In Year 5, the newsletter distribution frequency was increased from quarterly to monthly to ensure more timely updates within the Center, as well as an effort to address MERCII survey opportunities to improve communication. Plans for Year 6 include cross-training Campus Directors, Strategic Pillar Directors, and even Center Directors on a customizable template within the Mailchimp platform for their own team communications. *Additional information on Center-wide Communications can be found in the Assessment and Evaluation supplemental documents of Appendix XIV.*

1.4. Research Lab Safety

As a crucial resource for communicating the message and vision of ASPIRE, the EVR has hosted many current and investigatory industry and innovation partners. ASPIRE recognizes the societal impact of research completed within the EVR's walls is far reaching. However, perhaps even more impactful is the training and development that each student gains and will carry with them from participating in the research. For this reason, the qualified EVR engineering staff strives to provide career-preparing applied learning experiences for each student. Student experiences include, but are not limited to:

- On-the-job training
- Creating test plans and procedures
- Work permits
- Chemical safety
- Proper use of PPE
- PCB design
- GD&T
- Drawing revision control
- Modeling
- Simulation
- Stakeholder engagement
- Hardware assembly
- Software integration

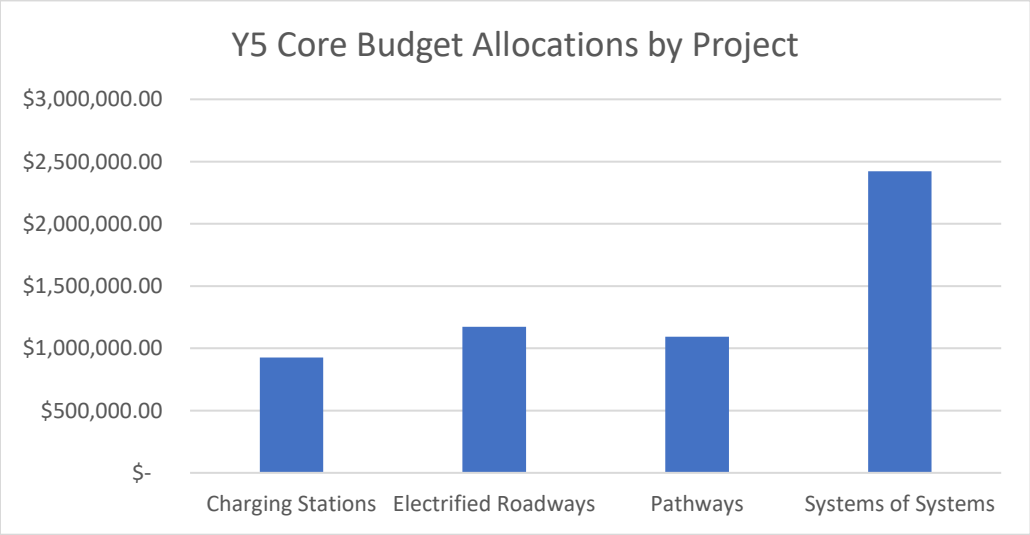
- High-voltage testing

1.5. University Administration

ASPIRE has enjoyed active engagement and support from university administrators from across ASPIRE's campus consortium. USU's former President championed the vision and fundraising for the EVR expansion, and supported state legislative priorities that led to the pilot projects in Utah and designation of ASPIRE as the lead research institution for statewide strategic planning around electrified transportation. The Interim President continues this support and has advocated for the Board of Trustee's approval in creating the external entity that will serve as ASPIRE's non-profit arm post NSF support. The Deans Council and campus directors meet quarterly and have played an active role in leveraging college and campus resources and supporting diversity and retention through recruitment and mentoring programs. Additionally, campus directors help to cultivate a culture of student engagement and leadership through their support of the work of the ASAs and their student leadership (Council of Presidents) within each campus.

1.6. Use of Financial Resources

The ASPIRE leadership team has carefully structured the Center's logic model to align and track all efforts around the Center's goals and societal impact targets. Project leaders have gained a more comprehensive view of financial status for all projects, and, moving into 2026, will have full-time project coordination support to track quarterly expenses against project tasks and milestones. The assignment of core funds by project for Year 5, excluding associated project funding, are shown in the **Y5 Core Budget Allocations by Project** figure. Additionally, all projects include Innovation Ecosystem components, such as active engagement with IIB and additional stakeholders, and entrepreneurial training and activities. Heading into Year 6, the Center has a carryover of less than 23% of NSF support when removing associated funds. Procedures, detailing how technical reporting and proposal requirements must be met by projects in order to receive funding and approval, have been initiated in Year 5 and will continue to be improved upon in Year 6 and beyond.



Appendix i – NSF Required Project Summary

ASPIRE is an NSF ERC that furthers innovative infrastructure and systems solutions to inform society on the best path forward to electrify the transportation sector. ASPIRE is committed to supporting the nation's goals by driving innovation and workforce development across industries. These critical efforts are essential for reducing emissions and enabling smart efficient management of utility infrastructure to support the increasing societal adoption of electrified transportation.

ASPIRE's work emphasizes the crucial role of developing and implementing electrified transportation systems (ETS) in shaping a better future for generations to come. Our fundamental research and workforce development efforts are catalyzing practical transitions to widespread electrification in transportation with seamless integration of interconnected intelligent systems infrastructure. Center goals include improving air quality, as well as increasing economic opportunity and access to clean, affordable transportation. Electric vehicles offer tremendous opportunity to both reduce emissions and stabilize and reduce costs. However, there are significant challenges to the widespread adoption, centered around batteries, range, and charging infrastructure.

ASPIRE is the first center of its kind to take a holistic approach to addressing these challenges by creating a seamless, ubiquitous charging experience for all users and vehicle classes. The Center's team serves as a trusted guide for society, and as a champion for pathways in the workforce required to sustain widespread vehicle electrification.

Intellectual Merit: The ASPIRE team includes more than 450 participants across 10 universities with leading experts in the areas of transportation, adoption, power and data. ASPIRE is taking an integrated systems-of-systems approach to co-optimize transportation, electric utility, and charging systems together with end-user experience and productivity. This approach occurs at the nexus of electrical-mechanical-thermal design of vehicles, charging systems, pavements, and power systems, data fusion and dynamic optimization of networked and co-dependent systems, and econometrics, policy, user acceptance, and environmental and societal impacts. Breakthrough advancements include first in the world demonstrations of megawatt level wireless charging for class-8 trucks, high power in-motion wireless charging systems integrated into asphalt and concreate pavements, and an integrated evaluation framework that considers charging technologies and hardware, power systems, and transportation systems in combination with economic development and air quality improvement.

Broader Impacts: Success of the ASPIRE ERC will transform the automotive, transportation, and electric grid industries in positive ways that will impact everyone in the nation through (1) improved air quality, public health and quality of life through reduced emissions and improved mobility, (2) economic stimulus through reduced transportation costs, (3) U.S. job creation and workforce development in transportation and utility infrastructure and domestic renewable energy production, (4) improved national security through transformed, secure, resilient, and interdependent transportation and electrical grid infrastructure, and (5) development of tools, hardware equipment and software controls, to support the transition from oil dependence by transforming the only remaining major industry still dependent on it. The Center has advanced to the stage of sustained growth, maturity, and impact. ASPIRE has secured commitments for more than $174 million in research, planning, pre-pilot and pilot projects across the nation. These projects expand the Center's testbeds into real-world settings — with stakeholders who bring the technologies to industry, fleets, and end users — and prove the viability of our best practices for community engagement and policy development.

Appendix ii - NSF Required ERC & Center Produced Tables & Figures

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1. Participant Tables

1.1 Academic Institutions Table

Table: Academic Institutions				
Academic Institution	**Institution Type**	**City**	**State**	**Country**
Utah State University	Lead Institution	Logan	Utah	United States of America
Aerokats and Rover Education Network (NASA-funded)	Domestic Partner	Wayne	Michigan	United States of America
Amazon	Domestic Partner	Seattle	Washington	United States of America
Arrupe Jesuit High School	Domestic Partner	Denver	Colorado	United States of America
Beth Myers Consulting	Domestic Partner	Lafayette	Colorado	United States of America
Cabrillo College	Domestic Partner	Aptos	California	United States of America
Centralia College	Domestic Partner	Centralia	Washington	United States of America
Colorado Department of Transportation	Domestic Partner	Denver	Colorado	United States of America
Colorado State University	Domestic Partner	Fort Collins	Colorado	United States of America
Colorado Technology Students Association	Domestic Partner	Denver	Colorado	United States of America
Cornell University	Domestic Partner	Ithaca	New York	United States of America
CUB ODECE Rural Summer Program	Domestic Partner	Boulder	Colorado	United States of America
CUB Society of Hispanic Professional Engineers Student Society	Domestic Partner	Boulder	Colorado	United States of America
CUB Upward Bound Summer Academic Summer Institute	Domestic Partner	Boulder	Colorado	United States of America
Denver Museum of Nature and Science	Domestic Partner	Denver	Colorado	United States of America
Drive Electric Utah	Domestic Partner	Salt Lake City	Utah	United States of America
DSST Public Schools (HS Creative Engineering Design course)	Domestic Partner	Boulder	Colorado	United States of America
Eco El Paso	Domestic Partner	El Paso	Texas	United States of America
El Paso Community College	Domestic Partner	El Paso	Texas	United States of America
El Paso Electric	Domestic Partner	El Paso	Texas	United States of America
El Paso Fab Lab	Domestic Partner	El Paso	Texas	United States of America

El Paso Insights Science Center	Domestic Partner	El Paso	Texas	United States of America
El Paso Leadership Academy (HS Creative Engineering Design Course)	Domestic Partner	El Paso	Texas	United States of America
Fairpark Community Council	Domestic Partner	Salt Lake City	Utah	United States of America
Familias Triunfadoras	Domestic Partner	El Paso	Texas	United States of America
Front Range Community College	Domestic Partner	Westminster	Colorado	United States of America
GEAR Up Junior High School	Domestic Partner	Logan	Utah	United States of America
George Mason University	Domestic Partner	Fairfax	Virginia	United States of America
Glendale Community Council	Domestic Partner	Salt Lake City	Utah	United States of America
Grambling State University	Domestic Partner	Grambline	Louisiana	United States of America
Green Hope Project	Domestic Partner	El Paso	Texas	United States of America
Growth Sector	Domestic Partner	San Francisco	California	United States of America
I Have a Dream Foundation of Boulder County	Domestic Partner	Boulder	Colorado	United States of America
IBEW Local 659, Crater Lake JATC	Domestic Partner	Crater Lake	Oregon	United States of America
InTech Collegiate Academy (HS Engineering Design Course)	Domestic Partner	Logan	Utah	United States of America
Jordan Meadows Community Council	Domestic Partner	Salt Lake City	Utah	United States of America
Lewis County Transit	Domestic Partner	Centralia	Washington	United States of America
Michigan Department of Transportation	Domestic Partner	Lansing	Michigan	United States of America
Murdock Chevrolet GMC	Domestic Partner	Logan	Utah	United States of America
National Association of State Energy Officials	Domestic Partner	Arlington	Virginia	United States of America
Neighborhood House	Domestic Partner	Salt Lake City	Utah	United States of America
Northridge Elementary School	Domestic Partner	Longmont	Colorado	United States of America
NSF INCLUDES CAHSI	Domestic Partner	El Paso	Texas	United States of America
NSF LSAMP NICE	Domestic Partner	El Paso	Texas	United States of America
NW Energy Coalition	Domestic Partner	Seattle	Washington	United States of America
Poplar Grove Community Council	Domestic Partner	Salt Lake City	Utah	United States of America

Purdue Polytechnic High School	Domestic Partner	Indianapolis	Indiana	United States of America
Purdue University	Domestic Partner	West Lafayette	Indiana	United States of America
Rose Park Community Council	Domestic Partner	Salt Lake City	Utah	United States of America
Rose Park Community Learning Center	Domestic Partner	Salt Lake City	Utah	United States of America
Salt Lake City School District/West High School	Domestic Partner	Salt Lake City	Utah	United States of America
Salt Lake Community College	Domestic Partner	Salt Lake City	Utah	United States of America
Sorenson Multi-Cultural Center	Domestic Partner	Salt Lake City	Utah	United States of America
Spring Creek Middle School	Domestic Partner	Providence	Utah	United States of America
Stadler Rail	Domestic Partner	Salt Lake City	Utah	United States of America
Stellantis	Domestic Partner	Auburn Hills	Michigan	United States of America
Stevens Institute of Technology	Domestic Partner	Hoboken	New Jersey	United States of America
Sun Metro	Domestic Partner	El Paso	Texas	United States of America
The Bennett Consulting Group	Domestic Partner	Washington	District of Columbia	United States of America
The City Library, Glendale Branch	Domestic Partner	Salt Lake City	Utah	United States of America
Thornton Middle School	Domestic Partner	Thornton	Colorado	United States of America
TransAlta - First Mode Proving Grounds	Domestic Partner	Centralia	Washington	United States of America
UCB ODECE STEM Summer Program	Domestic Partner	Boulder	Colorado	United States of America
University Neighborhood Partners	Domestic Partner	Salt Lake City	Utah	United States of America
University of California Riverside	Domestic Partner	Riverside	California	United States of America
University of Colorado Boulder	Domestic Partner	Boulder	Colorado	United States of America
University of Colorado Colorado Springs	Domestic Partner	Colorado Springs	Colorado	United States of America
University of Michigan Battery Lab	Domestic Partner	Ann Arbor	Michigan	United States of America
University of Texas at El Paso	Domestic Partner	El Paso	Texas	United States of America
University of Utah	Domestic Partner	Salt Lake City	Utah	United States of America
Utah AFL-CIO	Domestic Partner	Salt Lake City	Utah	United States of America

Utah Asphalt Pavement Association	Domestic Partner	South Jordan	Utah	United States of America
Utah Division of Multicultural Affairs	Domestic Partner	Salt Lake City	Utah	United States of America
Utah System of Higher Education	Domestic Partner	Salt Lake City	Utah	United States of America
Utah Transit Authority	Domestic Partner	Salt Lake City	Utah	United States of America
UTEP Upward Bound	Domestic Partner	El Paso	Texas	United States of America
Virginia Polytechnic Institute and State University	Domestic Partner	Arlington	Virginia	United States of America
Washington State Ferries	Domestic Partner	Seattle	Washington	United States of America
Weber State University	Domestic Partner	Ogden	Utah	United States of America
Western Tech El Paso	Domestic Partner	El Paso	Texas	United States of America
Westpointe Community Council	Domestic Partner	Salt Lake City	Utah	United States of America
Westside Coalition	Domestic Partner	Salt Lake City	Utah	United States of America
Wilson Motors	Domestic Partner	Logan	Utah	United States of America
Yes-She-Can	Domestic Partner	El Paso	Texas	United States of America
Young Automotive Group	Domestic Partner	Logan	Utah	United States of America
Auckland University of Technology	Foreign Partner	Auckland		New Zealand
GNS Science	Foreign Partner	Auckland		New Zealand
Institute for Factory Automation and Production Systems (FAPS)	Foreign Partner	Nuremberg		Germany
Mahi Maioro Professionals	Foreign Partner	Auckland		New Zealand
University of Auckland	Foreign Partner	Auckland		New Zealand
Victoria University of Wellington	Foreign Partner	Wellington		New Zealand

1.2 Leadership Team Table

Table: Leadership Team

Personnel Type	Name	Title	Department	Academic Institution
Director	Konstantina Gkritza	Professor and University Faculty Scholar / ASPIRE Purdue Campus Director	Lyles School of Civil Engineering	Purdue University

Director	Antje Graul	Assistant Professor / ASPIRE USU Campus Director	Jon M. Huntsman School of Business	Utah State University
Director	Qin Lv	Associate Professor / ASPIRE UCB Campus Director	Computer Science	University of Colorado Boulder
Director	Soheil Nazarian	Professor / ASPIRE UTEP Campus Director	Civil Engineering	University of Texas at El Paso
Director	Steve D. Pekarek	Edmund O. Schweitzer III Professor / ASPIRE Convergent Research Director	ECE	Purdue University
Director	Ivonne Santiago	Associate Professor / ASPIRE Co-Director	Civil Engineering	University of Texas at El Paso
Director	Douglas J. Wilson	Associate Professor / ASPIRE UofA Campus Director	Civil and Environmental Engineering	University of Auckland
Director	Regan A. Zane	Professor / ASPIRE Center Director	Electrical and Computer Engineering / ASPIRE	Utah State University
Research Thrust Leader	John E. Haddock	Professor of Civil Engineering; Director, Local Technical Assistance Program / ASPIRE Research Area Lead	Lyles School of Civil Engineering	Purdue University
Research Thrust Leader	Marv W. Halling	Professor / ASPIRE Electrified Roadways Co-Lead	Civil and Environmental Engineering	Utah State University
Research Thrust Leader	Bri-Mathias S. Hodge	Associate Professor / ASPIRE Software Testbed Lead	Department of Electrical, COmputer and Energy Engineering	University of Colorado Boulder
Research Thrust Leader	Michael S. Trimboli	Associate Professor / ASPIRE Charging Stations Co-Lead	Electrical and Computer Engineering	University of Colorado Colorado Springs
Research Thrust Leader	Hongjie Wang	Assistant Professor / ASPIRE Charging Stations Co-Lead	Electrical and Computer Engineering	Utah State University
Research Thrust Leader	Paras Mandal	Professor / ASPIRE Research Area Lead	Electrical and Computer Engineering, The University of Texas at El Paso	University of Texas at El Paso
Research Thrust Leader	Dustin W. Maughan	ASPIRE Program Director, Hardware Testbed Lead	ASPIRE	Utah State University
Research Thrust Leader	Khurram K. Afridi	Associate Professor / ASPIRE Electrified Roadways Co-Lead	Electrical and Computer Engineering	Cornell University
Research Thrust Leader	Sivaranjani Seetharaman	Assistant Professor / ASPIRE Systems of Systems Co-Lead	Industrial Engineering	Purdue University
Research Thrust Leader	Patrick A. Singleton	Associate Professor / ASPIRE Systems of Systems Co-Lead	Civil and Environmental Engineering	Utah State University

Research Thrust Leader	Emma L. Mecham	Professional Practice Assistant Professor / ASPIRE Research Area Lead	School of Teacher Education and Leadership	Utah State University
Research Thrust Leader	Jennifer C. Ramos-Chavez	Post-Doctoral / ASPIRE Pathways Co-Lead	Civil Engineering	University of Texas at El Paso
Innovation Ecosystem Program Leader	Don G. Linford	ASPIRE Industry & Ecosystem Engagement Director	ASPIRE	Utah State University
Engineering Workforce Development Program Leader	Angela L. Minichiello	Associate Professor / ASPIRE Electrification Workforce Development (EWD) Co-Director Co-Director	engineering education, College of Engineering	Utah State University
Engineering Workforce Development Program Leader	Matthew W. Ohland	Dale and Suzi Gallagher Professor and Associate Head / ASPIRE Electrification Workforce Development (EWD) Co-Director	Engineering Education	Purdue University
Engineering Workforce Development Program Leader	Brandon C. Allen	Faculty / ASPIRE Electrification Workforce Development (EWD) Co-Director, Pathways Co-Lead	Political Science	Purdue University
Administrative Director	Angie Griffeth	Program Coordinator SR	ASPIRE	Utah State University
Staff (Leadership)	Beth A. Myers	Assessment Lead	N/A	Beth Myers Consulting
Staff (Leadership)	Fawn C. Groves	Education and Community Engagement Specialist	ASPIRE / College of Engineering	Utah State University
Staff (Leadership)	Michael P. Masquelier	Chief Commercial Officer	ASPIRE	Utah State University
Staff (Leadership)	Cassidy Bowman	Project Manager	ASPIRE	Utah State University
Staff (Leadership)	Melanie Conrad	Student Engagement Coordinator	ASPIRE Admin & Staff	Utah State University
Staff (Leadership)	Katherine Grover	Assessment Coordinator	ASPIRE	Utah State University
Staff (Leadership)	Anca Matcovschi	Chief Comms & Marketing Officer	ASPIRE	Utah State University
Staff (Leadership)	Meagan Roach	Art Director	ASPIRE	Utah State University
Staff (Leadership)	Jennifer Seelig	Director	Institute Government and Politics	Utah State University
Staff (Leadership)	Kat Webb	Content Director	Marketing and Communication	Utah State University
Student Leader	Fariba Soltani	Transportation Engineering /	Civil Engineering	Utah State University

		ASPIRE SLC Co-Chair		
Student Leader	Pedram Balooch Sirgani	Research Associate, PhD Student / ASPIRE SLC Co-Chair	Department of Civil Engineering	University of Texas at El Paso

1.3 Research Thrust Participants Table

Table: Research Thrust Participants			
Personnel Type	**Name**	**Department**	**Academic Institution**
Charging Stations			
Thrust Leader	Hongjie Wang	Electrical and Computer Engineering	Utah State University
Director	Ivonne Santiago	Civil Engineering	University of Texas at El Paso
Director	Regan A. Zane	Electrical and Computer Engineering / ASPIRE	Utah State University
Research Thrust Leader	Khurram K. Afridi	Electrical and Computer Engineering	Cornell University
Research Thrust Leader	Michael S. Trimboli	Electrical and Computer Engineering	University of Colorado Colorado Springs
Research Thrust Leader	Paras Mandal	Electrical and Computer Engineering, The University of Texas at El Paso	University of Texas at El Paso
Research Thrust Leader	Patrick A. Singleton	Civil and Environmental Engineering	Utah State University
Student Leader	Fariba Soltani	Civil Engineering	Utah State University
Senior Faculty	Adeeba A. Raheem	Civil Engineering	University of Texas at El Paso
Senior Faculty	Darcy M. Bullock	Civil Engineering	Purdue University
Senior Faculty	Dragan Maksimovic	Electrical, Computer and Energy Engineering	University of Colorado Boulder
Senior Faculty	Gregory L. Plett	Electrical and Computer Engineering	University of Colorado Colorado Springs
Senior Faculty	Luca Corradini	Electrical, Computer and Energy Engineering	University of Colorado Boulder
Senior Faculty	Nicholas A. Roberts	Mechanical and aerospace	Utah State University
Senior Faculty	Ole R. Sleipness	Not Reported	Utah State University
Senior Faculty	Rose Q. Hu	Electrical and Computer Engineering	Utah State University
Senior Faculty	Tzu-Liang Tseng	Department of Industrial, Manufacturing and Systems Engineering (IMSE)	University of Texas at El Paso

Senior Faculty	Wade Goodridge	Engineering Education	Utah State University
Junior Faculty	Hailei Wang	Mechanical and Aerospace Engineering	Utah State University
Junior Faculty	Honglun Xu	Industrial, Manufacturing, and Systems Engineering	University of Texas at El Paso
Junior Faculty	Janette Goodridge	Economics and Finance	Utah State University
Staff	Arumoy Biswas	Applied Economics	Utah State University
Staff	Jairaj C. Desai	Civil Engineering	Purdue University
Postdoc	Sayan Paul	Department of Electrical, Computer, and Energy Engineering	University of Colorado Boulder
Doctoral Student	Aditya Zade	Electrical and Computer Engineering	Utah State University
Doctoral Student	Daniel Kane	Engineering Education	Utah State University
Doctoral Student	Dheeraj Etta	Electrical and Computer Engineering	Cornell University
Doctoral Student	Jackson Morgan	Electrical and Computer Engineering and ASPIRE ERC	Utah State University
Doctoral Student	Juan-Jie Sun	Electrical Engineering department	University of Colorado Colorado Springs
Doctoral Student	Mahdi Ghorbani	Mechanical Engineering	Utah State University
Doctoral Student	Nestor Acosta	Engineer. Sci/Interdisciplinary	University of Texas at El Paso
Doctoral Student	Ramish Majeed Raja	Electrical and Computer Engineering	Utah State University
Doctoral Student	Rishika Tumula	Civil Engineering	Purdue University
Doctoral Student	Sanat R. Poddar	ECE	Utah State University
Doctoral Student	Shubhangi Gurudiwan	Electrical and Computer Engineering	Utah State University
Doctoral Student	Suchita A. Undare	Not Reported	University of Colorado Colorado Springs
Masters Student	Craig Chambers	Electrical and Computer Engineering	University of Colorado Colorado Springs
Masters Student	Eli Woodward	Landscape Architecture & Environmental Planning	Utah State University
Masters Student	Paul Bradford	Electrical and Computer Engineering	Utah State University
Masters Student	Tenzin Lhaden	IMSE	University of Texas at El Paso
Masters Student	Wesley A. Hileman	Electrical and Computer Engineering	University of Colorado Colorado Springs
Undergraduate Student	Dakota R. Goodrich	Electrical and Computer Engineering	Utah State University
Undergraduate Student	Johanna Mayfield	ASPIRE	Utah State University

Undergraduate Student	Jorge Hernandez Ramiro	mechanical and Aerospace	Utah State University
Undergraduate Student	Josh Christiansen	Kenworth Falcon EE	Utah State University
Undergraduate Student	Joshua Woolf	Department of Mechanical Engineering	Utah State University
Undergraduate Student	Kaylie Maddux	Electrical and Computer Engineering	University of Colorado Colorado Springs
Undergraduate Student	Lucy Peterson	Market Research Team	Utah State University
Undergraduate Student	Mason King	Marketing Research Internship	Utah State University
Electrified Roadways			
Thrust Leader	Khurram K. Afridi	Electrical and Computer Engineering	Cornell University
Director	Konstantina Gkritza	Lyles School of Civil Engineering	Purdue University
Director	Regan A. Zane	Electrical and Computer Engineering / ASPIRE	Utah State University
Director	Soheil Nazarian	Civil Engineering	University of Texas at El Paso
Director	Steve D. Pekarek	ECE	Purdue University
Research Thrust Leader	Hongjie Wang	Electrical and Computer Engineering	Utah State University
Research Thrust Leader	John E. Haddock	Lyles School of Civil Engineering	Purdue University
Research Thrust Leader	Marv W. Halling	Civil and Environmental Engineering	Utah State University
Student Leader	Pedram Balooch Sirgani	Department of Civil Engineering	University of Texas at El Paso
Senior Faculty	Adeeba A. Raheem	Civil Engineering	University of Texas at El Paso
Senior Faculty	Dionysios Aliprantis	Electrical and Computer Engineering	Purdue University
Senior Faculty	Jinha Jung	Civil Engineering	Purdue University
Senior Faculty	Nicholas A. Roberts	Mechanical and aerospace	Utah State University
Senior Faculty	Rose Q. Hu	Electrical and Computer Engineering	Utah State University
Senior Faculty	Ryan Gerdes	Electrical and Computer Engineering	Virginia Polytechnic Institute and State University
Senior Faculty	Simon Bickerton	Department of Mechanical and Mechatronics Engineering	University of Auckland
Junior Faculty	Aaron D. Brovont	School of Electrical and Computer Engineering	Purdue University
Junior Faculty	Amanda Katz	History	Utah State University
Junior Faculty	Cristina Torres-Machi	Civil, Environmental, and Architectural Engineering	University of Colorado Boulder

Junior Faculty	Janette Goodridge	Economics and Finance	Utah State University
Junior Faculty	Juhyeong Lee	Mechanical and Aerospace Engineering	Utah State University
Junior Faculty	Miguel A. Montoya	Civil Engineering	University of Texas at El Paso
Junior Faculty	Srishti Banerji	Civil and Environmental Engineering	Utah State University
Junior Faculty	Tianyi He	Mechanical and Aerospace Engineering	Utah State University
Junior Faculty	Tom D. Allen	Mechanical and Mechatronics Engineering	University of Auckland
Staff	Bryce L. Hesterman	ASPIRE	Utah State University
Staff	Cesar Tirado	Civil Engineering/Center for Transportation Infrastructure Systems	University of Texas at El Paso
Staff	Seho Kim	Department of Electrical, Computer and Software Engineering	University of Auckland
Visiting Faculty	Rajib Mallick	Civil Engineering	University of Texas at El Paso
Doctoral Student	Abdullah Baig	Not Reported	Utah State University
Doctoral Student	Ahmed Almaadawy	Civil and Environmental Engineering	Utah State University
Doctoral Student	Dheeraj Etta	Electrical and Computer Engineering	Cornell University
Doctoral Student	Francisco Contreras	Civil, Environmental and Architectural Engineering	University of Colorado Boulder
Doctoral Student	Gaia Cervini	Not Reported	Purdue University
Doctoral Student	Hafiz Haris Ahmed	Electrical and Computer Engineering (ECE)	Utah State University
Doctoral Student	Hector Cruz	Civil Engineering	University of Texas at El Paso
Doctoral Student	Larry Catalasan	Mechanical and Aerospace Engineering	Utah State University
Doctoral Student	Oscar A. Moncada	Not Reported	Purdue University
Masters Student	Bethany Clapier	Civil Engineering	Utah State University
Masters Student	Mahmoud Ali	Structural Engineering	Utah State University
Masters Student	Mckay Waite	Not Reported	Utah State University
Masters Student	Oscar Villegas	Ctr for Transport Infras Sys	University of Texas at El Paso
Undergraduate Student	Catherine Fosborough	Economics and Finance	Utah State University
Undergraduate Student	Emma Wheeler	Civil and Environmental Department	Utah State University
Undergraduate Student	Hiep Nguyen	Mechanical and Aerospace Engineering	Utah State University

Undergraduate Student	Isabelle Berke	Utah State University College of Humanities and Social Sciences	University of Utah
Undergraduate Student	Joe Dewitz	Economics & Finance	Utah State University
Undergraduate Student	Jorge Hernandez Ramiro	mechanical and Aerospace	Utah State University
Undergraduate Student	Karmen Teuscher	Mechanical & Aerospace Engineering	Utah State University
Undergraduate Student	Mason King	Marketing Research Internship	Utah State University
Undergraduate Student	Noelia Garcia Weidling	Not Reported	Utah State University
Undergraduate Student	Sebastian Morales	Civil Engineering	University of Texas at El Paso
Pathways			
Thrust Leader	Brandon C. Allen	Political Science	Purdue University
Director	Ivonne Santiago	Civil Engineering	University of Texas at El Paso
Director	Konstantina Gkritza	Lyles School of Civil Engineering	Purdue University
Research Thrust Leader	Emma L. Mecham	School of Teacher Education and Leadership	Utah State University
Research Thrust Leader	Jennifer C. Ramos-Chavez	Civil Engineering	University of Texas at El Paso
Innovation Ecosystem Program Leader	Don G. Linford	ASPIRE	Utah State University
Engineering Workforce Development Program Leader	Angela L. Minichiello	engineering education, College of Engineering	Utah State University
Engineering Workforce Development Program Leader	Matthew W. Ohland	Engineering Education	Purdue University
Staff (Leadership)	Anca Matcovschi	ASPIRE	Utah State University
Staff (Leadership)	Fawn C. Groves	ASPIRE / College of Engineering	Utah State University
Staff (Leadership)	Melanie Conrad	ASPIRE Admin & Staff	Utah State University
Senior Faculty	Nicholas A. Roberts	Mechanical and aerospace	Utah State University
Senior Faculty	Penelope Espinoza	Educational Leadership	University of Texas at El Paso
Senior Faculty	Rosalee A. Clawson	Political Science	Purdue University
Junior Faculty	Amanda Katz	History	Utah State University
Junior Faculty	Hillary L. Swanson	Not Reported	Utah State University
Junior Faculty	LuEttaMae Lawrence	Instructional Technology and Learning Sciences	Utah State University
Staff	Jennifer L. Taylor	College of Engineering and Applied Science, Integrated Teaching and Learning Program	University of Colorado Boulder

Doctoral Student	Alisia V. Dawkins	Instructional Technology and Learning Sciences	Utah State University
Doctoral Student	Foeday Zinnah	Engineering Education	Utah State University
Doctoral Student	Idris Solola	Instructional Technology & Learning Sciences	Utah State University
Doctoral Student	Polly Parkinson	ASPIRE	Utah State University
Doctoral Student	Rida Munir	Instructional technology and Learning sciences	Utah State University
Undergraduate Student	Benjamin J. OBrien	Not Reported	Purdue University
Undergraduate Student	Jorge Hernandez Ramiro	mechanical and Aerospace	Utah State University
Systems of Systems			
Thrust Leader	Patrick A. Singleton	Civil and Environmental Engineering	Utah State University
Director	Antje Graul	Jon M. Huntsman School of Business	Utah State University
Director	Ivonne Santiago	Civil Engineering	University of Texas at El Paso
Director	Konstantina Gkritza	Lyles School of Civil Engineering	Purdue University
Director	Qin Lv	Computer Science	University of Colorado Boulder
Research Thrust Leader	Bri-Mathias S. Hodge	Department of Electrical, COmputer and Energy Engineering	University of Colorado Boulder
Research Thrust Leader	Sivaranjani Seetharaman	Industrial Engineering	Purdue University
Senior Faculty	Amir Sajadi	Electrical, Computer and Energy Engineering	University of Colorado Boulder
Senior Faculty	Dionysios Aliprantis	Electrical and Computer Engineering	Purdue University
Senior Faculty	Jason C. Quinn	Mechanical Engineering	Colorado State University
Senior Faculty	Masood Parvania	ECE	University of Utah
Senior Faculty	Michael P. Hannigan	Mechanical Engineering	University of Colorado Boulder
Senior Faculty	Ole R. Sleipness	Not Reported	Utah State University
Senior Faculty	Prakash Ranjitkar	Civil and Environmental Engineering	University of Auckland
Senior Faculty	Rosalee A. Clawson	Political Science	Purdue University
Senior Faculty	Ruey Cheu	Civil Engineering	University of Texas at El Paso
Senior Faculty	Vassilis Kekatos	Electrical and Computer Engineering	Purdue University
Senior Faculty	Vijay Gupta	Not Reported	Purdue University
Junior Faculty	Colleen E. Reid	Geography	University of Colorado Boulder
Junior Faculty	Daniel Mendoza	Atmospheric Sciences	University of Utah

Junior Faculty	Greg N. Droge	Electrical and Computer Engineering	Utah State University
Junior Faculty	Janette Goodridge	Economics and Finance	Utah State University
Junior Faculty	Junjie Qin	ECE	Purdue University
Junior Faculty	Mario Y. Harper	Computer Science	Utah State University
Junior Faculty	Sarah Grajdura	Civil and Environmental Engineering	Utah State University
Junior Faculty	Steve Petruzza	Computer Science	Utah State University
Staff	Arumoy Biswas	Applied Economics	Utah State University
Staff	David Trinko	ASPIRE Admin & Staff	Colorado State University
Staff	Maysen Smith	Computer Science	Utah State University
Staff	Noah T. Horesh	Mechanical Engineering	Colorado State University
Staff	Selena Sheng	Energy Centre, Department of Economics	University of Auckland
Postdoc	Qinshuang Wei	Electrical and Computer Engineering	Purdue University
Doctoral Student	Anthony Sauter	Electrical, Computer and Energy Engineering Department (ECEE)	University of Colorado Boulder
Doctoral Student	Bruno Cesar Krause Moras	Lyles School of Civil Engineering - Purdue University	Purdue University
Doctoral Student	Emma S. Rieves	CU Boulder Geography	University of Colorado Boulder
Doctoral Student	Gaia Cervini	Not Reported	Purdue University
Doctoral Student	Isaac Peterson	Computer Science	Utah State University
Doctoral Student	James Swedeen	Electrical and Computer Engineering	Utah State University
Doctoral Student	Jonathan Silberstein	Mechanical Engineering	University of Colorado Boulder
Doctoral Student	Kenny Chandra Wijaya	Civil Engineering	Purdue University
Doctoral Student	Kobra Bohlourihajar	Not Reported	Utah State University
Doctoral Student	Mahyar Vahedi Saheli	Civil Engineering	Utah State University
Doctoral Student	Nestor Acosta	Engineer. Sci/Interdisciplinary	University of Texas at El Paso
Doctoral Student	Spencer R. Paulissen	Computer Science	University of Colorado Boulder
Doctoral Student	Yifan Dong	Electrical and Computer Engineering	Purdue University
Doctoral Student	Zainab Imran	Electrical & Computer Engineering	Purdue University
Masters Student	Aashay Mahesharkar	Science	Utah State University
Masters Student	Ishara Mawelle	Computer Science	Utah State University
Masters Student	Sajid Bin Hasnat	ASPIRE Admin & Staff	Utah State University

Undergraduate Student	Adrian Morales	Electrical Engineering	University of Texas at El Paso
Undergraduate Student	Anthony Wood	Computer Science	Utah State University
Undergraduate Student	Cedar Hopwood	Civil and Environmental Engineering	Utah State University
Undergraduate Student	Christian Hall	Computer Science	Utah State University
Undergraduate Student	Christopher Hopkins	Computer Science	Utah State University
Undergraduate Student	Dallin Maughan	ASPIRE Admin & Staff	Utah State University
Undergraduate Student	Joseph Brijs	ASPIRE Admin & Staff	Utah State University
Undergraduate Student	Joshua Taggart	Electrical and Computer Engineering	Utah State University
Undergraduate Student	Matthew Webecke	ASPIRE	Utah State University
Undergraduate Student	Tyson Buxton	ASPIRE	Utah State University

1.4 ERC Partners Table

Table: ERC Partners

ERC Partner Name	ERC Partner Type	Country	City	State
ABB E-Mobility	Industrial/Practitioner Member	Switzerland	Zurich	
AECOM Technology Corporation	Industrial/Practitioner Member	United States of America	Los Angeles	California
Aerokats and Rover Education Network (NASA-funded)	Collaborating Institution	United States of America	Wayne	Michigan
Amazon	Collaborating Institution	United States of America	Seattle	Washington
American Association of Port Authorities	Innovation Partner	United States of America	Washington	District of Columbia
Argonne National Lab	Innovation Partner	United States of America	Lemont	Illinois
Arrupe Jesuit High School	Pre-college Partner	United States of America	Denver	Colorado
Asphalt Systems Inc	Industrial/Practitioner Member	United States of America	Salt Lake City	Utah
Auckland University of Technology	Collaborating Institution	New Zealand	Auckland	
Beth Myers Consulting	Collaborating Institution	United States of America	Lafayette	Colorado
BorderPlex Alliance	Innovation Partner	United States of America	El Paso	Texas
Cabrillo College	Non-ERC Institution Providing REU Students	United States of America	Aptos	California
Cache Valley Electric	Contributing Organization	United States of America	Logan	Utah
CALSTART, Inc.	Innovation Partner	United States of America	Pasadena	California

Center for Transportation & the Environment (CTE)	Innovation Partner	United States of America	Atlanta	Georgia
Central Florida Expressway Authority	Industrial/Practitioner Member	United States of America	Orlando	Florida
Centralia College	Community College	United States of America	Centralia	Washington
Colorado Department of Transportation	Collaborating Institution	United States of America	Denver	Colorado
Colorado Department of Transportation	Funder of Associated Projects	United States of America	Denver	Colorado
Colorado State University	Collaborating Institution	United States of America	Fort Collins	Colorado
Colorado Technology Students Association	Collaborating Institution	United States of America	Denver	Colorado
Concrete & Masonry & Hardscapes Association	Industrial/Practitioner Member	United States of America	Herndon	Virginia
Conexus Indiana	Innovation Partner	United States of America	Indianapolis	Indiana
Cornell University	Collaborating Institution	United States of America	Ithaca	New York
Crater Lake Electrical JATC	Funder of Associated Projects	United States of America	Medford	Oregon
CRH Group Services Limited	Industrial/Practitioner Member	Ireland	Dublin	
CUB ODECE Rural Summer Program	Collaborating Institution	United States of America	Boulder	Colorado
CUB Society of Hispanic Professional Engineers Student Society	Collaborating Institution	United States of America	Boulder	Colorado
CUB Upward Bound Summer Academic Summer Institute	Collaborating Institution	United States of America	Boulder	Colorado
Cummins, Inc.	Industrial/Practitioner Member	United States of America	Columbus	Indiana
Dallas Fort Worth Airport	Innovation Partner	United States of America	Dallas Fort Worth	Texas
Denso Corporation	Industrial/Practitioner Member	Japan	Kariya	
Denver Museum of Nature and Science	Collaborating Institution	United States of America	Denver	Colorado
Department of Education	Funder of Associated Projects	United States of America	Washington	District of Columbia
Department of Energy	Funder of Associated Projects	United States of America	Washington	District of Columbia
Drive Electric Utah	Collaborating Institution	United States of America	Salt Lake City	Utah
DSST Public Schools (HS Creative Engineering Design course)	Pre-college Partner	United States of America	Boulder	Colorado
Eaton Corporation	Industrial/Practitioner Member	Ireland	Dublin	

Eco El Paso	Collaborating Institution	United States of America	El Paso	Texas
El Paso Community College	Community College	United States of America	El Paso	Texas
El Paso Electric	Collaborating Institution	United States of America	El Paso	Texas
El Paso Fab Lab	Collaborating Institution	United States of America	El Paso	Texas
El Paso Insights Science Center	Collaborating Institution	United States of America	El Paso	Texas
El Paso Leadership Academy (HS Creative Engineering Design Course)	Pre-college Partner	United States of America	El Paso	Texas
Electreon Wireless	Industrial/Practitioner Member	Israel	Beit Yanai	
Electric Power Systems	Industrial/Practitioner Member	United States of America	Logan	Utah
ENRX	Industrial/Practitioner Member	Germany	Efringen-Kirchen	
Environmental Branch, Hill Air Force Base	Innovation Partner	United States of America	Ogden	Utah
Esri	Industrial/Practitioner Member	United States of America	Redlands	California
Fairpark Community Council	Collaborating Institution	United States of America	Salt Lake City	Utah
Familias Triunfadoras	Collaborating Institution	United States of America	El Paso	Texas
Ford Motor Company	Industrial/Practitioner Member	United States of America	Dearborn	Michigan
Forth Mobility	Innovation Partner	United States of America	Portland	Oregon
Front Range Community College	Community College	United States of America	Westminster	Colorado
GEAR Up Junior High School	Pre-college Partner	United States of America	Logan	Utah
George Mason University	Non-ERC Institution Providing REU Students	United States of America	Fairfax	Virginia
Geotab	Industrial/Practitioner Member	Canada	Oakville	
Glendale Community Council	Collaborating Institution	United States of America	Salt Lake City	Utah
GNS Science	Collaborating Institution	New Zealand	Auckland	
Grambling State University	Non-ERC Institution Providing REU Students	United States of America	Grambline	Louisiana
Green Hope Project	Collaborating Institution	United States of America	El Paso	Texas
Growth Sector	Collaborating Institution	United States of America	San Francisco	California
Heal Utah	Innovation Partner	United States of America	Salt Lake City	Utah

HNTB	Industrial/Practitioner Member	United States of America	Midvale	Utah
Hyster-Yale Group, Inc.	Industrial/Practitioner Member	United States of America	Portland	Oregon
I Have a Dream Foundation of Boulder County	Collaborating Institution	United States of America	Boulder	Colorado
IBEW Local 659, Crater Lake JATC	Collaborating Institution	United States of America	Crater Lake	Oregon
Idaho National Lab	Innovation Partner	United States of America	Idaho Falls	Idaho
Illinois Asphalt Pavement Association (IAPA)	Innovation Partner	United States of America	Springfield	Illinois
Illinois Concrete Pavement Association (ICPA)	Innovation Partner	United States of America	Springfield	Illinois
Illinois Tollway	Innovation Partner	United States of America	Downer's Grove	Illinois
IMTA (Indiana Motor Truck Association)	Innovation Partner	United States of America	Indianapolis	Indiana
Indiana Department of Transportation	Industrial/Practitioner Member	United States of America	Indianapolis	Indiana
InductEV	Industrial/Practitioner Member	United States of America	Prussia	Pennsylvania
Institute for Factory Automation and Production Systems (FAPS)	Collaborating Institution	Germany	Nuremberg	
InTech Collegiate Academy (HS Engineering Design Course)	Pre-college Partner	United States of America	Logan	Utah
ITSA (Intelligent Transportation Society of Amer)	Innovation Partner	United States of America	Washington	District of Columbia
John Deere	Industrial/Practitioner Member	United States of America	Moline	Illinois
Jordan Meadows Community Council	Collaborating Institution	United States of America	Salt Lake City	Utah
Kenworth Trucks, Inc.	Industrial/Practitioner Member	United States of America	Bellevue	Washington
Laurel Group	Industrial/Practitioner Member	United States of America	Bluffton	South Carolina
Lewis County Transit	Collaborating Institution	United States of America	Centralia	Washington
Mahi Maioro Professionals	Collaborating Institution	New Zealand	Auckland	
Michigan Department of Transportation	Collaborating Institution	United States of America	Lansing	Michigan
Michigan Economic Development Corporation, Office of Future Mobility and Electrification	Innovation Partner	United States of America	Lansing	Michigan

Ministry of Business, Innovation & Employment NZ	Funder of Associated Projects	New Zealand	Auckland	
Minnesota Asphalt Pavement Association (MAPA)	Innovation Partner	United States of America	Minneapolis	Minnesota
Minnesota Department of Transportation	Innovation Partner	United States of America	St. Paul	Minnesota
Murdock Chevrolet GMC	Collaborating Institution	United States of America	Logan	Utah
NACFE (North American Council for Freight Efficiency)	Innovation Partner	United States of America	Fort Wayne	Indiana
National Asphalt Pavement Association	Innovation Partner	United States of America	Greenbelt	Maryland
National Association of State Energy Officials	Collaborating Institution	United States of America	Arlington	Virginia
National Renewable Energy Lab	Innovation Partner	United States of America	Golden	Colorado
Neighborhood House	Pre-college Partner	United States of America	Salt Lake City	Utah
North Carolina Turnpike	Innovation Partner	United States of America	Charlotte	North Carolina
North Central Texas Council of Governments	Innovation Partner	United States of America	Dallas Fort Worth	Texas
Northridge Elementary School	Pre-college Partner	United States of America	Longmont	Colorado
NSF INCLUDES CAHSI	Collaborating Institution	United States of America	El Paso	Texas
NSF LSAMP NICE	Collaborating Institution	United States of America	El Paso	Texas
NW Energy Coalition	Collaborating Institution	United States of America	Seattle	Washington
Oak Ridge National Lab	Innovation Partner	United States of America	Oak Ridge	Tennessee
Ohio Turnpike and Infrastructure Commission	Innovation Partner	United States of America	Berea	Ohio
Oldcastle Infrastructure	Contributing Organization	United States of America	Atlanta	Georgia
PacifiCorp - Rocky Mountain Power	Industrial/Practitioner Member	United States of America	Salt Lake City	Utah
PC Krause and Associates, Inc.	Industrial/Practitioner Member	United States of America	West Lafayette	Indiana
Pennsylvania Turnpike Authority	Industrial/Practitioner Member	United States of America	Middleton	Pennsylvania
Poplar Grove Community Council	Collaborating Institution	United States of America	Salt Lake City	Utah
Purdue Polytechnic High School	Pre-college Partner	United States of America	Indianapolis	Indiana
Purdue University	Core Partner	United States of America	West Lafayette	Indiana

Rekor	Industrial/Practitioner Member	United States of America	Columbia	Maryland
RMI (Rocky Mountain Institute)	Innovation Partner	United States of America	Basalt	Colorado
Rose Park Community Council	Collaborating Institution	United States of America	Salt Lake City	Utah
Rose Park Community Learning Center	Collaborating Institution	United States of America	Salt Lake City	Utah
Salt Lake City School District/West High School	Pre-college Partner	United States of America	Salt Lake City	Utah
Salt Lake Community College	Community College	United States of America	Salt Lake City	Utah
SANDAG (San Diego Association of Governments)	Innovation Partner	United States of America	San Diego	California
Schneider Electric	Industrial/Practitioner Member	France	Rueil-Malmaison	
Smartville Inc.	Funder of Associated Projects	United States of America	Carlsbad	California
SMUD	Innovation Partner	United States of America	Sacramento	California
Sorenson Multi-Cultural Center	Collaborating Institution	United States of America	Salt Lake City	Utah
Southwire	Industrial/Practitioner Member	United States of America	Carrollton	Georgia
Spring Creek Middle School	Pre-college Partner	United States of America	Providence	Utah
Stadler Rail	Collaborating Institution	United States of America	Salt Lake City	Utah
State of Colorado	Funder of Associated Projects	United States of America	Denver	Colorado
State of Utah	Industrial/Practitioner Member	United States of America	Salt Lake City	Utah
Stellantis	Collaborating Institution	United States of America	Auburn Hills	Michigan
Stevens Institute of Technology	Non-ERC Institution Providing REU Students	United States of America	Hoboken	New Jersey
Sun Metro	Collaborating Institution	United States of America	El Paso	Texas
Sunbelt Rentals	Contributing Organization	United States of America	Fort Mill	South Carolina
The Bennett Consulting Group	Collaborating Institution	United States of America	Washington	District of Columbia
The City Library, Glendale Branch	Collaborating Institution	United States of America	Salt Lake City	Utah
The Ray	Innovation Partner	United States of America	Atlanta	Georgia
Thornton Middle School	Pre-college Partner	United States of America	Thornton	Colorado
Toyota Motor Engineering &	Industrial/Practitioner Member	Japan	Toyota City	

Manufacturing North America, Inc.				
TransAlta - First Mode Proving Grounds	Collaborating Institution	United States of America	Centralia	Washington
UAPA	Innovation Partner	United States of America	Salt Lake City	Utah
UCB ODECE STEM Summer Program	Pre-college Partner	United States of America	Boulder	Colorado
UDOT (Utah Department of Transportation)	Industrial/Practitioner Member	United States of America	Salt Lake City	Utah
University Neighborhood Partners	Collaborating Institution	United States of America	Salt Lake City	Utah
University of Auckland	Foreign Partner	New Zealand	Auckland	
University of California Riverside	Non-ERC Institution Providing REU Students	United States of America	Riverside	California
University of Colorado Boulder	Core Partner	United States of America	Boulder	Colorado
University of Colorado Colorado Springs	Collaborating Institution	United States of America	Colorado Springs	Colorado
University of Michigan Battery Lab	Collaborating Institution	United States of America	Ann Arbor	Michigan
University of Texas at El Paso	Core Partner	United States of America	El Paso	Texas
University of Utah	Collaborating Institution	United States of America	Salt Lake City	Utah
UTA (Utah Transit Authority)	Innovation Partner	United States of America	Salt Lake City	Utah
Utah AFL-CIO	Collaborating Institution	United States of America	Salt Lake City	Utah
Utah Asphalt Pavement Association	Collaborating Institution	United States of America	South Jordan	Utah
Utah Clean Cities Coalition	Innovation Partner	United States of America	Salt Lake City	Utah
Utah Division of Multicultural Affairs	Pre-college Partner	United States of America	Salt Lake City	Utah
Utah Governor's Office of Energy Development	Innovation Partner	United States of America	Salt Lake City	Utah
Utah Inland Port Authority	Industrial/Practitioner Member	United States of America	Salt Lake City	Utah
Utah State University	Lead Institution	United States of America	Logan	Utah
Utah System of Higher Education	Collaborating Institution	United States of America	Salt Lake City	Utah
Utah Transit Authority	Collaborating Institution	United States of America	Salt Lake City	Utah
UTEP Upward Bound	Collaborating Institution	United States of America	El Paso	Texas
VDOT (Virginia Department of Transportation)	Innovation Partner	United States of America	Richmond	Virginia

Victoria University of Wellington	Collaborating Institution	New Zealand	Wellington	
Virginia Polytechnic Institute and State University	Collaborating Institution	United States of America	Arlington	Virginia
Washington State Ferries	Collaborating Institution	United States of America	Seattle	Washington
Weber State University	Community College	United States of America	Ogden	Utah
Western Tech El Paso	Community College	United States of America	El Paso	Texas
Westpointe Community Council	Collaborating Institution	United States of America	Salt Lake City	Utah
Westside Coalition	Collaborating Institution	United States of America	Salt Lake City	Utah
Wilson Motors	Collaborating Institution	United States of America	Logan	Utah
WiTricity Corporation	Industrial/Practitioner Member	United States of America	Watertown	Massachusetts
WSP	Industrial/Practitioner Member	Canada	Montreal	
Yes-She-Can	Collaborating Institution	United States of America	El Paso	Texas
Young Automotive Group	Collaborating Institution	United States of America	Logan	Utah

1.5 Advisory Boards Table

Table: Advisory Boards			
Name	**Professional Title**	**Department/Division**	**Organization/Firm**
Council of Deans			
Keith R. Molenaar	Dean	College of Engineering and Applied Science	University of Colorado Boulder
Kenith E. Meissner	Dean	College of Engineering	University of Texas at El Paso
Arvind Raman	Dean	College of Engineering	Purdue University
Richard Clarke	Dean of Engineering	Operations Administration	University of Auckland
David Jones	Dean	College of Engineering	Utah State University
Executive Advisory Board			
Denise Casalino	Executive Vice President	North American Cities Program	AECOM
Chris Gearhart	Director	Center for Integrated Mobility Sciences	National Renewable Energy Lab
Scott Hinton	President	Space Dynamics Laboratory	Utah State University
Laura Kelley	Executive Director (Retired)	Executive	Central Florida Expressway Authority

Allie Kelly	Executive Director	Executive	The Ray
Brian Lindgren	Director (Retired)	Research & Development	Kenworth Truck Company
Prabhakar B. Patil	Former CEO	Retired	LG Chem Power Inc
Joseph Spence	Managing Partner	Executive	Sovereign Alliance
Kent Wanner	Sr. Staff Engineer	Power Electronics Design	John Deere
Peter Turner	Chief Engineer	Power Electronics and Control Systems	Hyster-Yale
Donna Riley	Dean	Engineering and Computing	University of New Mexico
Student Leadership Council (SLC) / Council of Presidents			
Brian Gu	Student Leader (outgoing SLC)	Electrical Engineering	University of Auckland
Lazlo Stepback	Student Leader (outgoing SLC)	Engineering Education	Purdue University
Fariba Soltani	Student Leader (outgoing SLC Chair)	Civil & Environmental Engineering	Utah State University
Missel Sanchez	Student Leader (outgoing SLC)	Civil Engineering	University of Texas at El Paso
Pedram Balooch Sirgani	Student Leader (outgoing SLC Co-Chair)	Civil Engineering	University of Texas at El Paso
Spencer Paulissen	Student Leader (outgoing SLC)	Computer Science	University of Colorado Boulder
Patrick Gu	Student Leader (outgoing SLC)	Electrical Engineering	Virginia Tech
Suchita Anil Undare	Student Leader (outgoing SLC Treasurer)	Electrical Engineering	University of Colorado Colorado Springs
Ethan Moser	Student Leader (outgoing SLC)	Electrical & Computer Engineering	Utah State University
Syed Saeed	Student Leader (outgoing SLC)	Electrical & Computer Engineering	Cornell University
Sarah Khan	Student Leader (outgoing SLC)	Electrical & Computer Engineering	University of Utah
Raquel Srabia Soto	Student Leader - Council of Presidents	Electrical Engineering	Cornell University
Dipanjan Ghose	Student Leader - Council of Presidents	Electrical & Computer Engineering	Purdue University
Francisco Contreras	Student Leader - Council of Presidents	Civil, Environmental and Architectural Engineering	University of Colorado Boulder
Isaac Zuniga	Student Leader - Council of Presidents	Civil Engineering	University of Texas at El Paso
Pedro Chavez	Student Leader - Council of Presidents	Civil Engineering	University of Texas at El Paso
Ali Tasavvori	Student Leader - Council of Presidents	Electrical & Computer Engineering	University of Utah
Mackay Baugh	Student Leader - Council of Presidents	Mechanical Engineering	Utah State University

Brittany Piquet	Student Leader - Council of Presidents	Electrical & Computer Engineering	Utah State University
Bruno Cesar Krause Moras	Student Leader - Council of Presidents	Civil Engineering	Purdue University

2. Strategic Plan

2.1 Quantifiable Outputs Table

Table: Quantifiable Outputs

Outputs	Sep-01-2020 - Jun-30-2021	Jul-01-2021 - Jun-30-2022	Jul-01-2022 - Jun-30-2023	Jul-01-2023 - Jun-30-2024	Jul-01-2024 - Jun-30-2025	All Years
Publications Resulting From Core Funding						
In Peer-Reviewed Technical Journals	0	5	18	17	15	55
In Peer-Reviewed Conference Proceedings	0	9	18	20	25	72
In Trade Journals	0	1	0	1	0	2
With Multiple Authors:	0	15	36	36	40	127
Co-authored With ERC Students	0	9	30	30	35	104
Co-authored With Industry	0	1	2	2	3	8
With Authors From Multiple Engineering Disciplines	0	2	17	9	11	39
With Authors From Both Engineering and Non-Engineering Fields	0	2	8	11	9	30
With Authors From Multiple Institutions	0	2	13	6	18	39
Publications Resulting From Associated Projects in the Strategic Plan						
In Peer-Reviewed Technical Journals	14	18	16	12	9	69
In Peer-Reviewed Conference Proceedings	21	8	14	11	11	65
Publications Resulting From Sponsored Projects						
In Peer Reviewed Technical Journals	0	0	0	0	0	0
In Peer-Reviewed Conference Proceedings	0	0	0	0	0	0
Participating Organizations						
Industrial Practitioner Members	22	32	33	30	34	151
Innovation Partners	20	21	29	33	35	138
Funders of Sponsored Projects	0	0	0	0	0	0
Funders of Associated Projects	15	8	9	4	7	43
Contributing Organizations	2	3	3	1	3	12
ERC Technology Transfer						
Inventions Disclosed (by researchers or tech transfer office)	0	0	4	0	0	4
Total Patent Applications Filed	0	0	5	6	4	15
Provisional Patent Applications Filed [1]	0	0	0	1	0	1
Full Patent Applications Filed [1]	0	0	5	5	4	14
Patent Awarded	8	2	4	5	1	20

Licenses Issued	0	0	0	0	0	0
Spin-off Companies Started	0	0	0	0	0	0
Estimated Number of Spin-off Company Employees	0	0	0	0	0	0
Building Codes Impacts	0	0	0	0	0	0
Technology Standards Impacts	0	0	0	0	0	0
New Surgical and Other Medical Procedures Adopted	0	0	0	0	0	0
Degrees to ERC Students						
Bachelor's Degrees Granted	6	23	21	24	39	113
Master's Degrees Granted	6	6	15	12	24	63
Doctoral Degrees Granted	6	6	16	12	7	47
Job Sector of ERC Graduates						
Undergraduates Hired by:						
Industry:	4	5	4	3	2	18
ERC Member Firms	1	1	1	1	0	4
Other U.S. Firms	3	4	3	2	2	14
Other Foreign Firms	0	0	0	0	0	0
Government	0	0	0	0	0	0
Academic Institutions	2	0	0	0	1	3
Other	0	0	0	0	0	0
Undecided/Still Looking/Unknown	0	18	17	21	36	92
Undergraduate ERC Graduates Total	6	23	21	24	39	113
Master's Graduates Hired by:						
Industry:	4	1	7	3	3	18
ERC Member Firms	0	0	3	0	0	3
Other U.S. Firms	4	1	4	2	3	14
Other Foreign Firms	0	0	0	1	0	1
Government	0	0	2	0	0	2
Academic Institutions	2	1	1	0	0	4
Other	0	0	0	0	0	0
Undecided/Still Looking/Unknown	0	4	5	9	21	39
Master's ERC Graduates Total	6	6	15	12	24	63
Ph.D.s Hired by:						
Industry:	6	4	8	3	3	24
ERC Member Firms	2	0	2	0	0	4
Other U.S. Firms	4	4	6	3	2	19
Other Foreign Firms	0	0	0	0	1	1
Government	0	0	0	0	0	0
Academic Institutions	0	0	7	2	1	10
Other	0	0	0	0	0	0
Undecided/Still Looking/Unknown	0	2	1	7	3	13
Ph.D. ERC Graduates Total	6	6	16	12	7	47

ERC Influence on Curriculum						
New Courses Based on ERC Research That Have Been Approved by the Curriculum Committee and Are Currently Offered [2]	0	3	2	1	0	6
Currently Offered, ongoing Courses With ERC Content	13	15	18	24	28	98
New Textbooks Based on ERC Research	0	0	0	0	0	0
New Textbook Chapter Based on ERC Research	0	0	0	0	0	0
Free-Standing Course Modules or Instructional CDs	0	0	0	0	0	0
New Full-Degree Programs Based on ERC Research	0	0	0	0	0	0
New Degree Minors or Minor Emphases Based on ERC Research	0	0	0	0	0	0
New Certificate Programs Based on ERC Research	0	0	0	0	0	0
Total Full-Degree Programs Based on ERC Research	0	0	0	0	0	0
Number of Students Enrolled	0	0	0	0	0	0
Number of Students Graduated	0	0	0	0	0	0
Total Certificate Programs Based on ERC Research	0	0	0	0	0	0
Number of Students Enrolled	0	0	0	0	0	0
Number of Students Graduated	0	0	0	0	0	0
Active Information Dissemination/Educational Outreach						
Workshops, Short Courses, and Webinars [3]	2	3	22	3	18	48
Number of Participants That Attended Events	48	75	3702	231	1185	5241
Innovation-focused Workshops, Short courses, Webinars, and Seminars	18	10	18	14	13	73
Number of Participants That Attended Events	1180	830	2265	7410	813	12498
Seminars, Colloquia, Invited Talks, Etc.	0	28	66	105	108	307
ERC Sponsored Educational Outreach Events for K-12 Students	4	14	14	32	25	89
Number of Students That Attended Events	260	662	3738	1817	1708	8185
Number of Teachers That Attended Events	3	113	309	154	476	1055
ERC Sponsored Educational Outreach Events for Community Colleges	0	0	0	1	1	2
Number of Community College Students That Attended Events	0	0	0	20	200	220
Number of Community College Faculty That Attended Events	0	0	0	2	0	2
ERC Sponsored Educational Outreach Events for Non-ERC Undergraduate Students	0	0	6	3	4	13
Number of Non-ERC Undergraduate Students That Attended Events	0	0	568	88	268	924
Number of Undergraduate Faculty That Attended Events	0	0	143	15	32	190
Personnel Exchanges						

Student Internships in Industry	0	5	30	23	6	64
Faculty Working at Member Firm	0	0	0	0	0	0
Member Firm Personnel Working at ERC	0	1	0	0	0	1

[1] Data for the breakdown of "Total Patent Applications Filed" into "Provisional Applications Filed" and "Full Patent Applications Filed" were not collected prior to 2013.

[2] New courses currently offered and approved by the curriculum committee are only counted in the first year that they are offered so there is no multiple counting of these courses.

[3] For years prior to 2009, the values include "Workshops and short courses to industry" and "Workshops and short courses to non-industry groups".

[4] Educational impacts/outreach activities may result from activities initiated as part of the ERC Engineering Workforce Development, Diversity and Culture of Inclusion, and Innovation Ecosystem programs.

2.2 Average Metrics Table

Table: 2024 Average Metrics Benchmarked Against All Active ERCs and the Center's Tech Sector					
Metric	**Average All Active ERCs FY 2024**	**Average Energy, Sustainability, and Infrastructure Sector FY 2024**	**Average Class of 2020 FY 2024**	**ASPIRE Total**	**ASPIRE Total**
	(15 ERCs)	**(5 ERCs)**	**(4 ERCs)**	**FY 2024**	**FY 2025**
Organizations Within Non-Industry Sectors	**22**	**21**	**29**	**41**	**48**
Organizations Within Industry Sectors	**19**	**18**	**21**	**25**	**31**
Small	51%	47%	53%	40%	32%
Medium	5%	3%	6%	0%	0%
Large	44%	50%	41%	60%	68%
Industrial/Practitioner Member Firms	**16**	**18**	**22**	**30**	**34**
Innovation Partners	**13**	**15**	**18**	**33**	**35**
Funders of Sponsored Projects	**1**	**0**	**0**	**0**	**0**
Funders of Associated Projects	**7**	**5**	**11**	**4**	**7**
Contributing Organizations	**3**	**1**	**0**	**1**	**3**
Total Number of Organizations	**41**	**39**	**51**	**68**	**79**
Total Membership Fees Received	**$177,274**	**$236,298**	**$221,736**	**$210,492**	**$241,507**
Sources of Support [1]	**$6,767,338**	**$6,892,401**	**$12,797,018**	**$15,960,144**	**$10,234,117**
NSF	64%	61%	46%	40%	34%
Other Federal	0%	0%	0%	0%	0%

State Government	2%	6%	4%	13%	21%
Local Government	0%	0%	0%	0%	0%
Foreign Government	0%	0%	0%	0%	0%
Quasi-Government Research	0%	0%	0%	0%	0%
Industry (U.S. and Foreign)	4%	4%	2%	1%	7%
University (U.S. and Foreign)	29%	29%	47%	46%	39%
Other	0%	0%	0%	0%	0%

Associated Project Support	**$7,546,421**	**$5,330,159**	**$19,099,765**	**$16,642,700**	**$15,122,940**

ERC Personnel and Educational Participants	**2,564**	**4,070**	**2,323**	**2,438**	**2,819**
Leadership Team [2]	31	31	34	41	37
Faculty [3]	42	47	51	90	87
Graduate Students	75	89	100	158	146
Undergraduate Students	41	67	67	143	152
REU Students	16	17	21	6	6
Community College RET	0	0	0	0	0
K-12 Teachers (RET and non-RET)	9	14	2	1	1
K-12 Students (Young Scholars)	14	15	7	6	6
Faculty/Teachers That Attended ERC Sponsored Educational Outreach Events for K-12 Students [4]	158	291	86	154	476
Students That Attended ERC Sponsored Educational Outreach Events for K-12 Students [4]	2,132	3,392	1,945	1,817	1,708
Faculty That Attended ERC Sponsored Educational Outreach Events for Community Colleges [4]	4	12	1	2	0
Students That Attended ERC Sponsored Educational Outreach Events for Community Colleges [4]	43	95	11	20	200
% Women [5]	36%	35%	29%	21%	21%
% Underrepresented Racial Minorities [6]	13%	11%	9%	4%	4%
% Hispanic [6]	15%	19%	12%	12%	11%

Publications	**Average**	**Average**	**Average**	**Total**	**Total**

In Peer-Reviewed Technical Journals	32	35	39	17	15
In Peer-Reviewed Conference Proceedings	10	6	21	20	25
Multiple Authors: Co-Authored With ERC Students	36	27	64	30	35
Multiple Authors: Co-Authored With Industry	4	2	4	2	3

Intellectual Property	**Average**	**Average**	**Average**	**Total**	**Total**
Invention Disclosures	4	2	7	0	0
Patent Applications (Provisional and Full)	6	6	11	6	4
Patents Awarded	1	3	1	5	1
Licenses (patents, software)	1	3	0	0	0

Education and Outreach Outputs	**Average**	**Average**	**Average**	**Total**	**Total**
New Courses Developed	2	2	3	1	0
Currently Offered, Ongoing Courses With ERC Content	13	20	14	24	28
New Full Degree Programs	0	0	1	0	0
New Degree Minors or Minor Emphases	0	0	1	0	0
New Certificate Programs Based on ERC Research	0	0	0	0	0

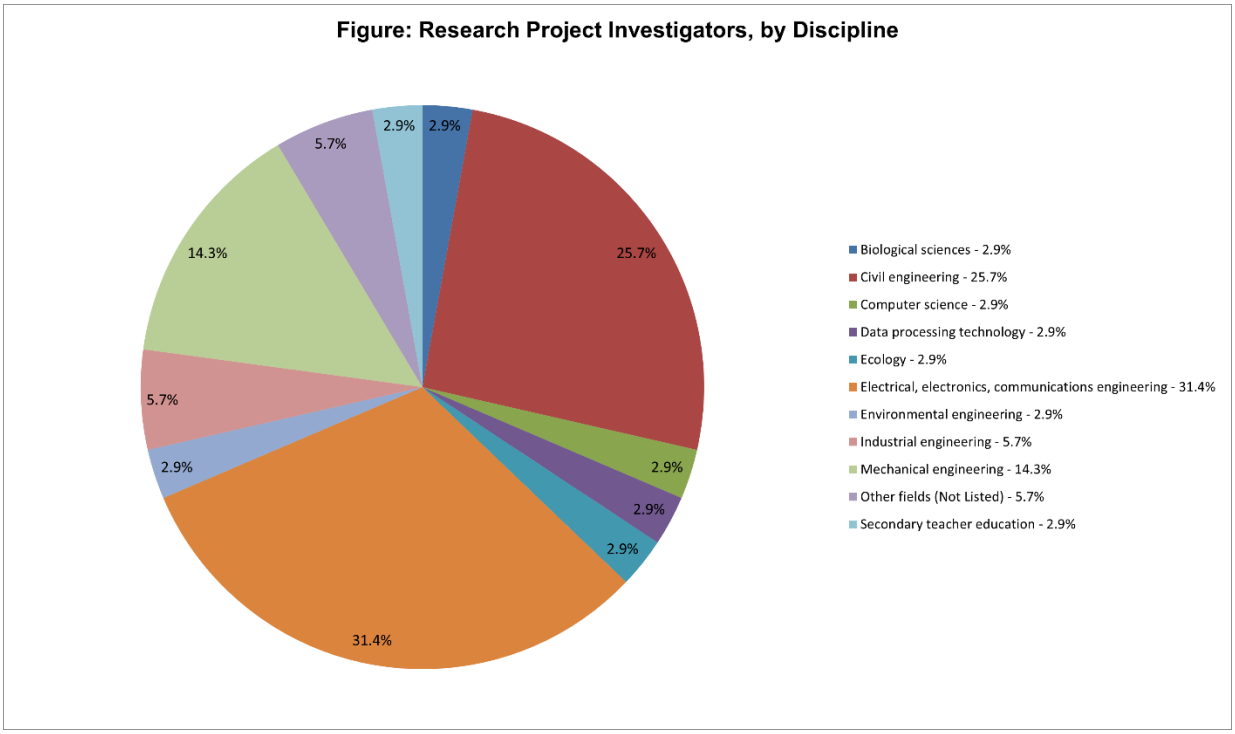
[1] - Includes new support (unrestricted cash, restricted cash, and in-kind donations) from Sources of Support Table only. Multi-year support and residual funds carried over from previous years are not included in benchmarking figures.
[2] - Includes Directors, Research Thrust Leaders, Engineering Workforce Development Program Leaders, Administrative Director, Innovation Ecosystem Program Leaders, Staff, Diversity and Culture of Inclusion Program Leaders and Student Leaders.
[3] - Includes Directors, Engineering Workforce Development Program Leaders, Research Thrust Leaders, Senior Faculty, Junior Faculty, and Visiting Faculty.

[4] - Includes participant values from Quantifiable Outputs Table.

[5] - Calculated out of total number of personnel.

[6] - Calculated out of total number of U.S. Citizens or Permanent Residents.
[7] - Educational impacts/outreach activities may result from activities initiated as part of the ERC Engineering Workforce Development, Diversity and Culture of Inclusion, and Innovation Ecosystem programs.

2.3 Research Project Investigators, by Discipline Figure



3. Infrastructure (Management and Organization)

3.1 ERC Web Partner Table

Table: Institutions Executing the ERC's Research, Technology Transfer, and Education Programs

Institutions							Personnel in ERC Activities [1]									
Name and Type	Total	Female Serving	Minority Serving	HBCU	Hispanic Serving	Large Number of URM Students in Engineering	Faculty	Community College RET	Teachers (K-12)		Postdocs	Students				Young Scholars
									RET	Non-RET		Graduate		UG Non-REU	REU	
												Doctoral	Masters			
I. Lead	**1**	**0**	**0**	**0**	**0**	**0**	**27**	**N/A**	**N/A**	**N/A**	**0**	**30**	**19**	**92**	**0**	**N/A**
Utah State University, Logan, UT							27	N/A	N/A	N/A	0	30	19	92	0	N/A
II. Core Partners	**3**	**0**	**1**	**0**	**1**	**1**	**40**	**N/A**	**N/A**	**N/A**	**7**	**41**	**14**	**50**	**0**	**N/A**

Purdue University, West Lafayette, IN							16	N/A	N/A	N/A	5	20	2	10	0	N/A
University of Colorado Boulder, Boulder, CO							9	N/A	N/A	N/A	1	13	7	16	0	N/A
University of Texas at El Paso, El Paso, TX			✔		✔	✔	15	N/A	N/A	N/A	1	8	5	24	0	N/A
III. Foreign Partners	**1**	**0**	**0**	**0**	**0**	**0**	**13**	**N/A**	**N/A**	**N/A**	**1**	**14**	**0**	**0**	**0**	**N/A**
University of Auckland							13	N/A	N/A	N/A	1	14	0	0	0	N/A
IV. Collaborating Institutions	**62**	**3**	**4**	**0**	**5**	**5**	**9**	**N/A**	**N/A**	**N/A**	**2**	**20**	**8**	**10**	**0**	**N/A**
Aerokats and Rover Education Network (NASA-funded), Wayne, MI							0	N/A	N/A	N/A	0	0	0	0	0	N/A
Amazon, Seattle, WA							0	N/A	N/A	N/A	0	0	0	0	0	N/A
Auckland University of Technology, Auckland							0	N/A	N/A	N/A	0	0	0	0	0	N/A
Beth Myers Consulting, Lafayette, CO							0	N/A	N/A	N/A	0	0	0	0	0	N/A
Colorado Department of Transportation, Denver, CO							0	N/A	N/A	N/A	0	0	0	0	0	N/A
Colorado State University, Fort Collins, CO							1	N/A	N/A	N/A	0	0	0	0	0	N/A
Colorado Technology Students Association, Denver, CO							0	N/A	N/A	N/A	0	0	0	0	0	N/A
Cornell University, Ithaca, NY							1	N/A	N/A	N/A	1	10	2	5	0	N/A
CUB ODECE Rural Summer Program, Boulder, CO						✔	0	N/A	N/A	N/A	0	0	0	0	0	N/A

CUB Society of Hispanic Professional Engineers Student Society, Boulder, CO					✔	✔	0	N/A	N/A	N/A	0	0	0	0	0	N/A
CUB Upward Bound Summer Academic Summer Institute, Boulder, CO		✔	✔			✔	0	N/A	N/A	N/A	0	0	0	0	0	N/A
Denver Museum of Nature and Science, Denver, CO							0	N/A	N/A	N/A	0	0	0	0	0	N/A
Drive Electric Utah, Salt Lake City, UT							0	N/A	N/A	N/A	0	0	0	0	0	N/A
Eco El Paso, El Paso, TX							0	N/A	N/A	N/A	0	0	0	0	0	N/A
El Paso Electric, El Paso, TX							0	N/A	N/A	N/A	0	0	0	0	0	N/A
El Paso Fab Lab, El Paso, TX					✔		0	N/A	N/A	N/A	0	0	0	0	0	N/A
El Paso Insights Science Center, El Paso, TX					✔		0	N/A	N/A	N/A	0	0	0	0	0	N/A
Fairpark Community Council, Salt Lake City, UT							0	N/A	N/A	N/A	0	0	0	0	0	N/A
Familias Triunfadoras, El Paso, TX							0	N/A	N/A	N/A	0	0	0	0	0	N/A
Glendale Community Council, Salt Lake City, UT							0	N/A	N/A	N/A	0	0	0	0	0	N/A
GNS Science, Auckland							0	N/A	N/A	N/A	0	0	0	0	0	N/A
Green Hope Project, El Paso, TX							0	N/A	N/A	N/A	0	0	0	0	0	N/A
Growth Sector, San Francisco, CA							0	N/A	N/A	N/A	0	0	0	0	0	N/A
I Have a Dream Foundation of Boulder						✔	0	N/A	N/A	N/A	0	0	0	0	0	N/A

County, Boulder, CO																
IBEW Local 659, Crater Lake JATC, Crater Lake, OR							0	N/A	N/A	N/A	0	0	0	0	0	N/A
Institute for Factory Automation and Production Systems (FAPS), Nuremberg							0	N/A	N/A	N/A	0	0	0	0	0	N/A
Jordan Meadows Community Council, Salt Lake City, UT							0	N/A	N/A	N/A	0	0	0	0	0	N/A
Lewis County Transit, Centralia, WA							0	N/A	N/A	N/A	0	0	0	0	0	N/A
Mahi Maioro Professionals, Auckland							0	N/A	N/A	N/A	0	0	0	0	0	N/A
Michigan Department of Transportation, Lansing, MI							0	N/A	N/A	N/A	0	0	0	0	0	N/A
Murdock Chevrolet GMC, Logan, UT							0	N/A	N/A	N/A	0	0	0	0	0	N/A
National Association of State Energy Officials, Arlington, VA							0	N/A	N/A	N/A	0	0	0	0	0	N/A
NSF INCLUDES CAHSI, El Paso, TX		✔	✔				0	N/A	N/A	N/A	0	0	0	0	0	N/A
NSF LSAMP NICE, El Paso, TX			✔				0	N/A	N/A	N/A	0	0	0	0	0	N/A
NW Energy Coalition, Seattle, WA							0	N/A	N/A	N/A	0	0	0	0	0	N/A
Poplar Grove Community Council, Salt Lake City, UT							0	N/A	N/A	N/A	0	0	0	0	0	N/A
Rose Park Community Council, Salt Lake City, UT							0	N/A	N/A	N/A	0	0	0	0	0	N/A

Rose Park Community Learning Center, Salt Lake City, UT							0	N/A	N/A	N/A	0	0	0	0	0	N/A
Sorenson Multi-Cultural Center, Salt Lake City, UT							0	N/A	N/A	N/A	0	0	0	0	0	N/A
Stadler Rail, Salt Lake City, UT							0	N/A	N/A	N/A	0	0	0	0	0	N/A
Stellantis, Auburn Hills, MI							0	N/A	N/A	N/A	0	0	0	0	0	N/A
Sun Metro, El Paso, TX							0	N/A	N/A	N/A	0	0	0	0	0	N/A
The Bennett Consulting Group, Washington, DC							0	N/A	N/A	N/A	0	0	0	0	0	N/A
The City Library, Glendale Branch, Salt Lake City, UT							0	N/A	N/A	N/A	0	0	0	0	0	N/A
TransAlta - First Mode Proving Grounds, Centralia, WA							0	N/A	N/A	N/A	0	0	0	0	0	N/A
University Neighborhood Partners, Salt Lake City, UT							0	N/A	N/A	N/A	0	0	0	0	0	N/A
University of Colorado Colorado Springs, Colorado Springs, CO							2	N/A	N/A	N/A	0	3	3	3	0	N/A
University of Michigan Battery Lab, Ann Arbor, MI							0	N/A	N/A	N/A	0	0	0	0	0	N/A
University of Utah, Salt Lake City, UT							2	N/A	N/A	N/A	1	3	0	2	0	N/A
Utah AFL-CIO, Salt Lake City, UT							0	N/A	N/A	N/A	0	0	0	0	0	N/A
Utah Asphalt Pavement Association, South Jordan, UT							0	N/A	N/A	N/A	0	0	0	0	0	N/A
Utah System of Higher Education,							0	N/A	N/A	N/A	0	0	0	0	0	N/A

Salt Lake City, UT																
Utah Transit Authority, Salt Lake City, UT							0	N/A	N/A	N/A	0	0	0	0	0	N/A
UTEP Upward Bound, El Paso, TX			✔		✔	✔	0	N/A	N/A	N/A	0	0	0	0	0	N/A
Victoria University of Wellington, Wellington							0	N/A	N/A	N/A	0	0	0	0	0	N/A
Virginia Polytechnic Institute and State University, Arlington, VA							3	N/A	N/A	N/A	0	4	3	0	0	N/A
Washington State Ferries, Seattle, WA							0	N/A	N/A	N/A	0	0	0	0	0	N/A
Westpointe Community Council, Salt Lake City, UT							0	N/A	N/A	N/A	0	0	0	0	0	N/A
Westside Coalition, Salt Lake City, UT							0	N/A	N/A	N/A	0	0	0	0	0	N/A
Wilson Motors, Logan, UT							0	N/A	N/A	N/A	0	0	0	0	0	N/A
Yes-She-Can, El Paso, TX		✔			✔		0	N/A	N/A	N/A	0	0	0	0	0	N/A
Young Automotive Group, Logan, UT							0	N/A	N/A	N/A	0	0	0	0	0	N/A
V. Non-ERC Institutions Providing REU Students	**5**	**3**	**4**	**1**	**2**	**3**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**6**	**N/A**
Cabrillo College, Aptos, CA		✔	✔		✔	✔	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	N/A
George Mason University, Fairfax, VA			✔			✔	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	N/A
Grambling State University, Grambline, LA		✔	✔	✔		✔	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	N/A
Stevens Institute of Technology, Hoboken, NJ							N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	N/A

University of California Riverside, Riverside, CA		✔	✔		✔		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2	N/A
VI. NSF Diversity Program Awardees	**0**	**0**	**0**	**0**	**0**	**0**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**0**	**0**	**0**	**0**	**N/A**
Alliances for Graduate Education and the Professoriate (AGEP)	**0**	**0**	**0**	**0**	**0**	**0**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**0**	**0**	**0**	**0**	**N/A**
No AGEP institutions were entered.																
Centers of Research Excellence in Science and Technology (CREST)	**0**	**0**	**0**	**0**	**0**	**0**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**0**	**0**	**0**	**0**	**N/A**
No CREST institutions were entered.																
Louis Stokes Alliances for Minority Participation (LSAMP)	**0**	**0**	**0**	**0**	**0**	**0**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**0**	**0**	**0**	**0**	**N/A**
No LSAMP institutions were entered.																
Tribal Colleges and Universities Program (TCUP)	**0**	**0**	**0**	**0**	**0**	**0**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**0**	**0**	**0**	**0**	**N/A**
No TCUP institutions were entered.																
NSF Diversity Program Collaborations (NSF Diversity Program Collaborations)	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**N/A**	**N/A**	**N/A**	**0**	**0**	**0**	**0**	**0**	**N/A**
No NSF Diversity Program Collaborations were entered.																
VII. Precollege Partners	**13**	**0**	**3**	**0**	**2**	**6**	**N/A**	**N/A**	**0**	**1**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**6**
Arrupe Jesuit High School, Denver, CO						✔	N/A	N/A	0	0	N/A	N/A	N/A	N/A	N/A	0
DSST Public Schools (HS Creative Engineering Design course), Boulder, CO						✔	N/A	N/A	0	0	N/A	N/A	N/A	N/A	N/A	0

El Paso Leadership Academy (HS Creative Engineering Design Course), El Paso, TX					✔	✔	N/A	N/A	0	0	N/A	N/A	N/A	N/A	N/A	0
GEAR Up Junior High School, Logan, UT			✔				N/A	N/A	0	0	N/A	N/A	N/A	N/A	N/A	0
InTech Collegiate Academy (HS Engineering Design Course), Logan, UT						✔	N/A	N/A	0	0	N/A	N/A	N/A	N/A	N/A	0
Neighborhood House, Salt Lake City, UT					✔		N/A	N/A	0	0	N/A	N/A	N/A	N/A	N/A	0
Northridge Elementary School, Longmont, CO							N/A	N/A	0	0	N/A	N/A	N/A	N/A	N/A	0
Purdue Polytechnic High School, Indianapolis, IN							N/A	N/A	0	1	N/A	N/A	N/A	N/A	N/A	6
Salt Lake City School District/West High School, Salt Lake City, UT			✔				N/A	N/A	0	0	N/A	N/A	N/A	N/A	N/A	0
Spring Creek Middle School, Providence, UT							N/A	N/A	0	0	N/A	N/A	N/A	N/A	N/A	0
Thornton Middle School, Thornton, CO						✔	N/A	N/A	0	0	N/A	N/A	N/A	N/A	N/A	0
UCB ODECE STEM Summer Program, Boulder, CO						✔	N/A	N/A	0	0	N/A	N/A	N/A	N/A	N/A	0
Utah Division of Multicultural Affairs, Salt Lake City, UT			✔				N/A	N/A	0	0	N/A	N/A	N/A	N/A	N/A	0
VIII. Community Colleges	**6**	**1**	**0**	**0**	**1**	**0**	**0**	**0**	**N/A**	**N/A**	**0**	**0**	**0**	**0**	**0**	**N/A**

Centralia College, Centralia, WA							0	0	N/A	N/A	0	0	0	0	0	N/A
El Paso Community College, El Paso, TX					✔		0	0	N/A	N/A	0	0	0	0	0	N/A
Front Range Community College, Westminster, CO		✔					0	0	N/A	N/A	0	0	0	0	0	N/A
Salt Lake Community College, Salt Lake City, UT							0	0	N/A	N/A	0	0	0	0	0	N/A
Weber State University, Ogden, UT							0	0	N/A	N/A	0	0	0	0	0	N/A
Western Tech El Paso, El Paso, TX							0	0	N/A	N/A	0	0	0	0	0	N/A
Total	**91**	**7**	**12**	**1**	**11**	**15**	**89**	**0**	**0**	**1**	**10**	**105**	**41**	**152**	**6**	**6**

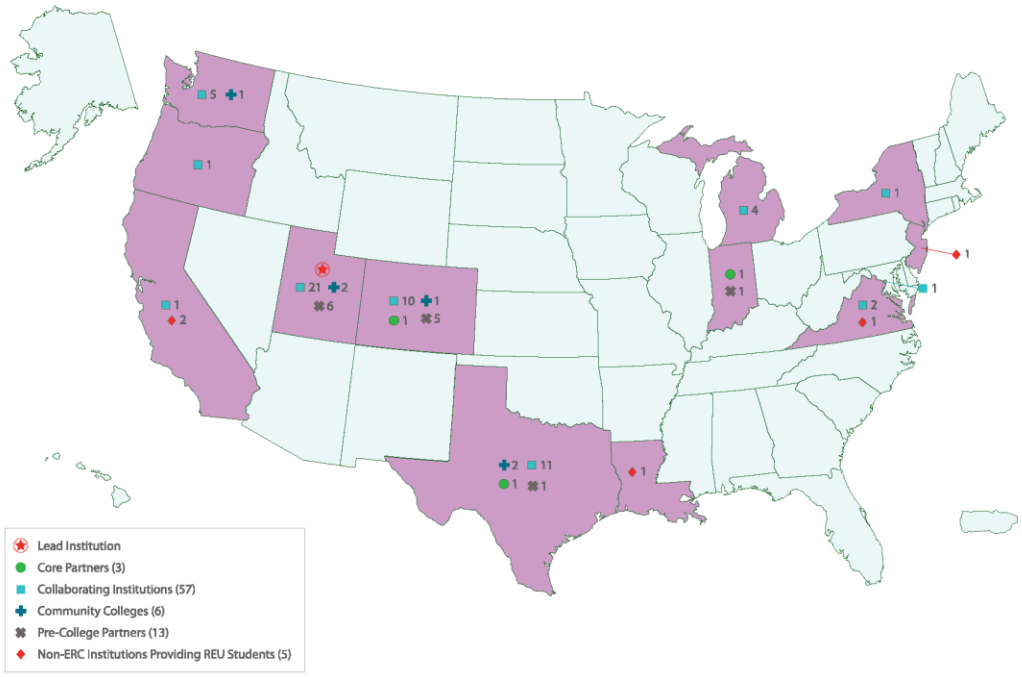
[1] - Only ERC personnel executing the ERC mission are shown in this table.

[2] Faculty is calculated by counting all personnel associated with institutions that have one of the following attributes: Director, Research Thrust, Engineering Workforce Development Program Leaders, Programmatic Personnel Junior Faculty, Programmatic Personnel Senior Faculty and Programmatic Personnel Visiting Faculty.

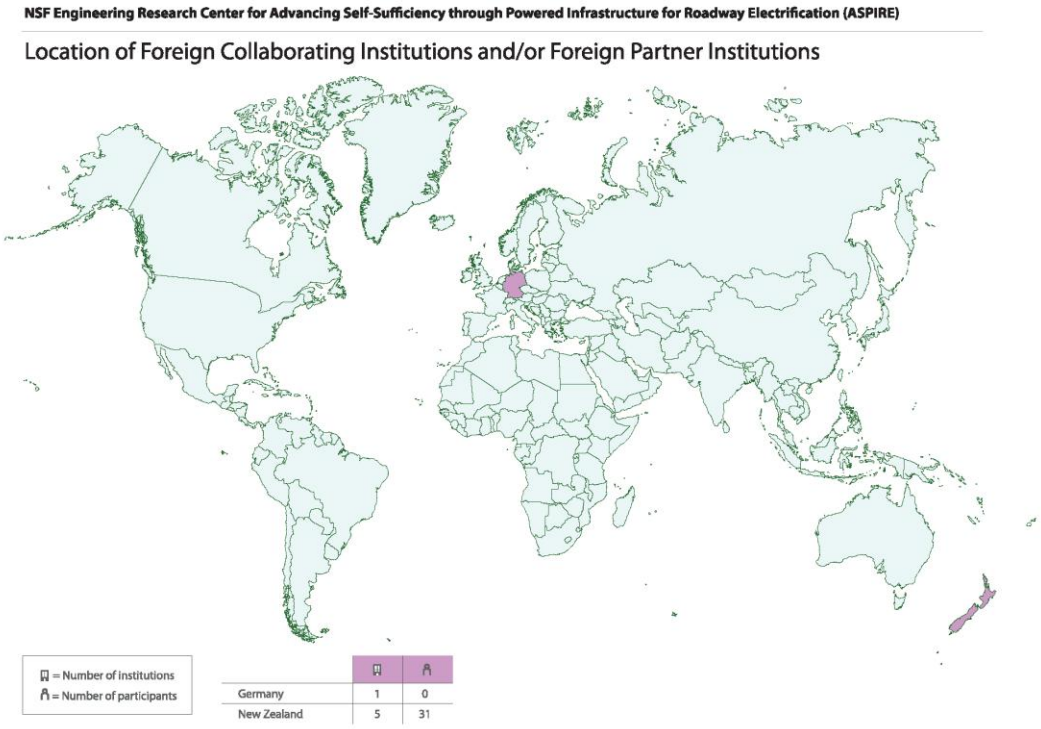
3.2 Location of Lead, core Partner and Collaborating Institutions Map

NSF Engineering Research Center for Advancing Self-Sufficiency through Powered Infrastructure for Roadway Electrification (ASPIRE)

Location of Lead, Core Partner, and All Domestic Collaborating Institutions



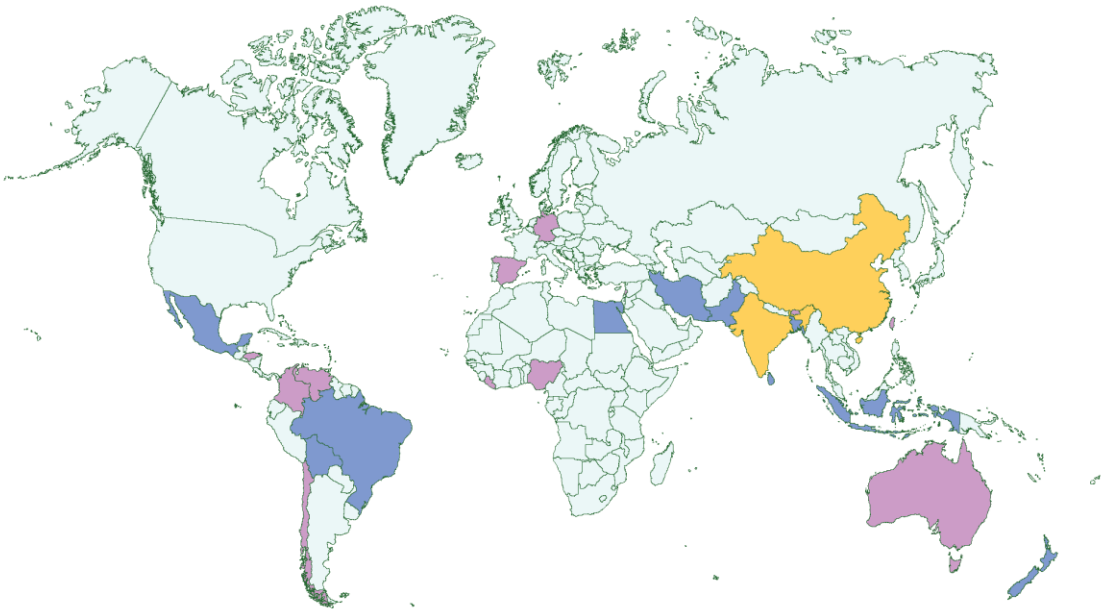
3.3 Location of Foreign Collaborating or Partner Institutions Map



3.4 Country of Citizenship for Foreign Personnel Map

NSF Engineering Research Center for Advancing Self-Sufficiency through Powered Infrastructure for Roadway Electrification (ASPIRE)

Country of Citizenship for ERC Foreign Personnel



= Number of ERC personnel from this country

- 1 person
- 2–10 people
- 11+ people

1 person		2–10 people		2–10 people		11+ people	
Australia	Lebanon	Bangladesh	3	Iran	6	China	11
Bhutan	Liberia	Bolivia	2	Mexico	5	India	27
Chile	Nigeria	Brazil	2	New Zealand	4		
Colombia	Spain	Egypt	3	Pakistan	5		
Germany	Taiwan	Indonesia	2	Sri Lanka	3		
Honduras	Venezuela						
Hong Kong							

Country Not Reported	0*

* Number of ERC personnel who are foreign and did not provide a country name

4. Convergent Research (CR)

4.1 Estimated Budgets Table

Estimated Budgets Table: Budgets by Research Thrust and Project Type				
Thrust	**Current Year Budget**			**Estimated Next Year Budget**
	Center Controlled Projects	**Sponsored Projects**	**Projects Total**	
Charging Stations	$925,465	$0	$925,465	$1,041,470
Electrified Roadways	$1,173,943	$0	$1,173,943	$1,555,282
Pathways	$1,094,243	$0	$1,094,243	$1,030,807
Systems of Systems	$2,422,029	$0	$2,422,029	$1,555,057

Table: Estimated Budgets by Research Thrust [1]						
Thrust	**Project Name**	**Organizational Sponsor**	**Project Leader**	**Investigators**	**Current Year Budget**	**Estimated Next Year Budget**
Charging Stations Thrust Leader: Hongjie Wang (Utah State University-Electrical and Computer	1.1 - Modeling, State Estimation, and Life-Aware Model-Predictive Controls of On-Vehicle Battery Systems (Center Controlled Project)	NSF ERC Program	Michael S. Trimboli (University of Colorado Colorado Springs-Electrical and Computer Engineering)	Gregory L. Plett (University of Colorado Colorado Springs-Electrical and Computer Engineering)	$129,541	$1,041,470

Engineering)	1.2 - Advancing charging technologies (Center Controlled Project)	NSF ERC Program	Michael S. Trimboli (University of Colorado Colorado Springs-Electrical and Computer Engineering)	Paras Mandal (University of Texas at El Paso-Electrical and Computer Engineering, The University of Texas at El Paso) Hongjie Wang (Utah State University-Electrical and Computer Engineering)	$438,563	
	1.3 - Thermal Modeling, Management, and Storage to Enable Sustainable and Advanced High-Powered EV Charging Infrastructure (Center Controlled Project)	NSF ERC Program	Michael S. Trimboli (University of Colorado Colorado Springs-Electrical and Computer Engineering)	Nicholas A. Roberts (Utah State University-Mechanical and aerospace) Hongjie Wang (Utah State University-Electrical and Computer Engineering)	$108,111	
	1.4 - Design, Planning, and Implementation of EV Charging Infrastructure (Center Controlled Project)	NSF ERC Program	Michael S. Trimboli (University of Colorado Colorado Springs-Electrical and Computer Engineering)	Adeeba A. Raheem (University of Texas at El Paso-Civil Engineering) Patrick A. Singleton (Utah State University-Civil and Environmental Engineering)	$74,992	
	1.5 - Charging Station Virtual Reality Visualization and Smart Management (Center Controlled Project)	NSF ERC Program	Michael S. Trimboli (University of Colorado Colorado Springs-Electrical and Computer Engineering)	Tzu-Liang Tseng (University of Texas at El Paso-Department of Industrial, Manufacturing and Systems Engineering (IMSE))	$106,437	
	1.6 - Connected Vehicle Data Analytics for Charging Stations of the Future	NSF ERC Program	Michael S. Trimboli (University of Colorado Colorado Springs-	Darcy M. Bullock (Purdue University-Civil Engineering)	$67,821	

	(Center Controlled Project)		Electrical and Computer Engineering)	Jairaj C. Desai (Purdue University-Civil Engineering)		
				Translational Research Projects Within Thrust	**$0**	
				Subtotal (all projects) for Thrust	**$925,465**	**$1,041,470**
				Total Number of Undergraduate Students in Thrust	**8**	
				Total Number of Graduate Students (M.S. and Ph.D.) in Thrust	**18**	
				Total Number of Postdocs in Thrust	**1**	
				Total Number of Personnel in Thrust	**49**	
Electrified Roadways Thrust Leader: Khurram K. Afridi (Cornell University-Electrical and Computer Engineering)	2.1 - Design Considerations towards High Performing Embedded Dynamic Wireless Power Transfer Systems (Center Controlled Project)	NSF ERC Program	Marv W. Halling (Utah State University-Civil and Environmental Engineering)	Srishti Banerji (Utah State University-Civil and Environmental Engineering) Cesar Tirado (University of Texas at El Paso-Civil Engineering/Center for Transportation Infrastructure Systems)	$489,795	$1,555,282
	2.2 - Coupled Thermal/Mechanical Modeling and Evaluation of Electrified Pavement Systems (Center Controlled Project)	NSF ERC Program	Marv W. Halling (Utah State University-Civil and Environmental Engineering)	Konstantina Gkritza (Purdue University-Lyles School of Civil Engineering) Nicholas A. Roberts (Utah State University-Mechanical and aerospace)	$139,060	
	2.3 - Investigation of System Interoperability for Dynamic Inductive	NSF ERC Program	Marv W. Halling (Utah State University-Civil and	Steve D. Pekarek (Purdue University-ECE)	$19,541	

	Wireless Charging (Center Controlled Project)		Environmental Engineering)	Regan A. Zane (Utah State University-Electrical and Computer Engineering / ASPIRE)		
	2.4 - Evaluation of Potential Electrical Threats to Electrified Pavement Components (Center Controlled Project)	NSF ERC Program	Marv W. Halling (Utah State University-Civil and Environmental Engineering)	Juhyeong Lee (Utah State University-Mechanical and Aerospace Engineering)	$132,831	
	2.5 - Modeling, Communications, Networking Infrastructure, and Protection for Secure and Smart Electrified Roadway Charging (Center Controlled Project)	NSF ERC Program	Marv W. Halling (Utah State University-Civil and Environmental Engineering)	Ryan Gerdes (Virginia Polytechnic Institute and State University-Electrical and Computer Engineering) Rose Q. Hu (Utah State University-Electrical and Computer Engineering)	$64,867	
	2.6 - Evaluate Performance and Resilience of Transportation Asset Management for Electrified Road Systems (Center Controlled Project)	NSF ERC Program	Marv W. Halling (Utah State University-Civil and Environmental Engineering)	Cristina Torres-Machi (University of Colorado Boulder-Civil, Environmental, and Architectural Engineering)	$327,849	

Translational Research Projects Within Thrust	**$0**	
Subtotal (all projects) for Thrust	**$1,173,943**	**$1,555,282**
Total Number of Undergraduate Students in Thrust	**10**	
Total Number of Graduate Students (M.S. and Ph.D.) in Thrust	**14**	
Total Number of Postdocs in Thrust	**0**	
Total Number of Personnel in Thrust	**52**	

Pathways Thrust Leader: Brandon C. Allen (Purdue University-Political Science)	4.1 - Pre-College Curricula, Engagement & PD (Center Controlled Project)	NSF ERC Program	Jennifer C. Ramos-Chavez (University of Texas at El Paso-Civil Engineering)	Jennifer L. Taylor (University of Colorado Boulder-College of Engineering and Applied Science, Integrated Teaching and Learning Program)	$224,382	$1,030,807
	4.2 - REU, Higher Education Curricula & Engagement (Center Controlled Project)	NSF ERC Program	Jennifer C. Ramos-Chavez (University of Texas at El Paso-Civil Engineering)	Brandon C. Allen (Purdue University-Political Science)	$154,396	
	4.3 - Student Engagement and Center-Wide Mentorship (Center Controlled Project)	NSF ERC Program	Jennifer C. Ramos-Chavez (University of Texas at El Paso-Civil Engineering)	Melanie Conrad (Utah State University-ASPIRE Admin & Staff)	$25,049	
	4.4 - Community College and Post-secondary Electrified Transportation Systems (ETS) Pathway Credentialing (Center Controlled Project)	NSF ERC Program	Jennifer C. Ramos-Chavez (University of Texas at El Paso-Civil Engineering)	Angela L. Minichiello (Utah State University-engineering education, College of Engineering)	$242,983	
	4.5 - Community Engagement & Governance (Center Controlled Project)	NSF ERC Program	Jennifer C. Ramos-Chavez (University of Texas at El Paso-Civil Engineering)	Fawn C. Groves (Utah State University-ASPIRE / College of Engineering)	$321,193	
	4.6 - Social Context and Justice Research (Center Controlled Project)	NSF ERC Program	Jennifer C. Ramos-Chavez (University of Texas at El Paso-Civil Engineering)	Brandon C. Allen (Purdue University-Political Science)	$126,240	
				Translational Research Projects Within Thrust	**$0**	
				Subtotal (all projects) for Thrust	**$1,094,243**	**$1,030,807**

				Total Number of Undergraduate Students in Thrust	**2**	
				Total Number of Graduate Students (M.S. and Ph.D.) in Thrust	**5**	
				Total Number of Postdocs in Thrust	**1**	
				Total Number of Personnel in Thrust	**25**	
Systems of Systems Thrust Leader: Patrick A. Singleton (Utah State University-Civil and Environmental Engineering)	3.1 - Power and Transportation Simulator (Center Controlled Project)	NSF ERC Program	Sivaranjani Seetharaman (Purdue University-Industrial Engineering)	Dionysios Aliprantis (Purdue University-Electrical and Computer Engineering) Bri-Mathias S. Hodge (University of Colorado Boulder-Department of Electrical, COmputer and Energy Engineering)	$635,604	$1,555,057
	3.2 - Examining the air quality and health implications of vehicle electrification (Center Controlled Project)	NSF ERC Program	Sivaranjani Seetharaman (Purdue University-Industrial Engineering)	Michael P. Hannigan (University of Colorado Boulder-Mechanical Engineering)	$291,942	
	3.3 - Adoption of Electric Vehicles and Transportation Systems (Center Controlled Project)	NSF ERC Program	Sivaranjani Seetharaman (Purdue University-Industrial Engineering)	Konstantina Gkritza (Purdue University-Lyles School of Civil Engineering) Patrick A. Singleton (Utah State University-Civil and Environmental Engineering)	$560,732	
	3.4 - Optimization of Transportation Electrification Solutions Through	NSF ERC Program	Sivaranjani Seetharaman (Purdue University-Industrial Engineering)	Noah T. Horesh (Colorado State University-Mechanical Engineering)	$144,116	

	Integrated Techno-Economic and Life-Cycle Assessment (Center Controlled Project)			Jason C. Quinn (Colorado State University-Mechanical Engineering)		
	3.5 - Combined Simulation Framework for Mass Charger Utilization through Massive Simulation and Distributed Market Approaches (Center Controlled Project)	NSF ERC Program	Sivaranjani Seetharaman (Purdue University-Industrial Engineering)	Mario Y. Harper (Utah State University-Computer Science)	$272,961	
	3.6 - Environmentally Aware EV Charging Integration in Energy Systems (Center Controlled Project)	NSF ERC Program	Sivaranjani Seetharaman (Purdue University-Industrial Engineering)	Junjie Qin (Purdue University-ECE)	$315,451	
	3.7 - Empowering Urban Electrification: Leveraging Socio-Economic and Social Network Insights with CARLA-Charge in the ASPIRE Framework for Optimal EV Charging Solutions (Center Controlled Project)	NSF ERC Program	Sivaranjani Seetharaman (Purdue University-Industrial Engineering)	Mario Y. Harper (Utah State University-Computer Science) Steve Petruzza (Utah State University-Computer Science)	$201,223	
				Translational Research Projects Within Thrust	**$0**	
				Subtotal (all projects) for Thrust	**$2,422,029**	**$1,555,057**
				Total Number of Undergraduate Students in Thrust	**10**	
				Total Number of Graduate Students (M.S. and Ph.D.) in Thrust	**17**	
				Total Number of Postdocs in Thrust	**1**	

Total Number of Personnel in Thrust	**59**	

[1] The sum of personnel for all thrusts may be greater than the total number of personnel associated with the ERC if personnel are associated with projects under multiple thrusts.

[2] Starting in 2023, Associated Project details are not included in this table and are instead reflected in the separate Associated Projects reporting table.

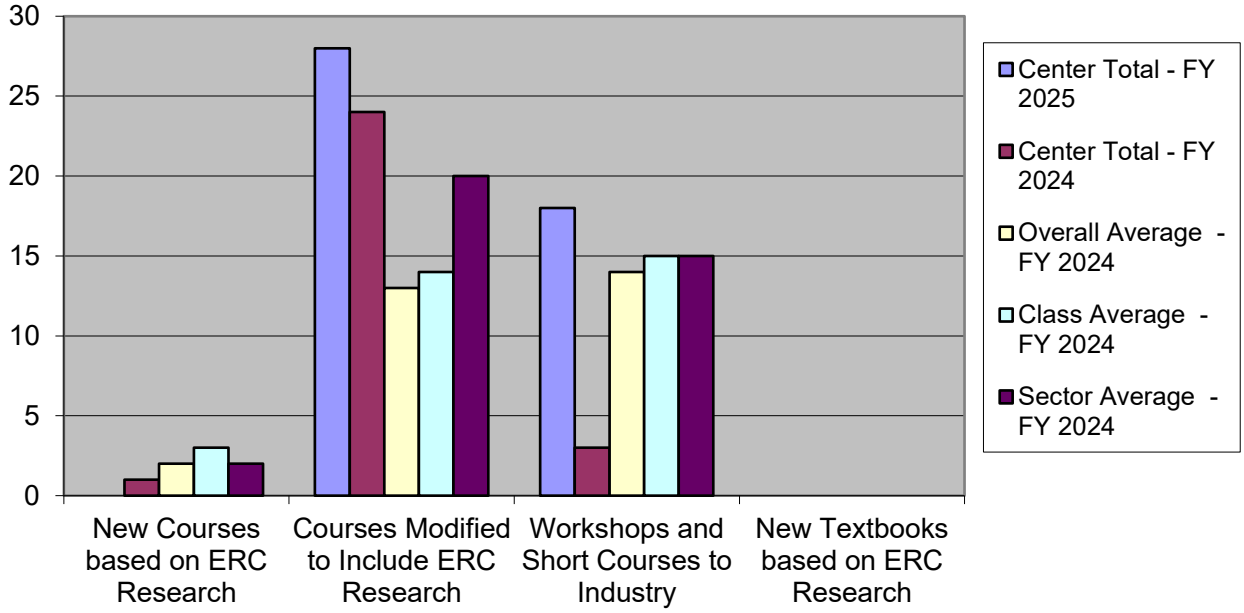
5. Engineering Workforce Development (EWD)

5.1 Educational Impact Table

Table: Educational Impact														
	Total from Quantifiable Outputs Table	With Engineered Systems Focus		With Multidisciplinary Content		Team Taught by Faculty From More Than 1 Department		Undergraduate Level		Graduate Level		Used at More Than 1 ERC Institution		Cumulative Total for All Years
		Jul 01, 2024-Jun 30, 2025	Percent	Jul 01, 2024-Jun 30, 2025	Percent	Jul 01, 2024-Jun 30, 2025	Percent	Jul 01, 2024-Jun 30, 2025	Percent	Jul 01, 2024-Jun 30, 2025	Percent	Jul 01, 2024-Jun 30, 2025	Percent	
New Courses Currently Offered [1]	0	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	6
Currently Offered Ongoing Courses With ERC Content [2]	28	27	96%	21	75%	10	36%	12	43%	16	57%	7	25%	98
Workshops, Short Courses, and Webinars	18	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	48
New textbooks based on ERC research	0	0	0%	0	0%	N/A	N/A	0	0%	0	0%	0	0%	0

5.2 Educational Impact, Comparison of Center, ERC Program Overall, Center Class and Center Sector Figure

Figure: Educational Impact - Comparison of Center, ERC Program Overall, Center Class, and Center Sector



[1] New courses currently offered and approved by the curriculum committee are only counted in the first year that they are offered so there is no multiple counting of these courses.

[2] The cumulative totals for "Currently offered, ongoing courses with ERC content" may count the same course more than once.
This is due to the fact that a single course can be modified in multiple years and therefore will be included in the cumulative total multiple times.

[3] Educational impacts/outreach activities may result from activities initiated as part of the ERC Engineering Workforce Development, Diversity and Culture of Inclusion,
and Innovation Ecosystem programs.

5.3 Student Ratio Table

Table: Ratio of Graduates to Undergraduates							
Center Grouping	**Undergraduates**	**Graduate Students**	**Ratio Grad/UG**	**REU Students**	**Total College Students**	**Young Scholars**	**Total Students (Graduate, Undergraduate, Young Scholar, and REU Students)**
Average All Active ERCs FY 2024	41	75	1.8	16	132	14	146
Average Energy, Sustainability, and Infrastructure Sector FY 2024	67	89	1.3	17	174	15	189
Average for Class of 2020 FY 2024	67	100	1.5	21	188	7	195
ASPIRE FY 2024	143	158	1.1	6	307	6	313
ASPIRE FY 2025	**152**	**146**	**1.0**	**6**	**304**	**6**	**310**

6. Diversity and Culture of Inclusion (DCI)

6.1 ERC Personnel Diversity Table

Table: Diversity Statistics for ERC Faculty and Students																		
	U.S. Citizens or Permanent Residents							**Foreign (Temporary Visa Holders)**						**Citizenship Not Reported**					
	Leadership Team [4]	**Faculty [5]**	**Postdocs**	**Doctoral Students**	**Masters Students**	**Undergrad Non-REU**	**REU Students**	**Leadership Team [4]**	**Faculty [5]**	**Postdocs**	**Doctoral Students**	**Masters Students**	**Undergrad Non-REU**	**Leadership Team [4]**	**Faculty [5]**	**Postdocs**	**Doctoral Students**	**Masters Students**	**Undergrad Non-REU**
Center Total	**30**	**60**	**4**	**23**	**18**	**98**	**0**	**4**	**11**	**4**	**44**	**14**	**8**	**3**	**16**	**2**	**38**	**9**	**46**

Women																			
Category Total	15	20	2	7	4	20	0	3	3	0	6	4	3	0	3	0	3	0	1

Center Percent	50.0%	33.3%	50.0%	30.4%	22.2%	20.4%	0	75.0%	27.3%	0.0%	13.6%	28.6%	37.5%	0.0%	18.8%	0.0%	7.9%	0.0%	2.2%
National Percent [1][2]	N/A	20.8%	N/A	32.4%	26.8%	26.0%	N/A	N/A	24.6%	N/A	27.6%	31.4%	26.6%	N/A	N/A	N/A	N/A	N/A	N/A

Underrepresented Racial Minorities																			
Category Total	2	2	0	2	1	4	0	0	0	1	2	0	1	0	0	0	1	0	0
Center Percent	6.7%	3.3%	0.0%	8.7%	5.6%	4.1%	0	0.0%	0.0%	25.0%	4.5%	0.0%	12.5%	0.0%	0.0%	0.0%	2.6%	0.0%	0.0%
National Percent [1][2]	N/A	2.7%	N/A	6.1%	6.6%	6.4%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Hispanic or Latino																			
Category Total	2	5	2	3	1	14	0	0	1	0	5	2	5	0	0	0	1	0	0

Center Percent	6.7 %	8.3 %	50.0%	13.0%	5.6 %	14.3%	0	0.0 %	9.1 %	0.0 %	11.4%	14.3%	62.5%	0.0 %	0.0 %	0.0 %	2.6 %	0.0 %	0.0 %
National Percent [1][2]	N/A	4.2 %	N/A	10.0%	11.8%	17.1%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Persons With Disabilities																			
Category Total	1	3	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0
Center Percent	3.3 %	5.0 %	0.0 %	0.0 %	0.0 %	4.1 %	0	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %
National Percent [1][2] [3]	N/A	7.4 %	N/A	7.1 %	7.1 %	10.3%	N/A	N/A	7.4 %	N/A	7.1 %	7.1 %	10.3%	N/A	N/A	N/A	N/A	N/A	N/A

[1]The national percentages for Underrepresented Racial Minorities and Hispanic or Latino are only available for U.S. citizens and permanent residents (Source: ASEE).

[2]Most recent national percentages available are from the following years: Women - 2024, Underrepresented Racial Minorities - 2024, Hispanic or Latino - 2024, and Persons with Disabilities - 2008. (Source: ASEE).
[3]The national percentages for Persons with Disabilities are for all persons, regardless of citizenship. The national percentages for Doctoral students with disabilities and Masters students with disabilities are from the national percentages for Graduate students (Masters and Doctoral students combined) (Source: ASEE).
[4]Leadership Team includes Directors, Research Thrust Leaders, Engineering Workforce Development Program Leaders, Innovation Ecosystem Program Leader, Administrative Director, Staff, Diversity and Culture of Inclusion Program Leaders and Student Leaders.
[5]Faculty includes Programmatic Personnel - Senior Faculty, Programmatic Personnel - Junior Faculty and Programmatic Personnel - Visiting Faculty.

Table: Summary: Count of ERC Personnel

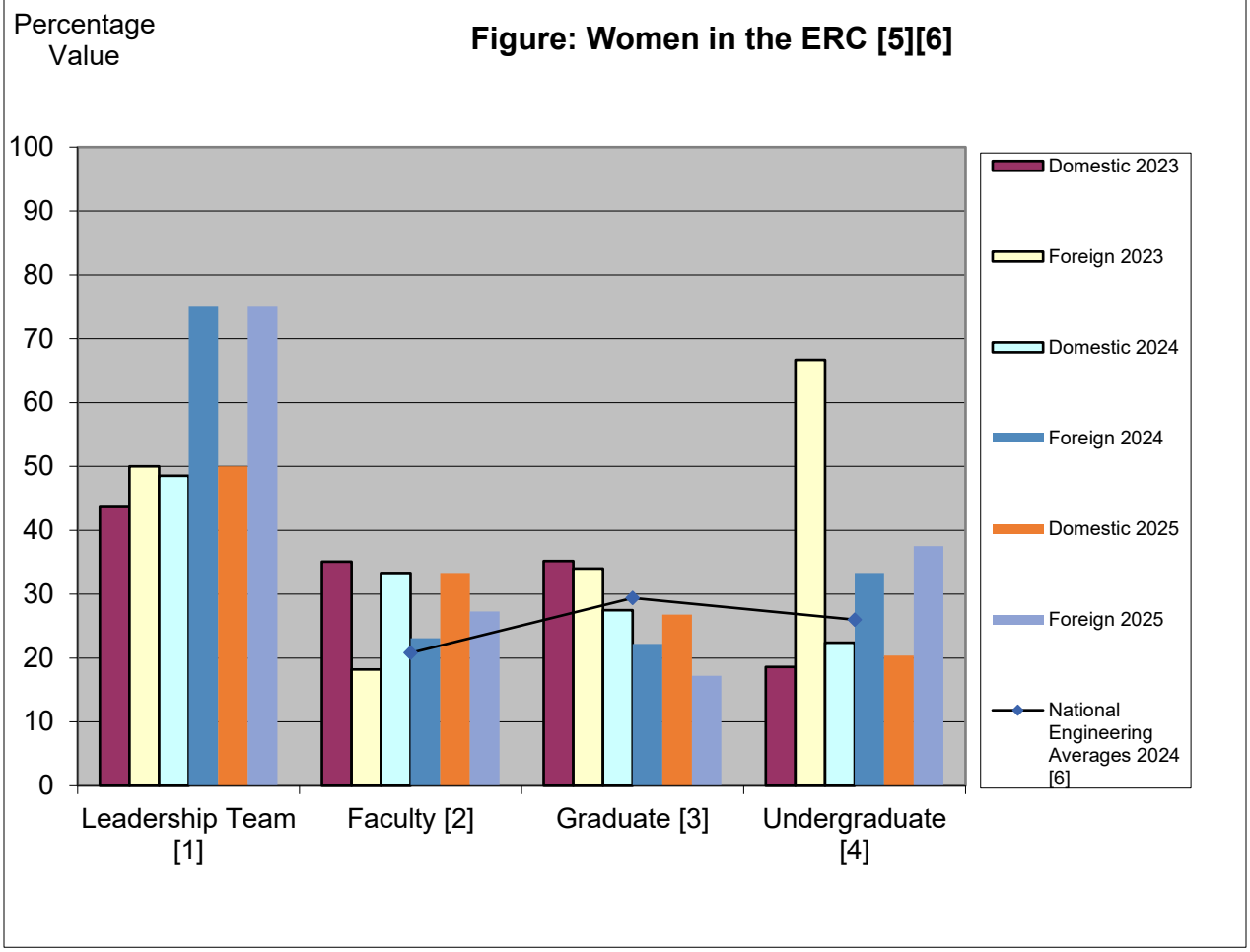
Faculty	Community College RET	K-12 Teachers		Postdocs	Students				Young Scholars	Other [6]	Total
		RET	Non-RET		Graduate		UG Non-REU	REU			
					Doctoral	Masters					
87	0	0	1	10	105	41	152	6	6	56	462

[6]Other includes Innovation Ecosystem Program Leader, Administrative Director, Staff, Programmatic Personnel - Industry Researchers, Programmatic Personnel - Other Visiting College Students and Programmatic Personnel - Staff.

6.2 Women Table and Figure

Averages	Leadership Team	Faculty	Graduate	Undergraduate
National Engineering Averages 2024 [6]	N/A	20.8%	29.4%	26%
All ERC's 2024 (Domestic)	48.2%	31.7%	39.8%	46.8%
All ERC's 2024 (Foreign)	37.5%	26.3%	30.4%	43.5%
Domestic Percentage for NSF Engineering Research Center for Advancing Self-Sufficiency through Powered Infrastructure for Roadway Electrification (ASPIRE) 2025	50%	33.3%	26.8%	20.4%
Foreign Percentage for NSF Engineering Research Center for Advancing Self-Sufficiency through Powered Infrastructure for Roadway Electrification (ASPIRE) 2025	75%	27.3%	17.2%	37.5%

Figure: Women in the ERC [5][6]



[1] Leadership Team includes Directors, Research Thrust Leaders, Engineering Workforce Development Program Leaders, Innovation Ecosystem Program Leader, Administrative Directors, Staff, Diversity and Culture of Inclusion Program Leaders and Student Leaders.
[2] Faculty includes Programmatic Personnel - Senior Faculty, Programmatic Personnel - Junior Faculty and Programmatic Personnel - Visiting Faculty.

[3] Graduate students include Doctoral and Master's students.

[4] Undergraduate students include non-REU and REU students.

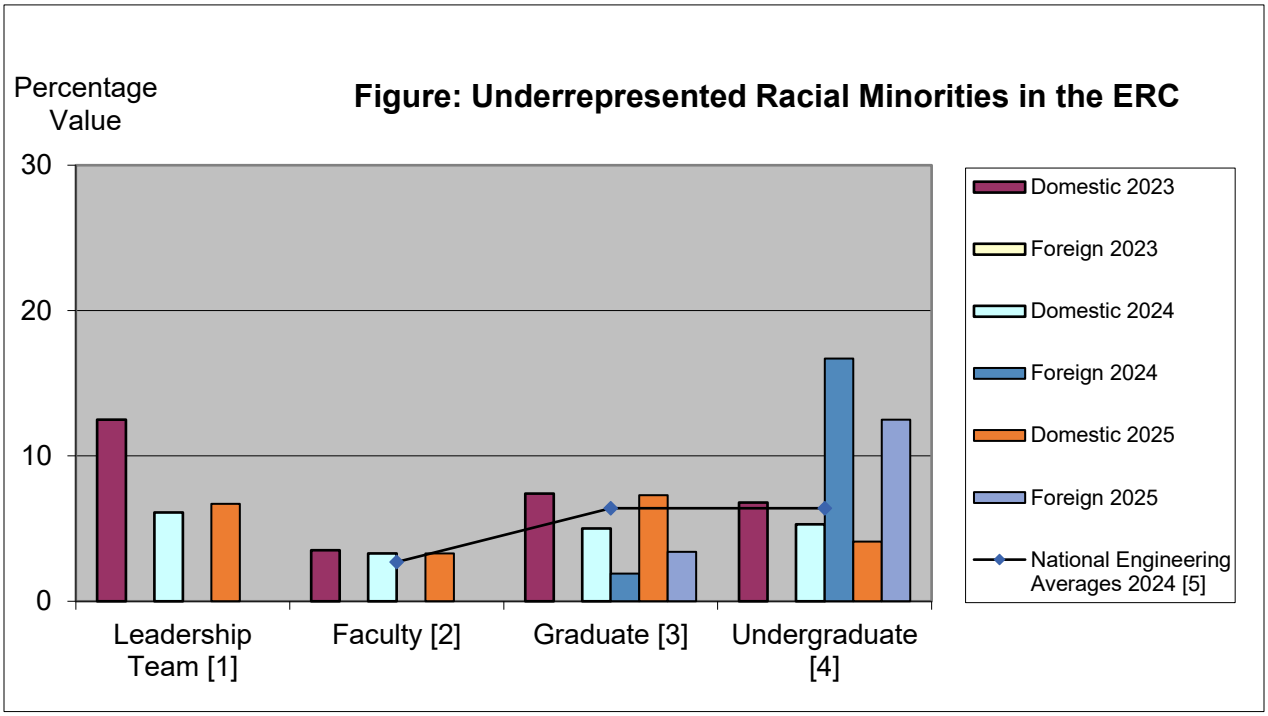
[5] The number of personnel for whom sex was not reported are not excluded from the percentage calculations.

[6] National Engineering Averages for faculty are for U.S. citizens only (Source: ASEE).

6.3 Underrepresented Racial Minorities in the ERC Table and Figure

Averages	Leadership Team	Faculty	Graduate	Undergraduate
National Engineering Averages 2024 [5]	N/A	2.7%	6.4%	6.4%
All ERC's 2024 (Domestic)	12.1%	8.3%	12.7%	17.6%

All ERC's 2024 (Foreign)	14.1%	3.5%	8.3%	10.9%
Domestic Percentage for NSF Engineering Research Center for Advancing Self-Sufficiency through Powered Infrastructure for Roadway Electrification (ASPIRE) 2025	6.7%	3.3%	7.3%	4.1%
Foreign Percentage for NSF Engineering Research Center for Advancing Self-Sufficiency through Powered Infrastructure for Roadway Electrification (ASPIRE) 2025	0%	0%	3.4%	12.5%

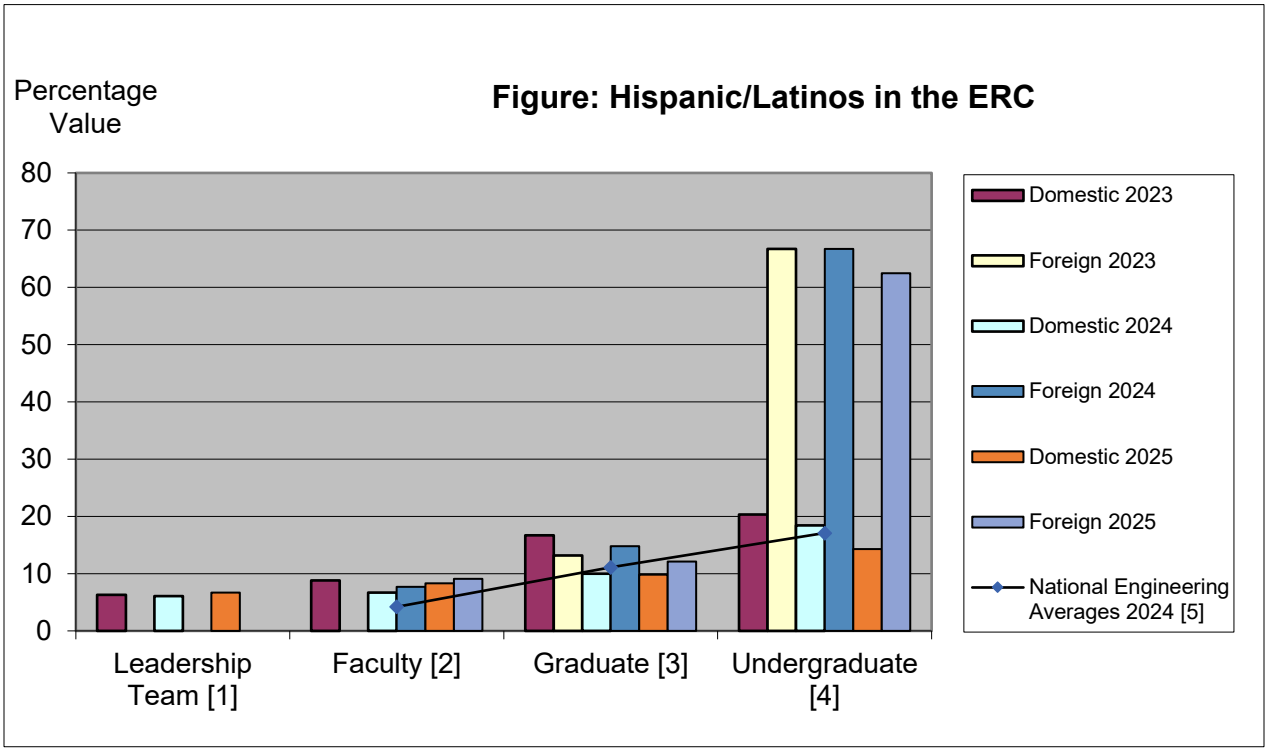


[1] Leadership Team includes Directors, Research Thrust Leaders, Engineering Workforce Development Program Leaders, Innovation Ecosystem Program Leader, Administrative Directors, Staff, Diversity and Culture of Inclusion Program Leaders and Student Leaders.
[2] Faculty includes Programmatic Personnel - Senior Faculty, Programmatic Personnel - Junior Faculty and Programmatic Personnel - Visiting Faculty.
[3] Graduate students include Doctoral and Master's students.
[4] Undergraduate students include non-REU and REU students.
[5] National Engineering Averages are for U.S. citizens only (Source: ASEE).

6.4 Hispanic/ Latinos in the ERC Table and Figure

Averages	Leadership Team	Faculty	Graduate	Undergraduate
National Engineering Averages 2024 [5]	N/A	4.2%	11.1%	17.1%
All ERC's 2024 (Domestic)	11.9%	8.8%	14%	21.8%
All ERC's 2024 (Foreign)	6.3%	12.3%	11%	21.7%

Domestic Percentage for NSF Engineering Research Center for Advancing Self-Sufficiency through Powered Infrastructure for Roadway Electrification (ASPIRE) 2025	6.7%	8.3%	9.8%	14.3%
Foreign Percentage for NSF Engineering Research Center for Advancing Self-Sufficiency through Powered Infrastructure for Roadway Electrification (ASPIRE) 2025	0%	9.1%	12.1%	62.5%



[1] Leadership Team includes Directors, Research Thrust Leaders, Engineering Workforce Development Program Leaders, Innovation Ecosystem Program Leader, Administrative Directors, Staff, Diversity and Culture of Inclusion Program Leaders and Student Leaders.
[2] Faculty includes Programmatic Personnel - Senior Faculty, Programmatic Personnel - Junior Faculty and Programmatic Personnel - Visiting Faculty.

[3] Graduate students include Doctoral and Master's students.

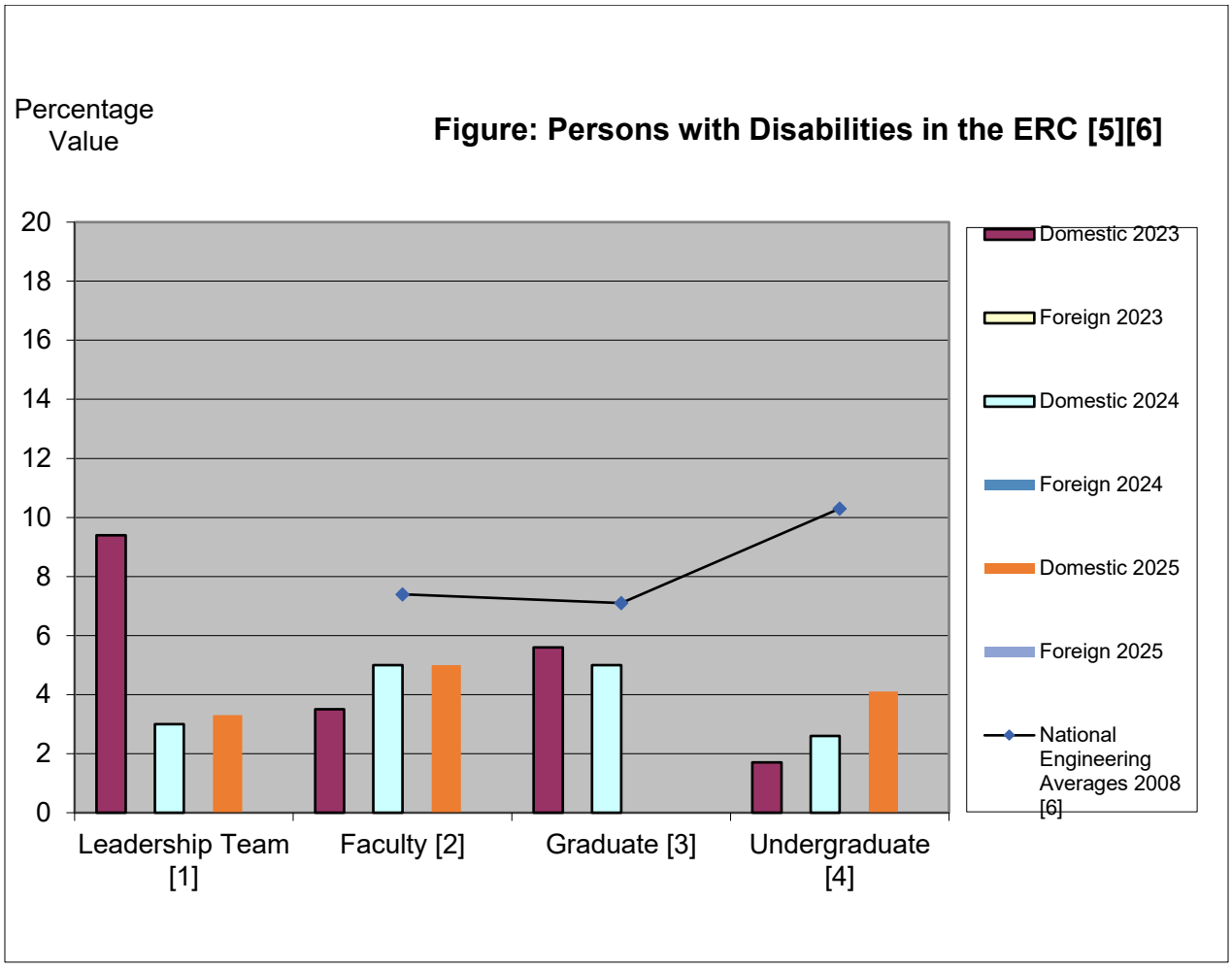
[4] Undergraduate students include non-REU and REU students.

[5] National Engineering Averages are for U.S. citizens only (Source: ASEE).

6.5 Disabilities Table and Figure

Averages	Leadership Team	Faculty	Graduate	Undergraduate
National Engineering Averages 2008 [6]	N/A	7.4%	7.1%	10.3%
All ERC's 2024 (Domestic)	4.9%	4.2%	5.4%	5.2%
All ERC's 2024 (Foreign)	0%	0%	0.4%	2.2%

Domestic Percentage for NSF Engineering Research Center for Advancing Self-Sufficiency through Powered Infrastructure for Roadway Electrification (ASPIRE) 2025	3.3%	5%	0%	4.1%
Foreign Percentage for NSF Engineering Research Center for Advancing Self-Sufficiency through Powered Infrastructure for Roadway Electrification (ASPIRE) 2025	0%	0%	0%	0%



[1] Leadership Team includes Directors, Research Thrust Leaders, Engineering Workforce Development Program Leaders, Innovation Ecosystem Program Leader, Administrative Directors, Staff, Diversity and Culture of Inclusion Program Leaders and Student Leaders.
[2] Faculty includes Programmatic Personnel - Senior Faculty, Programmatic Personnel - Junior Faculty and Programmatic Personnel - Visiting Faculty.

[3] Graduate students include Doctoral and Master's students.

[4] Undergraduate students include non-REU and REU students.
[5] The number of personnel for whom disability was not reported are not excluded from the percentage calculations.
[6] National Engineering Averages are derived from data provided by the American Society for Engineering Education (ASEE).

6.6 Institutional Diversity Table

Table: Center Diversity, by Institution						
Institution	**Women [1]**		**Underrepresented Racial Minorities [1] [2]**		**Hispanics [1]**	
	Number	**Percent**	**Number**	**Percent**	**Number**	**Percent**
Lead Institution						
Utah State University	37	26%	4	3%	3	2%
Core Partners						
Purdue University	5	23%	2	9%	2	9%
University of Colorado Boulder	14	52%	1	4%	1	4%
University of Texas at El Paso	8	30%	2	7%	19	70%
Collaborating Institutions						
Beth Myers Consulting	1	100%	0	0%	0	0%
Colorado State University	0	0%	0	0%	0	0%
Cornell University	2	40%	1	20%	0	0%
University of Colorado Colorado Springs	1	13%	0	0%	1	13%
University of Utah	0	0%	0	0%	0	0%
Virginia Polytechnic Institute and State University	3	100%	0	0%	0	0%
Non-ERC Institutions Providing REU Students						
Cabrillo College	0	0%	0	0%	0	0%
George Mason University	0	0%	0	0%	0	0%
Grambling State University	0	0%	0	0%	0	0%
Stevens Institute of Technology	0	0%	0	0%	0	0%
University of California Riverside	0	0%	0	0%	0	0%
Precollege Partners						
Purdue Polytechnic High School	0	0%	0	0%	0	0%
Foreign Partners						
University of Auckland	0	0%	0	0%	0	0%

[1] - This data includes U.S. Citizens and Legal Permanent Residents only.
[2] - Underrepresented Racial Minorities is a sum of all personnel entered in the following categories: American Indian or Alaska Native, Black or African American, Native Hawaiian or Other Pacific Islander, or More than one race reported, minority.

7. Innovation Ecosystems (IE)

7.1 Supporting Organizations Table

Table: Industrial/Practitioner Members, Innovation Partners, Funders of Sponsored Projects, Funders of Associated Projects, and Contributing Organizations

Summary:

34 - Industrial/Practitioner Members
35 - Innovation Partners
0 - Funder of Sponsored Projects
7 - Funders of Associated Projects
3 - Contributing Organizations

Section 1: 34 Industrial/Practitioner Members									
Organization	**Sector**	**Product Focus (Industry only)**	**Type of Financial Support**	**Type of Involvement**	**Domestic / Foreign**	**Size (Industry Only)**	**New Member (Yes/No)**	**Total # of Sponsored Projects**	**Total # of Associated Projects**
Industrial/Practitioner Members That Have Already Provided Current Award Year Support.									
ABB E-Mobility	Industry	Electric - Power, Utility, Systems, Components	Unrestricted Cash Donations Associated Project Support	Member of Center's Industrial Advisory Board Participates in science/engineering research projects Participation in innovation/entrepreneurship activities Involvement in Technology Transfer	foreign	large (>1000 employees)	no	0	1

AECOM Technology Corporation	Industry	Consulting services	Associated Project Support	Member of Center's Industrial Advisory Board Participates in science/engineering research projects Participation in education/outreach activities Participation in translational research Participation in innovation/entrepreneurship activities Involvement in Technology Transfer	domestic	large (>1000 employees)	no	0	2
Asphalt Systems Inc	Industry	Consumer products	Unrestricted Cash Donations	Member of Center's Industrial Advisory Board Participation in education/outreach activities	domestic	small (<500 employees)	yes	0	0
Central Florida Expressway Authority	State government	n/a	Associated Project Support	Member of Center's Industrial Advisory Board Participates in science/engineering research projects Participation in education/outreach activities Participation in translational research Participation in innovation/entrepreneurship activities	domestic	n/a	no	0	1

Concrete & Masonry & Hardscapes Association	Industrial Association	n/a	Unrestricted Cash Donations Associated Project Support	Member of Center's Industrial Advisory Board Participates in science/engineering research projects	domestic	n/a	yes	0	1
CRH Group Services Limited	Industry	Consumer products		Member of Center's Industrial Advisory Board Participates in science/engineering research projects Participation in translational research	foreign	large (>1000 employees)	no	0	0
Cummins, Inc.	Industry	Transportation	Unrestricted Cash Donations Restricted Cash Donations Associated Project Support	Member of Center's Industrial Advisory Board Participates in science/engineering research projects Participation in education/outreach activities Participation in translational research Participation in innovation/entrepreneurship activities	domestic	large (>1000 employees)	no	0	1

Denso Corporation	Industry	Automotive	Unrestricted Cash Donations Restricted Cash Donations Associated Project Support	Member of Center's Industrial Advisory Board Participates in science/engineering research projects Participation in education/outreach activities Participation in translational research Participation in innovation/entrepreneurship activities	foreign	large (>1000 employees)	no	0	2
Eaton Corporation	Industry	Power Solutions	Associated Project Support	Member of Center's Industrial Advisory Board Participates in science/engineering research projects Participation in translational research	foreign	large (>1000 employees)	no	0	1
Electreon Wireless	Industry	Transportation	Unrestricted Cash Donations Restricted Cash Donations	Member of Center's Industrial Advisory Board Participates in science/engineering research projects Participation in translational research Participation in innovation/entrepreneurship activities Involvement in Technology Transfer	foreign	small (<500 employees)	no	0	0

Electric Power Systems	Industry	Batteries	Unrestricted Cash Donations	Member of Center's Industrial Advisory Board Participation in innovation/entrepreneurship activities Involvement in Technology Transfer	domestic	small (<500 employees)	no	0	0
ENRX	Industry	Power Solutions	Unrestricted Cash Donations Restricted Cash Donations Associated Project Support	Member of Center's Industrial Advisory Board Participates in science/engineering research projects Participation in education/outreach activities Participation in translational research Participation in innovation/entrepreneurship activities	foreign	small (<500 employees)	no	0	1
Esri	Industry	Mapping & Fleet Solutions		Member of Center's Industrial Advisory Board Participation in innovation/entrepreneurship activities	domestic	large (>1000 employees)	no	0	0
Ford Motor Company	Industry	Transportation	Unrestricted Cash Donations	Member of Center's Industrial Advisory Board Participation in innovation/entrepreneurship activities	domestic	large (>1000 employees)	no	0	0

Geotab	Industry	Mapping & Fleet Solutions	Unrestricted Cash Donations In-Kind Donations	Member of Center's Industrial Advisory Board Participates in science/engineering research projects Participation in innovation/entrepreneurship activities	foreign	large (>1000 employees)	no	0	0
HNTB	Industry	Engineering services	Unrestricted Cash Donations	Member of Center's Industrial Advisory Board Participation in education/outreach activities	domestic	large (>1000 employees)	no	0	0
Hyster-Yale Group, Inc.	Industry	Off roadway equipment	Unrestricted Cash Donations	Member of Center's Industrial Advisory Board Participation in innovation/entrepreneurship activities	domestic	large (>1000 employees)	no	0	0
Indiana Department of Transportation	State government	n/a	Associated Project Support	Member of Center's Industrial Advisory Board Participates in science/engineering research projects Participation in education/outreach activities Participation in innovation/entrepreneurship activities	domestic	n/a	no	0	4
InductEV	Industry	Power Solutions	Unrestricted Cash Donations	Member of Center's Industrial Advisory Board Participation in education/outreach activities Participation in innovation/entrepreneurship activities	domestic	small (<500 employees)	no	0	0

John Deere	Industry	Consumer products	Unrestricted Cash Donations	Member of Center's Industrial Advisory Board Participation in innovation/entrepreneurship activities	domestic	large (>1000 employees)	no	0	0
Kenworth Trucks, Inc.	Industry	Transportation	Unrestricted Cash Donations Associated Project Support	Member of Center's Industrial Advisory Board Participates in science/engineering research projects Participation in translational research Participation in innovation/entrepreneurship activities Involvement in Technology Transfer	domestic	large (>1000 employees)	no	0	1
Laurel Group	Industry	Consulting services	Unrestricted Cash Donations	Member of Center's Industrial Advisory Board Participation in education/outreach activities Participation in innovation/entrepreneurship activities	domestic	small (<500 employees)	yes	0	0

PacifiCorp - Rocky Mountain Power	Industry	Electric - Power, Utility, Systems, Components	Unrestricted Cash Donations Associated Project Support	Member of Center's Industrial Advisory Board Participates in science/engineering research projects Participation in education/outreach activities Participation in translational research Participation in innovation/entrepreneurship activities Involvement in Technology Transfer	domestic	large (>1000 employees)	no	0	3
PC Krause and Associates, Inc.	Industry	Engineering services	Unrestricted Cash Donations	Member of Center's Industrial Advisory Board Participates in science/engineering research projects Participation in education/outreach activities	domestic	small (<500 employees)	yes	0	0
Pennsylvania Turnpike Authority	State government	n/a	Unrestricted Cash Donations	Member of Center's Industrial Advisory Board Participation in education/outreach activities Participation in innovation/entrepreneurship activities	domestic	n/a	no	0	0
Rekor	Industry	Data management	Unrestricted Cash Donations In-Kind Donations	Member of Center's Industrial Advisory Board	domestic	small (<500 employees)	yes	0	0

Schneider Electric	Industry	Electric - Power, Utility, Systems, Components	Unrestricted Cash Donations	Member of Center's Industrial Advisory Board Participation in education/outreach activities Participation in innovation/entrepreneurship activities	foreign	large (>1000 employees)	no	0	0
Southwire	Industry	Electric - Power, Utility, Systems, Components	Unrestricted Cash Donations	Member of Center's Industrial Advisory Board Participation in education/outreach activities Participation in innovation/entrepreneurship activities	domestic	large (>1000 employees)	no	0	0
State of Utah	State government	n/a	Unrestricted Cash Donations Restricted Cash Donations Associated Project Support	Participates in science/engineering research projects Participation in translational research	domestic	n/a	no	0	2
Toyota Motor Engineering & Manufacturing North America, Inc.	Industry	Transportation	Unrestricted Cash Donations Associated Project Support	Member of Center's Industrial Advisory Board Participates in science/engineering research projects Participation in education/outreach activities Participation in innovation/entrepreneurship activities	foreign	large (>1000 employees)	no	0	1

UDOT (Utah Department of Transportation)	State government	n/a	Associated Project Support	Member of Center's Industrial Advisory Board Participates in science/engineering research projects Participation in translational research Participation in innovation/entrepreneurship activities	domestic	n/a	no	0	1
Utah Inland Port Authority	State government	n/a	Unrestricted Cash Donations	Member of Center's Industrial Advisory Board Participates in science/engineering research projects Participation in innovation/entrepreneurship activities	domestic	n/a	no	0	0
WiTricity Corporation	Industry	Wireless devices		Member of Center's Industrial Advisory Board Participation in education/outreach activities Participation in innovation/entrepreneurship activities	domestic	small (<500 employees)	no	0	0
WSP	Industry	Engineering services	Unrestricted Cash Donations	Member of Center's Industrial Advisory Board Participation in education/outreach activities Involvement in Technology Transfer	foreign	large (>1000 employees)	yes	0	0

Section 2: 35 Innovation Partners

Organization	Sector	Product Focus (Industry only)	Type of Involvement	Domestic / Foreign	Size (Industry Only)	New Partner (Yes/No)
American Association of Port Authorities	Other Sector	n/a	Member of Center's Industrial Advisory Board Participation in innovation/entrepreneurship activities	domestic	n/a	yes
Argonne National Lab	Other Sector	n/a	Member of Center's Industrial Advisory Board	domestic	n/a	no
BorderPlex Alliance	Other Sector	n/a	Member of Center's Industrial Advisory Board Participation in education/outreach activities Participation in innovation/entrepreneurship activities	domestic	n/a	no
CALSTART, Inc.	Private Foundation	n/a	Member of Center's Industrial Advisory Board	domestic	n/a	no
Center for Transportation & the Environment (CTE)	Private Foundation	n/a	Member of Center's Industrial Advisory Board Participation in education/outreach activities	domestic	n/a	yes
Conexus Indiana	Other Sector	n/a	Member of Center's Industrial Advisory Board Participation in innovation/entrepreneurship activities	domestic	n/a	no
Dallas Fort Worth Airport	Other Sector	n/a	Member of Center's Industrial Advisory Board Participation in education/outreach activities	domestic	n/a	no

Environmental Branch, Hill Air Force Base	Other Sector	n/a	Member of Center's Industrial Advisory Board Participation in education/outreach activities Participation in innovation/entrepreneurship activities Involvement in Technology Transfer	domestic	n/a	no
Forth Mobility	Other Sector	n/a	Member of Center's Industrial Advisory Board	domestic	n/a	no
Heal Utah	Other Sector	n/a	Member of Center's Industrial Advisory Board	domestic	n/a	no
Idaho National Lab	Other Sector	n/a	Member of Center's Industrial Advisory Board Participates in science/engineering research projects Participation in education/outreach activities Participation in innovation/entrepreneurship activities	domestic	n/a	no
Illinois Asphalt Pavement Association (IAPA)	Other Sector	n/a	Member of Center's Industrial Advisory Board Participation in innovation/entrepreneurship activities	domestic	n/a	no
Illinois Concrete Pavement Association (ICPA)	Other Sector	n/a	Member of Center's Industrial Advisory Board Participation in innovation/entrepreneurship activities	domestic	n/a	no

Illinois Tollway	State government	n/a	Member of Center's Industrial Advisory Board Participation in innovation/entrepreneurship activities	domestic	n/a	yes
IMTA (Indiana Motor Truck Association)	Other Sector	n/a	Member of Center's Industrial Advisory Board Participation in education/outreach activities Participation in innovation/entrepreneurship activities	domestic	n/a	no
ITSA (Intelligent Transportation Society of Amer)	Private Foundation	n/a	Member of Center's Industrial Advisory Board Participation in education/outreach activities	domestic	n/a	no
Michigan Economic Development Corporation, Office of Future Mobility and Electrification	State government	n/a	Member of Center's Industrial Advisory Board	domestic	n/a	no
Minnesota Asphalt Pavement Association (MAPA)	Other Sector	n/a	Member of Center's Industrial Advisory Board Participation in education/outreach activities Participation in innovation/entrepreneurship activities	domestic	n/a	no
Minnesota Department of Transportation	State government	n/a	Member of Center's Industrial Advisory Board Participation in education/outreach activities	domestic	n/a	no

NACFE (North American Council for Freight Efficiency)	Other Sector	n/a	Member of Center's Industrial Advisory Board Participation in education/outreach activities Participation in innovation/entrepreneurship activities	domestic	n/a	no
National Asphalt Pavement Association	Other Sector	n/a	Member of Center's Industrial Advisory Board Participation in education/outreach activities Participation in innovation/entrepreneurship activities	domestic	n/a	yes
National Renewable Energy Lab	Other Sector	n/a	Member of Center's Industrial Advisory Board Participates in science/engineering research projects Participation in education/outreach activities Participation in innovation/entrepreneurship activities Involvement in Technology Transfer	domestic	n/a	no
North Carolina Turnpike	State government	n/a	Member of Center's Industrial Advisory Board	domestic	n/a	no
North Central Texas Council of Governments	Local government	n/a	Member of Center's Industrial Advisory Board Participation in education/outreach activities	domestic	n/a	no

Oak Ridge National Lab	Other Sector	n/a	Member of Center's Industrial Advisory Board Participation in education/outreach activities	domestic	n/a	no
Ohio Turnpike and Infrastructure Commission	State government	n/a	Member of Center's Industrial Advisory Board	domestic	n/a	no
RMI (Rocky Mountain Institute)	Private Foundation	n/a	Member of Center's Industrial Advisory Board Participates in science/engineering research projects Participation in education/outreach activities	domestic	n/a	no
SANDAG (San Diego Association of Governments)	Local government	n/a	Member of Center's Industrial Advisory Board	domestic	n/a	no
SMUD	Other Sector	n/a	Member of Center's Industrial Advisory Board Participation in education/outreach activities Participation in innovation/entrepreneurship activities	domestic	n/a	no
The Ray	Private Foundation	n/a	Member of Center's Industrial Advisory Board Participation in innovation/entrepreneurship activities	domestic	n/a	no

UAPA	State government	n/a	Member of Center's Industrial Advisory Board Participation in education/outreach activities Participation in innovation/entrepreneurship activities	domestic	n/a	no
UTA (Utah Transit Authority)	State government	n/a	Member of Center's Industrial Advisory Board Participates in science/engineering research projects Participation in innovation/entrepreneurship activities Involvement in Technology Transfer	domestic	n/a	no
Utah Clean Cities Coalition	Private Foundation	n/a	Member of Center's Industrial Advisory Board Participates in science/engineering research projects Participation in education/outreach activities Participation in innovation/entrepreneurship activities	domestic	n/a	no
Utah Governor's Office of Energy Development	State government	n/a	Member of Center's Industrial Advisory Board Participates in science/engineering research projects	domestic	n/a	no
VDOT (Virginia Department of Transportation)	State government	n/a	Member of Center's Industrial Advisory Board	domestic	n/a	no

Section 3: 0 Funder of Sponsored Projects								
Organization	Sector	Product Focus (Industry only)	Type of Financial Support	Type of Involvement	Domestic / Foreign	Size (Industry Only)	New Partner (Yes/No)	Total # of Sponsored Projects
There are no organizations of the organization type Funder of Sponsored Projects for which support has been received.								

Section 4: 7 Funders of Associated Projects								
Organization	Sector	Product Focus (Industry only)	Type of Financial Support	Type of Involvement	Domestic / Foreign	Size (Industry Only)	New Partner (Yes/No)	Total # of Associated Projects
Funders of Associated Projects That Have Already Provided Current Award Year Support.								
Colorado Department of Transportation	State government	n/a	Associated Project Support	Participates in science/engineering research projects	domestic	n/a	yes	1
Crater Lake Electrical JATC	Nonprofit	n/a	Associated Project Support	Participates in science/engineering research projects	domestic	n/a	yes	1
Department of Education	U.S. Government (Not NSF)	n/a	Associated Project Support	Participates in science/engineering research projects	domestic	n/a	no	1
Department of Energy	U.S. Government (Not NSF)	n/a	Associated Project Support	Participates in science/engineering research projects	domestic	n/a	no	2
Ministry of Business, Innovation & Employment NZ	Foreign government	n/a	Associated Project Support	Participates in science/engineering research projects Participation in translational research	foreign	n/a	no	1
Smartville Inc.	Industry	Batteries	Associated Project Support	Participates in science/engineering research projects	domestic	small (<500 employees)	yes	1
State of Colorado	State government	n/a	Associated Project Support	Participates in science/engineering research projects	domestic	n/a	no	2

Section 5: 3 Contributing Organizations							
Organization	**Sector**	**Product Focus (Industry only)**	**Type of Financial Support**	**Type of Involvement**	**Domestic / Foreign**	**Size (Industry Only)**	**New Partner (Yes/No)**
Contributing Organizations That Have Already Provided Current Award Year Support.							
Cache Valley Electric	Industry	Electric - Power, Utility, Systems, Components	Restricted Cash Donations	Participates in science/engineering research projects Participation in education/outreach activities	domestic	large (>1000 employees)	no
Oldcastle Infrastructure	Industry	Consumer products	Unrestricted Cash Donations	Participates in science/engineering research projects Participation in education/outreach activities Participation in innovation/entrepreneurship activities	domestic	large (>1000 employees)	yes
Sunbelt Rentals	Industry	Consumer products	In-Kind Donations	Participates in science/engineering research projects	domestic	large (>1000 employees)	yes

Section 6: Summary					
Sector	**Industrial/Practitioner Members**	**Percent Foreign**	**Percent Small**	**Percent Medium**	**Percent Large**
Industry	27	37%	33%	0%	67%
Industrial Association	1	0%	N/A	N/A	N/A
State government	6	0%	N/A	N/A	N/A
Total	**34**	**29%**	**N/A**	**N/A**	**N/A**

7.2 Organizational Involvement Table

Table: Organization Involvement in Innovation and Entrepreneurship Activities					
Organization Name	**Innovation/ Entrepreneurship Training Activities**	**Provides Incubation Facilities**	**Technology Screening Activities**	**Connections to Sources of Commercialization Funding**	**Other Activity**

ABB E-Mobility			✔		Cohort Mentoring
AECOM Technology Corporation	✔		✔		Exec Advisory Board
American Association of Port Authorities	✔				Membership Recruitment
BorderPlex Alliance	✔				
Central Florida Expressway Authority					Agency Working Group
Conexus Indiana					Membership Recruitment
Cummins, Inc.			✔		Conference Presenter
Denso Corporation					Conference Sponsor
Electreon Wireless			✔		Conference Sponsor/Conference Presenter
Electric Power Systems			✔		
ENRX			✔		Conference Sponsor/Conference Presenter
Environmental Branch, Hill Air Force Base	✔				
Esri			✔		Conference Presenter
Ford Motor Company			✔		
Geotab	✔				
Hyster-Yale Group, Inc.			✔		Exec Advisory Board
Idaho National Lab					Cohort Mentoring
Illinois Asphalt Pavement Association (IAPA)					Membership Recruitment
Illinois Concrete Pavement Association (ICPA)					Membership Recruitment
Illinois Tollway					Agency Working Group
IMTA (Indiana Motor Truck Association)	✔				
Indiana Department of Transportation			✔		Agency Working Group

InductEV					Conference Presentation
John Deere			✔		Exec Advisory Board
Kenworth Trucks, Inc.			✔		
Laurel Group					Membership Recruitment
Minnesota Asphalt Pavement Association (MAPA)					Membership Recruitment
NACFE (North American Council for Freight Efficiency)					Conference Presenter
National Asphalt Pavement Association	✔				
National Renewable Energy Lab			✔		Exec Advisory Board
Oldcastle Infrastructure					Conference Sponsorship/Cohort Mentoring
PacifiCorp - Rocky Mountain Power	✔		✔		
Pennsylvania Turnpike Authority					Agency Working Group/Conference Sponsorship/Conference Presenter
Schneider Electric					Cohort Mentoring
SMUD			✔		Membership Recruitment
Southwire					Cohort Mentoring
The Ray					Exec Advisory Board/Cohort Mentoring
Toyota Motor Engineering & Manufacturing North America, Inc.			✔		
UAPA					Conference Sponsor/Membership Recruitment
UDOT (Utah Department of Transportation)			✔		Agency Working Group

UTA (Utah Transit Authority)			✔		Conference Presenter /Cohort Mentoring
Utah Clean Cities Coalition					Community Engagement - Open House
Utah Inland Port Authority			✔		
WiTricity Corporation			✔		

7.3 Member Support Table

Table: Innovation Ecosystem Partners and Support, by Year				
	Sep 01, 2021 - Aug 31, 2022	**Sep 01, 2022 - Aug 31, 2023**	**Sep 01, 2023 - Aug 31, 2024**	**Sep 01, 2024 - Aug 31, 2025 [1]**
Industrial/Practitioner Members	32	33	30	34
Innovation Partners	21	29	33	35
Funders of Sponsored Projects	0	0	0	0
Funders of Associated Projects	8	9	4	7
Contributing Organizations	3	3	1	3
Total Participating Organizations	**64**	**74**	**68**	**79**
Number of Member-Sponsored Projects	0	0	0	0
Number of Non-Member-Sponsored Projects	0	0	0	0
Total Number of Sponsored Projects	**0**	**0**	**0**	**0**
Membership Fees Received - Cash	$387,678	$370,695	$210,492	$255,507
Membership Fees Expected from Prior Year Members [2]	N/A	N/A	N/A	$0
Member-Sponsored Projects Total Dollar Amount	$0	$2,100,000	$2,100,000	$2,139,380
Member-Associated Projects Total Dollar Amount	$3,635,880	$4,037,267	$14,031,789	$11,456,757
Member In-Kind Total Dollar Amount [3]	$0	$0	$0	$380,000
Total Dollar Amount, Industrial/Practitioner Member Support to Center	**$4,023,558**	**$6,507,962**	**$16,342,281**	**$14,231,644**

[1] Partial Award Year data only.

[2] Only applies for organizations that were already Industrial/Practitioner Members in a prior year.

[3] Data for this row is from the In-Kind Support reported in the Organizations section. There is no data prior to 2010 since it is a new field that year.

7.4 Technology Transfer Table

Table: Technology Transfer Activities

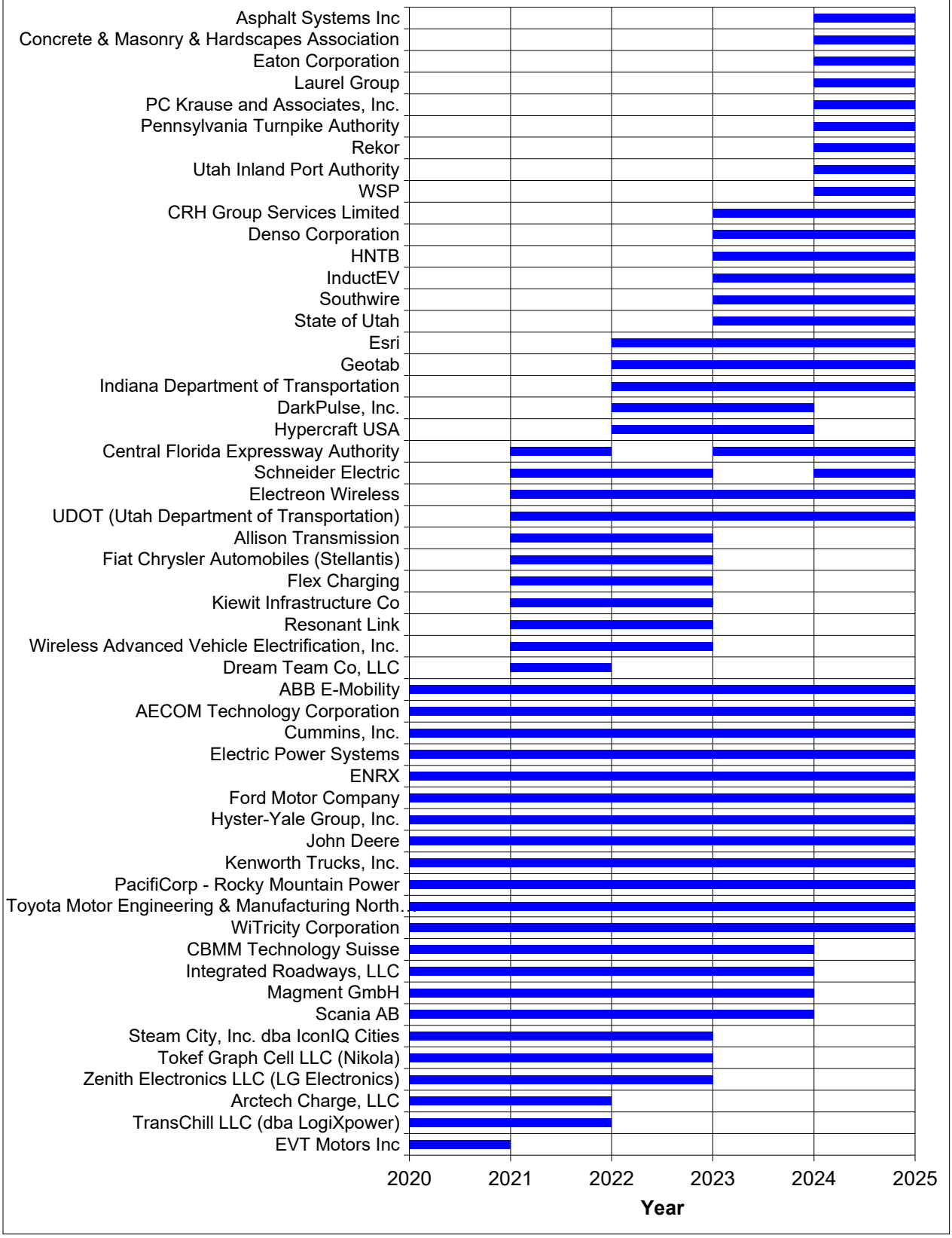
Organization Name	Faculty On Site at Organization	Faculty Instruction to Organization	Individual from Organization on Lead Institution Campus	Licensed Software	Licensed Technology (other than software)	Graduate Hired by Organization	Student On Site at Organization	Participation in Test Bed	Other Activities
ABB E-Mobility								✔	
AECOM Technology Corporation								✔	
American Association of Port Authorities									
Argonne National Lab									
Asphalt Systems Inc									
BorderPlex Alliance									
Cache Valley Electric									
CALSTART, Inc.									
Center for Transportation & the Environment (CTE)									
Central Florida Expressway Authority									
Colorado Department of Transportation									
Concrete & Masonry & Hardscapes Association									
Conexus Indiana									
Crater Lake Electrical JATC									
CRH Group Services Limited									
Cummins, Inc.									
Dallas Fort Worth Airport									
Denso Corporation									
Department of Education									
Department of Energy									
Eaton Corporation									
Electreon Wireless			✔					✔	
Electric Power Systems					✔				
ENRX									
Environmental Branch, Hill Air Force Base							✔		
Esri									
Ford Motor Company									

Forth Mobility									
Geotab									
Heal Utah									
HNTB									
Hyster-Yale Group, Inc.									
Idaho National Lab									
Illinois Asphalt Pavement Association (IAPA)									
Illinois Concrete Pavement Association (ICPA)									
Illinois Tollway									
IMTA (Indiana Motor Truck Association)									
Indiana Department of Transportation									
InductEV									
ITSA (Intelligent Transportation Society of Amer)									
John Deere									
Kenworth Trucks, Inc.								✔	
Laurel Group									
Michigan Economic Development Corporation, Office of Future Mobility and Electrification									
Ministry of Business, Innovation & Employment NZ									
Minnesota Asphalt Pavement Association (MAPA)									
Minnesota Department of Transportation									
NACFE (North American Council for Freight Efficiency)									
National Asphalt Pavement Association									
National Renewable Energy Lab							✔		
North Carolina Turnpike									
North Central Texas Council of Governments									
Oak Ridge National Lab									
Ohio Turnpike and Infrastructure Commission									
Oldcastle Infrastructure									
PacifiCorp - Rocky Mountain Power								✔	
PC Krause and Associates, Inc.									

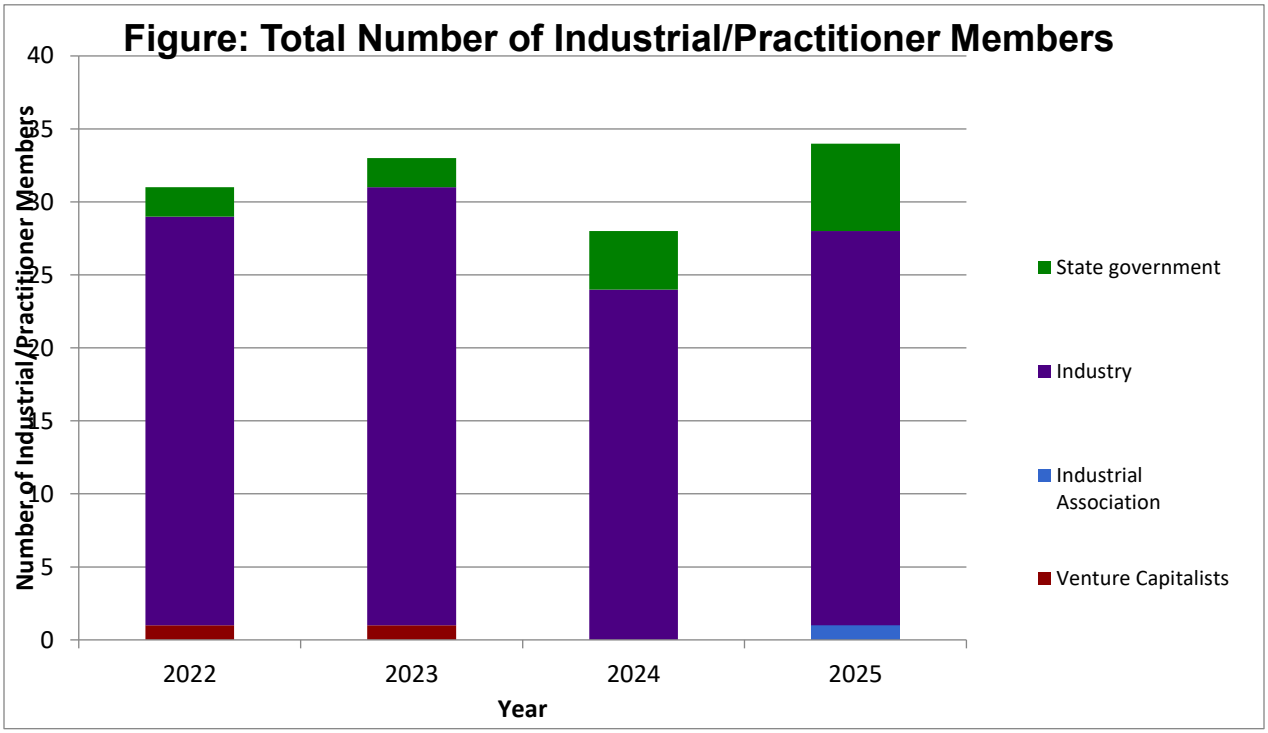
Pennsylvania Turnpike Authority									
Rekor									
RMI (Rocky Mountain Institute)									
SANDAG (San Diego Association of Governments)									
Schneider Electric									
Smartville Inc.									
SMUD									
Southwire									
State of Colorado									
State of Utah									
Sunbelt Rentals									
The Ray									
Toyota Motor Engineering & Manufacturing North America, Inc.									
UAPA									
UDOT (Utah Department of Transportation)									
UTA (Utah Transit Authority)							✔	✔	
Utah Clean Cities Coalition									
Utah Governor's Office of Energy Development									
Utah Inland Port Authority									
VDOT (Virginia Department of Transportation)									
WiTricity Corporation									
WSP							✔		

7.5 Member History Figure

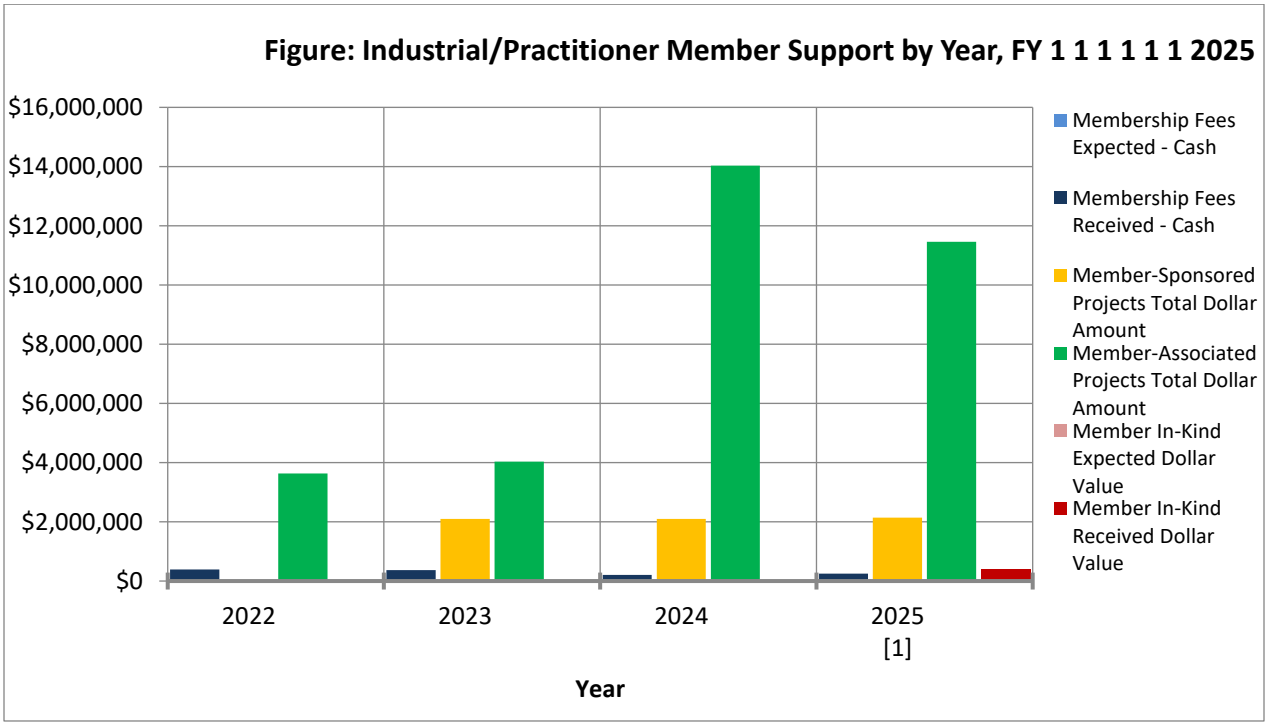
Figure: Lifetime Industrial/Practitioner Membership History



7.6 Member Total Figure



7.7 Member Support Year by Year Figure (May be incorrect due to ERC Website Developer Error)



[1] - Member support provided through end of current reporting year (includes only partial data)

7.8 Intellectual Property Table

Table: Intellectual Property					
IP License # or Name	**IP License Title or Name**	**IP Category**	**Brief Description of Technology**	**IP Owner**	**Year Awarded**
11735782	Voltage Sharing of Series Connected Battery Modules in a Plug-and-Play DC Microgrid	FP	Battery module controller, battery management system, method of generating a droop current, using the droop current.	USU; TOYOTA JIDOSHA KABUSHIKI KAISHA Inventors: Abhilash Kamineni *; Reebal Nimri	2023
11736031	Unfolder-Based Single-Stage AC-AC Conversion System	FP	The unfolder creates two unipolar piece-wise sinusoidal DC voltage waveforms offset by a half of a period. A three-input converter connected to the unfolder produces a quasi-sinusoidal output voltage across output terminals.	USU Inventors: Abhilash Kamineni *; Reebal Nimri	2023
11745594	Dynamic inductive wireless power transfer transmitter system with a power transmitter module	FP	Module LC input filter, a module transmitter circuit, a module transmitter coil and compensation circuit, a module controller.	USU Inventors: Abhilash Kamineni *; Reebal Nimri	2023
11862993	High-Power Reflexive Field Containment Circuit Topology for Dynamic Wireless Power Transfer Systems	FP	Inverter, WPT charging branches. System of WPT charging apparatus, with a WPT receiver apparatus.	?? ???? ???????(USU) Inventors: Abhilash Kamineni *; Reebal Nimri	2024
11894776	Constant Current to Constant Voltage Dual Active Bridge LCL-T Resonant DC-DC Converter	FP	H-bridges, LCL-T section, transformer, output capacitor, bidirectionality.	USU Inventors: Benny J Varghese *; Abhilash Kamineni; Regan A Zane	2024

12,230,982	State-of-Charge Balancing with Parallel and Series Output Connected Battery Power Modules	FP	Battery pack, battery brick controller, modular subsystems, battery management system	USU Inventors: Mohamed Ahmed Kamel Ahmed, Regan A Zane; University of Colorado Boulder Inventors: Dragan Maksimovic	2025
17023865	Static heat exchanger for wireless power transfer pad	FP	An apparatus for a wireless power transfer (WPT) pad heat management system includes a ferrite structure positioned adjacent to a coil configured to wirelessly transfer power.	Nicholas A Roberts	2021
US10,770,978	DC power supply from a constant current source	FP	High efficiency long distance current distribution	Utah State University. Inventors: Hongjie Wang, Regan Zane, Tarak Saha	2020
US10,804,807 B2	Low RMS Current Zero Voltage Switching Assisting Circuit with Low Power Loss and EMI	FP	Circuitry for improved efficiency in power converters	Utah State University. Inventors: Tarak Saha, Hongjie Wang, Regan Zane	2020
US10,804,809	High Frequency Link Coupled Multi-Port Converter Topology	FP	Scalable power converter for modular systems	Utah State University. Inventors: Dorai Yelaverthi, Regan Zane	2020
US10,917,019	Quasi-single stage power converter topology	FP	High efficiency topology for grid tied power converters	Utah State University. Inventors: Dorai Yelaverthi, Regan Zane	2021
US10,938,313 B2	Constant DC Current Input to Constant DC Voltage Output Power Supply Covering a Wide Programmable Range	FP	Constant current to regulated voltage converter	Tarak Saha, Hongjie Wang, Anindya Chitta Bagchi, Regan Zane	2021

US11,018,529	Wireless charger for underwater vehicles fed from a constant current distribution cable	FP	Wireless charging for underwater vehicles	Utah State University. Inventors: Anindya Bagchi, Tarak Saha, Abhilash Kamineni, Regan Zane	2021
US11,059,380 B2	Dynamic Inductive Wireless Power Transmitter System with a Power Transmitter Module	FP	DC current distribution for dynamic WPT	Hongjie Wang and Regan Zane	2021
US11,063,435	Energy-based adaptive stability control system	FP	Advanced stability control for distributed power	Raytheon. Inventors: Boris Jacobson, Dave Altman, Charles Scheffler, Regan Zane	2021
US11,521,792	Wireless Inductive Power Transfer Apparatus with Active Field Cancellation Using Multiple Magnetic Flux Sinks	FP	A wireless power transfer pad for wireless power transfer with active field cancellation using multiple magnetic flux sinks	Utah State University, Inventors: Benny J Varghese, Abhilash Kamineni, Regan A Zane	2022
US11,571,975	Dynamic Wireless Power Transfer Base Pad	FP	A dynamic wireless power transfer base pad can include a housing, a first conductor, a second conductor, and a third conductor.	Utah State University, Inventors: Abhilash Kamineni, Reebal Nimri	2023
US11,646,671	Unfolder-Based Single-Stage AC-AC Conversion System	FP	An power converter includes an unfolder connected to a three-phase source and has an output connection with a positive terminal, a negative terminal and a neutral terminal.	Utah State University: Regan A Zane, chakridhar Reddy teeneti, Hongjie Wang, Dorai Babu Yelaverthi	2023
US11,656,297	Power electronic instrument for continuously monitoring stability and stabilizing a DC microgrid	FP	An apparatus monitoring system stability of a DC power system includes a switching power converter with a control loop	Utah State University, Inventors: Rohail Hassan, Hongjie Wang, Regan A Zane	2023
US11218026	Zero-Crossing Current Detection in Wireless Power Transfer Systems	FP	Simplification of the primary-secondary communication link.	Matthew Hansen	2022

FP = full patent; PP = provisional patent; C = copyright; T = trademark

7.9 Technology Transfer Table

Table: Technology Transfer				
Adopting Company	**Technology**	**Industrial Application**		**Impact**
		When Transferred	**Use in Company**	
No technology transfer records have been entered.				

7.10 Start-Up Firms Table

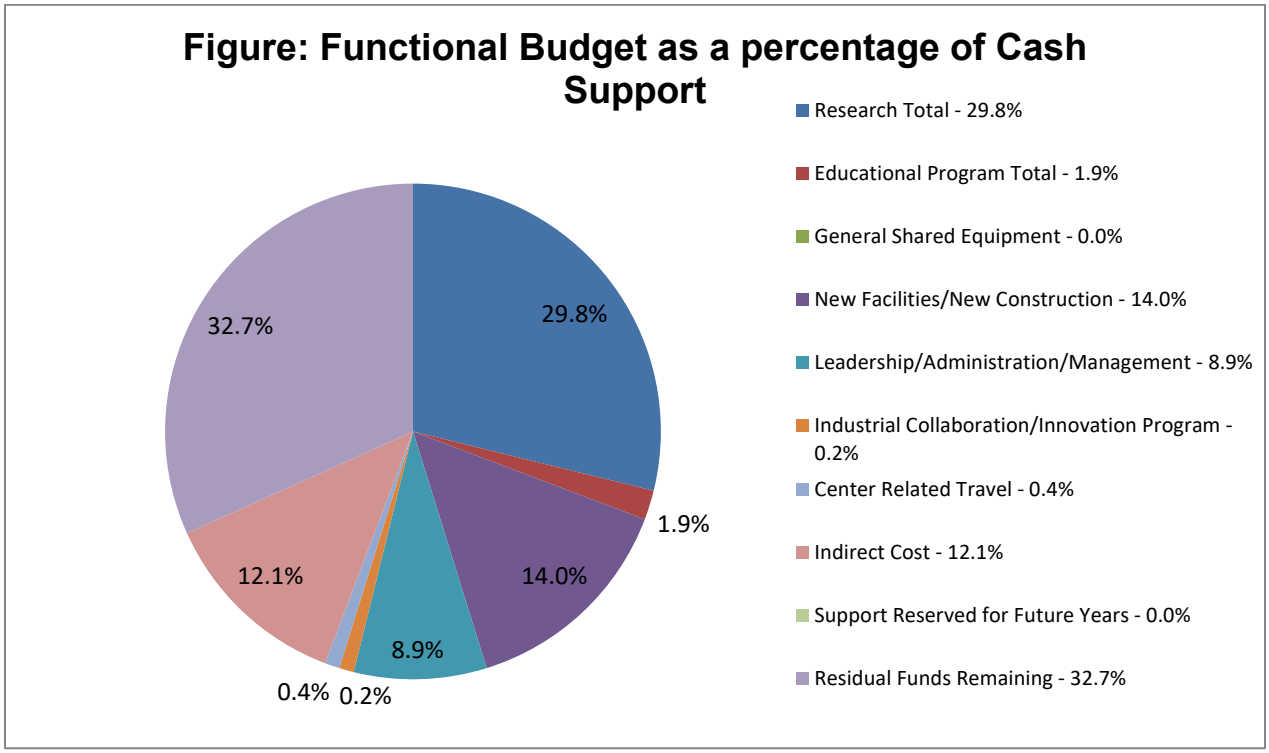
Table: Start-Up Firms						
Name of Firm	**Contact Information**	**Date Established**	**Principal Name/Relationship**	**Funding Status**	**Technology**	**Market Impact or Societal Benefit**
No start-up firms have been entered.						

8. Resources and Institutional Commitment

8.1 Functional Budget Table

Table: Current Award Year Functional Budget			
Function	**Cash Support**		**Cash Support Budget Total**
	Unrestricted Cash (Core Projects)	**Restricted Cash (Sponsored Projects)**	
Charging Stations	$925,465	$0	$925,465
Electrified Roadways	$1,173,943	$0	$1,173,943
Pathways	$1,094,243	$0	$1,094,243
Systems of Systems	$2,422,029	$0	$2,422,029
Research Total	**$5,615,680**	**$0**	**$5,615,680**
Educational Program Total	$342,457	$18,466	$360,923
General Shared Equipment	$0	$0	$0
New Facilities/New Construction	$0	$2,641,018	$2,641,018
Leadership/Administration/Management	$1,283,599	$386,620	$1,670,219
Industrial Collaboration/Innovation Program	$39,452	$0	$39,452
Center Related Travel	$72,295	$0	$72,295
Indirect Cost	$2,271,051	$6,925	$2,277,976
Functional and Educational Budget Total	**$4,008,854**	**$3,053,029**	**$7,061,883**
Support Reserved for Future Years	N/A	N/A	$0
Residual Funds Remaining	$2,726,549	$3,428,894	$6,155,443
Cash Support Budget Total	**$12,351,083**	**$6,481,923**	**$18,833,006**
Associated Project Support Total	**N/A**	**N/A**	**$15,384,725**
Grand Total (Cash Support + Associated Project Support)	**$12,351,083**	**$6,481,923**	**$34,217,731**

8.2 Functional Budget as a Percentage of Direct Support Figure



8.3 Associated Projects Table

Table: Associated Projects								
Project Name	**Award ID**	**PI Name**	**Funding Source**	**Start Date**	**End Date**	**Total Amount**	**Reporting Year Amount (7/1/2024-6/30/2025)**	**Award Year Amount (9/1/2024-8/31/2025)**
Blueprinting Electrified Transit System Implementation	DESC0025006	Noah T. Horesh	Department of Energy	9/1/2024	7/13/2025	200000	191772	200000
CAREER: Novel Direct Current Power Distribution for Large-scale Electrified Transportation Charging	2239169	Hongjie Wang	Other NSF (Not ERC Program)	8/1/2023	7/31/2028	500000	99891	99891
CHECRA 3	n/a	Qin Lv	State of Colorado	9/1/2023	8/31/2024	325000	55055	0
CHECRA 4	n/a	Qin Lv	State of Colorado	9/1/2024	8/31/2025	325000	269795	325000
Commercial Research Contract 2	N/A	Duleepa J. Thrimawithana	Anonymous	5/29/2023	12/31/2024	30840	9733	6454
Commercial Research Contract 3	n/a	Grant A. Covic	Anonymous	10/1/2023	9/30/2024	317000	79683	25984
Commercial Research Contract 4	n/a	Duleepa J. Thrimawithana	Anonymous	9/1/2023	12/31/2024	124738	47032	31185
Commercial Research Contract 5	n/a	Duleepa J. Thrimawithana	Anonymous	9/1/2024	12/31/2024	40886	40886	40886
DENSO DWPT Educational Support	n/a	Dustin W. Maughan	Denso Corporation	5/1/2025	11/30/2025	35000	9977	20117
DWPT Engineering Specifications & Standards Support	n/a	Dustin W. Maughan	Denso Corporation	6/1/2025	12/17/2025	89979	13497	41390
Electric Train Research	n/a	Regan A. Zane	State of Utah	9/1/2022	8/31/2026	24000000	5995893	5995893
Electric Vehicle Research	n/a	Regan A. Zane	State of Utah	9/1/2022	8/31/2026	11250000	2810575	2810575
eMosaic: Electrification Mosaic Platform for Grid-Informed Smart Charging Management	n/a	Regan A. Zane	ABB E-Mobility	9/1/2022	12/31/2024	1318159	284339	188529
Empowering Underrepresented Minorities through Applied Artificial Intelligence Education with Enhanced Access and Success in	P120A240054	Tzu-Liang Tseng	Department of Education	10/1/2024	9/30/2027	900000	224384	275342

Engineering (EASE)								
EV Adoption and Use in Rural and Urban Utah	249664	Patrick A. Singleton	UDOT (Utah Department of Transportation)	6/1/2024	5/31/2025	72000	66082	53852
FDOT PowerTrax Dynamic Wireless Power Transfer Pilot Consultation	60648310	Michael P. Masquelier	AECOM Technology Corporation	7/1/2024	12/11/2025	103597	71480	71480
Innovative Transportation Electrification Certificate Program	10065023-01-USU	Regan A. Zane	University of Utah	4/15/2025	11/30/2025	180000	60261	108783
IRES: Cultural Awareness and Research Experiences for Electric Vehicles (CARE-EV) Program	2505473	Brandon C. Allen	NSF ERC Program	7/1/2025	6/30/2028	432603	0	24472
Long-Range Heavy Duty Battery-Electric Vehicle with Megawatt Wireless Charging	127120076	Regan A. Zane	Kenworth Trucks, Inc.	7/1/2023	11/30/2024	1059545	312351	185778
LOW-COST AND SCALABLE 2ND USE BATTERY DEMONSTRATION IN CENTRAL CALIFORNIA	DE-EE0010406	Hongjie Wang	Smartville Inc.	9/1/2024	7/31/2026	650000	281760	339413
LOW-COST AND SCALABLE 2ND USE BATTERY DEMONSTRATION IN CENTRAL CALIFORNIA	DE-EE0010406	Hongjie Wang	Utah State University	9/1/2024	7/31/2026	650013	281765	339420
MD-HD ZEV Infrastructure Planning with focus on I-80 Midwest (IN-IL-OH) corridor	23123152	Konstantina Gkritza	Cummins, Inc.	10/1/2023	3/25/2025	450000	222509	171033
MDOT Inductive Vehicle Charging Pilot Consultation	60705656	Regan A. Zane	AECOM Technology Corporation	6/28/2023	2/20/2026	111272	41914	41914
Modeling of Modular Pad with Embedded Dynamic Wireless Power Transfer Technology in	PC0-CFX-AS	Dustin W. Maughan	ENRX	9/1/2023	9/30/2024	66032	15341	5002

Jointed Concrete Pavements	PIRE							
PCB Based Passive Repeater Coils for Phone Case WPT	n/a	Regan A. Zane	Toyota Motor Engineering & Manufacturing North America, Inc.	1/1/2025	8/31/2025	60338	44943	60338
Power Balance and Demand Response for a Charging Intermodal Hub	3590	Regan A. Zane	PacifiCorp - Rocky Mountain Power	9/1/2022	12/31/2024	819640	176804	117229
Pre-College Explorations into Electric Vehicles and Wireless Charging	25-HAA-ZL-00103	Jennifer L. Taylor	Colorado Department of Transportation	3/18/2025	3/18/2026	91000	26107	41522
Rural Electrician Pre-Apprenticeship (REPA) Project	n/a	Regan A. Zane	Crater Lake Electrical JATC	9/1/2024	6/30/2027	421464	123624	148920
Scalable Material & Product Solutions for Wireless Charging Systems	2025-502	Dustin W. Maughan	Concrete & Masonry & Hardscapes Association	6/1/2025	6/2/2026	169527	13858	42497
SPR- 4942: EV Charging Needs and Demand for Multifamily Dwellings in Indiana	21000479	Konstantina Gkritza	Indiana Department of Transportation	12/16/2024	12/15/2026	230000	62068	81603
SPR-4706	21000363	Konstantina Gkritza	Indiana Department of Transportation	9/1/2022	8/14/2024	240634	15166	0
SPR-4815 Development of Dashboards and Procedures for Using Connected Vehicle Data to Prioritize Investments in Electric Vehicle Charging Infrastructure	21000411	Darcy M. Bullock	Indiana Department of Transportation	9/1/2024	3/31/2026	388822	204182	245962
SPR-4856 Receiver, Vehicle, and Roadway Systems for a Dynamic Wireless Power Transfer Roadway Testbed	SPR-4856	John E. Haddock	Indiana Department of Transportation	9/1/2023	8/31/2025	670224	334654	334654

Task order 3: MSA Central Florida Expressway, Lake/Orange Expressway Electric Roadway Pilot Project	n/a	Dustin W. Maughan	Central Florida Expressway Authority	9/1/2024	2/1/2030	1530331	234187	282106
UDERMS iCommunity: UT EVIP - Innovation; Heavy Duty Truck Charging	3000159850	Dustin W. Maughan	PacifiCorp - Rocky Mountain Power	4/7/2025	12/31/2028	980000	61026	105538
UDERMS iCommunity: Utility Managed Distributed Energy Resources Intelligent Community Signatures	PO # 3000150547	Regan A. Zane	PacifiCorp - Rocky Mountain Power	5/10/2023	5/30/2028	1540756	304316	304316
Vehicle-to-Vehicle Bi-directional Mega-Watt Wireless Power Transfer	PO # 0011-46666	Dustin W. Maughan	Eaton Corporation	10/1/2024	9/30/2026	432104	161595	198294
Wasatch Front Multi-Modal Corridor Electrification Plan	DE-EE0010644	Regan A. Zane	Department of Energy	10/1/2023	3/31/2025	1107593	553797	428485
Wirelessly Powered Transport Infrastructure for a Low-carbon Future	CONT-78109-ENDRP-UOA	Grant A. Covic	Ministry of Business, Innovation & Employment NZ	9/1/2024	9/30/2026	3312492	1320638	1590868
Total						**55226589**	**15122940**	**15384725**

8.4 Educational Budget Table

Table: Current Award Year Education Functional Budget			
Education Programs	**Direct Support**		**Direct Support Budget Total**
	Unrestricted Cash OR Core Projects	**Restricted Cash OR Sponsored Projects**	
Precollege Education Activities	$64,184	$17,859	**$82,043**
University Education	$64,647	$0	**$64,647**
Student Leadership Council	$25,453	$125	**$25,578**
Young Scholars	$0	$0	**$0**
REU	$62,452	$0	**$62,452**

RET	$0	$482	**$482**
Assessment	$125,721	$0	**$125,721**
Community College activities	$0	$0	**$0**
Other	$0	$0	**$0**
Education Program Total	**$342,457**	**$18,466**	**$360,923**

8.5 Allocation of Current Award Year Budget By Institution Table

ALLOCATION OF CURRENT AWARD YEAR BUDGET, BY INSTITUTION, FY2025

Institutional Distribution of Current Award Year Budget					
Institution	**Cash Support (Unrestricted + Restricted)**	**Associated Project Support**	**Total Cash and Associated Project Support**	**Percent of Total Cash Support**	**Percent of Total Associated Project Support**
Utah State University (Lead)	$ 12,860,633	$ 11,927,358	$ 24,787,991	68.29%	77.53%
Purdue University (Core)	$ 1,992,539	$ 857,724	$ 2,850,263	10.58%	5.58%
The University of Auckland (Core)	$ 170,504	$ 1,695,377	$ 1,865,881	0.91%	11.02%
The University of Texas at El Paso (Core)	$ 1,391,781	$ 279,780	$ 1,671,561	7.39%	1.82%
University of Colorado Boulder (Core)	$ 1,632,515	$ 366,522	$ 1,999,037	8.67%	2.38%
All Other Institutions	$ 785,033	$ 257,964	$ 1,042,997	4.17%	1.68%
Grand Total	**$ 18,833,006**	**$ 15,384,725**	**$ 34,217,731**	**100.00%**	**100.00%**

8.6 Sources of Support Table

Table: Sources of Support								
Sources of Support	**Sep 1, 2020 - Aug 31, 2021**	**Sep 1, 2021 - Aug 31, 2022**	**Sep 1, 2022 - Aug 31, 2023**	**Sep 1, 2023 - Aug 31, 2024**	**Sep 1, 2024 - Aug 31, 2025**			**Cumulative Total [1]**
					Received	**Promised**	**Total**	
Unrestricted Cash								
Government								
NSF Funding								
NSF ERC Base Award	$3,500,000	$4,500,000	$7,985,000	$6,265,000	$3,450,000	$0	$3,450,000	$25,700,000

Other NSF (Not ERC Program)	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL NSF FUNDING	**$3,500,000**	**$4,500,000**	**$7,985,000**	**$6,265,000**	**$3,450,000**	**$0**	**$3,450,000**	**$25,700,000**
Other U.S. Government (Not NSF)	$0	$0	$0	$0	$0	$0	$0	$0
State Government	$2,870,803	$1	$1	$3	$10,503	$0	$10,503	$2,881,311
Local Government	$0	$0	$0	$0	$0	$0	$0	$0
Foreign Government	$0	$0	$0	$0	$0	$0	$0	$0
Quasi-government research organization	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL GOVERNMENT FUNDING	**$6,370,803**	**$4,500,001**	**$7,985,001**	**$6,265,003**	**$3,460,503**	**$0**	**$3,460,503**	**$28,581,311**
Industry								
U.S. Industry	$110,000	$178,625	$150,250	$135,500	$153,500	$0	$153,500	$727,875
Foreign Industry	$211,630	$209,053	$220,944	$74,989	$98,503	$0	$98,503	$815,119
Industrial Association	$750	$1,000	$0	$500	$1	$0	$1	$2,251
TOTAL INDUSTRY FUNDING	**$322,380**	**$388,678**	**$371,194**	**$210,989**	**$252,004**	**$0**	**$252,004**	**$1,545,245**
University								
U.S. University	$751,465	$1,157,769	$1,513,045	$1,243,896	$1,057,968	$0	$1,057,968	$5,724,143
Foreign University	$113,382	$113,382	$112,881	$170,699	$142,087	$28,417	$170,504	$680,848
TOTAL UNIVERSITY FUNDING	**$864,847**	**$1,271,151**	**$1,625,926**	**$1,414,595**	**$1,200,055**	**$28,417**	**$1,228,472**	**$6,404,991**
Other								
Private Foundation	$0	$0	$0	$0	$0	$0	$0	$0
Medical Facility	$0	$0	$0	$0	$0	$0	$0	$0
Non Profit	$0	$0	$0	$0	$0	$0	$0	$0
Venture Capitalist	$5,000	$5,000	$0	$0	$0	$0	$0	$10,000
Other	$0	$1,306	$2,092	$0	$50	$0	$50	$3,448
TOTAL OTHER FUNDING	**$5,000**	**$6,306**	**$2,092**	**$0**	**$50**	**$0**	**$50**	**$13,448**
Total Unrestricted Cash	**$7,563,030**	**$6,166,136**	**$9,984,213**	**$7,890,587**	**$4,912,612**	**$28,417**	**$4,941,029**	**$36,544,995**
Restricted Cash								
NSF Funding								
NSF ERC Program Special	$612,351	$0	$291,950	$109,813	$0	$0	$0	$1,014,114

Purpose Awards and Supplements								
Other NSF (Not ERC Program)	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL NSF FUNDING	**$612,351**	**$0**	**$291,950**	**$109,813**	**$0**	**$0**	**$0**	**$1,014,114**
Restricted Cash - Non Translational								
Government								
Other U.S. Government (Not NSF)	$0	$0	$0	$0	$0	$0	$0	$0
State Government	$0	$0	$0	$0	$0	$0	$0	$0
Local Government	$0	$0	$0	$0	$0	$0	$0	$0
Foreign Government	$0	$0	$0	$0	$0	$0	$0	$0
Quasi-government research organization	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL GOVERNMENT FUNDING	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Industry								
U.S. Industry	$0	$0	$0	$0	$1,500	$2,000	$3,500	$3,500
Foreign Industry	$0	$0	$0	$0	$20,991	$0	$20,991	$20,991
Industrial Association	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL INDUSTRY FUNDING	**$0**	**$0**	**$0**	**$0**	**$22,491**	**$2,000**	**$24,491**	**$24,491**
University								
U.S. University	$0	$5,000,000	$0	$5,739,360	$2,641,018	$2,000	$2,643,018	$13,382,378
Foreign University	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL UNIVERSITY FUNDING	**$0**	**$5,000,000**	**$0**	**$5,739,360**	**$2,641,018**	**$2,000**	**$2,643,018**	**$13,382,378**
Other								
Private Foundation	$0	$0	$0	$0	$0	$0	$0	$0
Medical Facility	$0	$0	$0	$0	$0	$0	$0	$0
Non Profit	$0	$0	$0	$0	$0	$0	$0	$0
Venture Capitalist	$0	$0	$0	$0	$0	$0	$0	$0
Other	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL OTHER FUNDING	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

Total Restricted Cash - Non Translational	**$0**	**$5,000,000**	**$0**	**$5,739,360**	**$2,663,509**	**$4,000**	**$2,667,509**	**$13,406,869**
Restricted Cash - Translational								
Government								
Other U.S. Government (Not NSF)	$0	$0	$0	$0	$0	$0	$0	$0
State Government	$0	$0	$2,100,000	$2,100,000	$0	$2,116,389	$2,116,389	$6,316,389
Local Government	$0	$0	$0	$0	$0	$0	$0	$0
Foreign Government	$0	$0	$0	$0	$0	$0	$0	$0
Quasi-government research organization	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL GOVERNMENT FUNDING	**$0**	**$0**	**$2,100,000**	**$2,100,000**	**$0**	**$2,116,389**	**$2,116,389**	**$6,316,389**
Industry								
U.S. Industry	$0	$0	$0	$0	$0	$0	$0	$0
Foreign Industry	$0	$0	$0	$0	$0	$0	$0	$0
Industrial Association	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL INDUSTRY FUNDING	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
University								
U.S. University	$0	$0	$0	$0	$0	$0	$0	$0
Foreign University	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL UNIVERSITY FUNDING	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Other								
Private Foundation	$0	$0	$0	$0	$0	$0	$0	$0
Medical Facility	$0	$0	$0	$0	$0	$0	$0	$0
Non Profit	$0	$0	$0	$0	$0	$0	$0	$0
Venture Capitalist	$0	$0	$0	$0	$0	$0	$0	$0
Other	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL OTHER FUNDING	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Total Restricted Cash - Translational	**$0**	**$0**	**$2,100,000**	**$2,100,000**	**$0**	**$2,116,389**	**$2,116,389**	**$6,316,389**
Total Restricted Cash	**$612,351**	**$5,000,000**	**$2,391,950**	**$7,949,173**	**$2,663,509**	**$2,120,389**	**$4,783,898**	**$20,737,372**

Multi-year support carried over from prior years								
Government								
Other U.S. Government (Not NSF)	$0	$0	$0	$0	$0	N/A	$0	N/A
State Government	$0	$0	$0	$0	$0	N/A	$0	N/A
Local Government	$0	$0	$0	$0	$0	N/A	$0	N/A
Foreign Government	$0	$0	$0	$0	$0	N/A	$0	N/A
Quasi-government research organization	$0	$0	$0	$0	$0	N/A	$0	N/A
TOTAL GOVT Multi-year Support from Prior Years	**$0**	**$0**	**$0**	**$0**	**$0**	**N/A**	**$0**	**N/A**
Industry								
U.S. Industry	$0	$0	$0	$0	$0	N/A	$0	N/A
Foreign Industry	$0	$0	$0	$0	$0	N/A	$0	N/A
Industrial Association	$0	$0	$0	$0	$0	N/A	$0	N/A
TOTAL INDUSTRY Multi-year Support from Prior Years	**$0**	**$0**	**$0**	**$0**	**$0**	**N/A**	**$0**	**N/A**
Other								
Private Foundation	$0	$0	$0	$0	$0	N/A	$0	N/A
Medical Facility	$0	$0	$0	$0	$0	N/A	$0	N/A
Non Profit	$0	$0	$0	$0	$0	N/A	$0	N/A
Venture Capitalist	$0	$0	$0	$0	$0	N/A	$0	N/A
Other	$0	$0	$0	$0	$0	N/A	$0	N/A
TOTAL OTHER Multi-year Support from Prior Years	**$0**	**$0**	**$0**	**$0**	**$0**	**N/A**	**$0**	**N/A**
Total Multi-year support carried over from prior years	**$0**	**$0**	**$0**	**$0**	**$0**	**N/A**	**$0**	**N/A**
Residual Funds carried over from prior years [2]								
Government								
NSF Funding								
NSF ERC Base Award	$0	$1,954,825	$2,440,330	$4,703,389	$5,179,701	N/A	$5,179,701	N/A
Other NSF (Not ERC Program)	$0	$0	$0	$0	$0	N/A	$0	N/A

TOTAL NSF Residual Funds from Prior Years	**$0**	**$1,954,825**	**$2,440,330**	**$4,703,389**	**$5,179,701**	**N/A**	**$5,179,701**	**N/A**
Other U.S. Government (Not NSF)	$0	$0	$0	$0	$0	N/A	$0	N/A
State Government	$0	$2,684,642	$1,114,348	$2,639,378	$3,363,812	N/A	$3,363,812	N/A
Local Government	$0	$0	$0	$0	$0	N/A	$0	N/A
Foreign Government	$0	$0	$0	$0	$0	N/A	$0	N/A
Quasi-government research organization	$0	$0	$0	$0	$0	N/A	$0	N/A
TOTAL GOVT Residual Funds from Prior Years	**$0**	**$4,639,467**	**$3,554,678**	**$7,342,767**	**$8,543,513**	**N/A**	**$8,543,513**	**N/A**
Industry								
U.S. Industry	$0	$42,500	$116,391	$19,143	$52,833	N/A	$52,833	N/A
Foreign Industry	$0	$101,571	$0	$92,881	$19,999	N/A	$19,999	N/A
Industrial Association	$0	$750	$1,200	$489	$755	N/A	$755	N/A
TOTAL INDUSTRY Residual Funds from Prior Years	**$0**	**$144,821**	**$117,591**	**$112,513**	**$73,587**	**N/A**	**$73,587**	**N/A**
University								
U.S. University	$0	$180,829	$5,065,741	$3,061,080	$490,826	N/A	$490,826	N/A
Foreign University	$0	$0	$120,692	$0	$0	N/A	$0	N/A
TOTAL UNIVERSITY Residual Funds from Prior Years	**$0**	**$180,829**	**$5,186,433**	**$3,061,080**	**$490,826**	**N/A**	**$490,826**	**N/A**
Other								
Private Foundation	$0	$0	$0	$0	$0	N/A	$0	N/A
Medical Facility	$0	$0	$0	$0	$0	N/A	$0	N/A
Non Profit	$0	$0	$0	$0	$0	N/A	$0	N/A
Venture Capitalist	$0	$0	$0	$0	$0	N/A	$0	N/A
Other	$0	$0	$1,306	$209	$153	N/A	$153	N/A
TOTAL OTHER Residual Funds from Prior Years	**$0**	**$0**	**$1,306**	**$209**	**$153**	**N/A**	**$153**	**N/A**
Total Residual Funds carried over from prior years [2]	**$0**	**$4,965,117**	**$8,860,008**	**$10,516,569**	**$9,108,079**	**N/A**	**$9,108,079**	**N/A**
Associated Projects [3]								
NSF Funding								

NSF ERC Program	$0	$0	$0	$0	N/A	N/A	$24,472	$24,472
Other NSF (Not ERC Program)	$0	$100,000	$8,484	$100,164	N/A	N/A	$99,891	$308,539
TOTAL NSF FUNDING	**$0**	**$100,000**	**$8,484**	**$100,164**	**N/A**	**N/A**	**$124,363**	**$333,011**
Associated Projects - Non Translational [3]								
Government								
Other U.S. Government (Not NSF)	$856,632	$1,146,814	$296,612	$778,249	N/A	N/A	$703,827	$3,782,134
State Government	$175,999	$2,402,635	$669,511	$472,810	N/A	N/A	$420,374	$4,141,329
Local Government	$0	$0	$0	$0	N/A	N/A	$0	$0
Foreign Government	$0	$0	$0	$0	N/A	N/A	$0	$0
Quasi-government research organization	$0	$0	$0	$0	N/A	N/A	$0	$0
TOTAL GOVERNMENT FUNDING	**$1,032,631**	**$3,549,449**	**$966,123**	**$1,251,059**	**N/A**	**N/A**	**$1,124,201**	**$7,923,463**
Industry								
U.S. Industry	$2,263,781	$1,729,602	$2,371,671	$1,434,838	N/A	N/A	$642,420	$8,442,312
Foreign Industry	$170,149	$264,035	$588,014	$565,588	N/A	N/A	$508,668	$2,096,454
Industrial Association	$0	$0	$0	$0	N/A	N/A	$42,497	$42,497
TOTAL INDUSTRY FUNDING	**$2,433,930**	**$1,993,637**	**$2,959,685**	**$2,000,426**	**N/A**	**N/A**	**$1,193,585**	**$10,581,263**
University								
U.S. University	$578,622	$585,816	$143,796	$48,063	N/A	N/A	$448,203	$1,804,500
Foreign University	$0	$0	$0	$0	N/A	N/A	$0	$0
TOTAL UNIVERSITY FUNDING	**$578,622**	**$585,816**	**$143,796**	**$48,063**	**N/A**	**N/A**	**$448,203**	**$1,804,500**
Other								
Private Foundation	$35,350	$0	$0	$0	N/A	N/A	$0	$35,350
Medical Facility	$0	$0	$0	$0	N/A	N/A	$0	$0
Non Profit	$0	$0	$0	$0	N/A	N/A	$148,920	$148,920
Venture Capitalist	$0	$0	$0	$0	N/A	N/A	$0	$0
Other	$476,551	$476,551	$0	$0	N/A	N/A	$0	$953,102
TOTAL OTHER FUNDING	**$511,901**	**$476,551**	**$0**	**$0**	**N/A**	**N/A**	**$148,920**	**$1,137,372**
Total Associated Projects - Non Translational	**$4,557,084**	**$6,605,453**	**$4,069,604**	**$3,299,548**	**N/A**	**N/A**	**$2,914,909**	**$21,446,598**

Associated Projects - Translational [3]								
Government								
Other U.S. Government (Not NSF)	$0	$0	$0	$0	N/A	N/A	$200,000	$200,000
State Government	$477,469	$3,750,000	$10,571,613	$10,682,850	N/A	N/A	$9,750,793	$35,232,725
Local Government	$0	$0	$0	$0	N/A	N/A	$0	$0
Foreign Government	$1,490,772	$4,788,791	$909,757	$912,249	N/A	N/A	$1,590,868	$9,692,437
Quasi-government research organization	$0	$0	$0	$0	N/A	N/A	$0	$0
TOTAL GOVERNMENT FUNDING	**$1,968,241**	**$8,538,791**	**$11,481,370**	**$11,595,099**	**N/A**	**N/A**	**$11,541,661**	**$45,125,162**
Industry								
U.S. Industry	$0	$0	$524,070	$786,064	N/A	N/A	$694,281	$2,004,415
Foreign Industry	$0	$0	$0	$61,030	N/A	N/A	$5,002	$66,032
Industrial Association	$0	$0	$0	$0	N/A	N/A	$0	$0
TOTAL INDUSTRY FUNDING	**$0**	**$0**	**$524,070**	**$847,094**	**N/A**	**N/A**	**$699,283**	**$2,070,447**
University								
U.S. University	$0	$0	$0	$0	N/A	N/A	$0	$0
Foreign University	$0	$0	$0	$0	N/A	N/A	$0	$0
TOTAL UNIVERSITY FUNDING	**$0**	**$0**	**$0**	**$0**	**N/A**	**N/A**	**$0**	**$0**
Other								
Private Foundation	$0	$0	$0	$0	N/A	N/A	$0	$0
Medical Facility	$0	$0	$0	$0	N/A	N/A	$0	$0
Non Profit	$0	$0	$0	$0	N/A	N/A	$0	$0
Venture Capitalist	$0	$0	$0	$0	N/A	N/A	$0	$0
Other	$0	$0	$282,240	$426,716	N/A	N/A	$104,509	$813,465
TOTAL OTHER FUNDING	**$0**	**$0**	**$282,240**	**$426,716**	**N/A**	**N/A**	**$104,509**	**$813,465**
Total Associated Projects - Translational	**$1,968,241**	**$8,538,791**	**$12,287,680**	**$12,868,909**	**N/A**	**N/A**	**$12,345,453**	**$48,009,074**
Total Associated Projects	**$6,525,325**	**$15,244,244**	**$16,365,768**	**$16,268,621**	**N/A**	**N/A**	**$15,384,725**	**$69,788,683**
Value of New Construction								
Government								

NSF Funding								
NSF ERC Base Award	$0	$0	$0	$0	$0	$0	$0	$0
Other NSF (Not ERC Program)	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL NSF FUNDING	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Other U.S. Government (Not NSF)	$0	$0	$0	$0	$0	$0	$0	$0
State Government	$0	$0	$0	$0	$0	$0	$0	$0
Local Government	$0	$0	$0	$0	$0	$0	$0	$0
Foreign Government	$0	$0	$0	$0	$0	$0	$0	$0
Quasi-government research organization	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL GOVERNMENT FUNDING	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Industry								
U.S. Industry	$0	$0	$0	$0	$0	$0	$0	$0
Foreign Industry	$0	$0	$0	$0	$0	$0	$0	$0
Industrial Association	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL INDUSTRY FUNDING	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
University								
U.S. University	$0	$0	$0	$0	$0	$0	$0	$0
Foreign University	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL UNIVERSITY FUNDING	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Other								
Private Foundation	$0	$0	$0	$0	$0	$0	$0	$0
Medical Facility	$0	$0	$0	$0	$0	$0	$0	$0
Non Profit	$0	$0	$0	$0	$0	$0	$0	$0
Venture Capitalist	$0	$0	$0	$0	$0	$0	$0	$0
Other	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL OTHER FUNDING	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Total Value of New Construction	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Value of Equipment								
Government								

NSF Funding								
NSF ERC Base Award	$0	$0	$0	$0	$0	$0	$0	$0
Other NSF (Not ERC Program)	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL NSF FUNDING	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Other U.S. Government (Not NSF)	$0	$0	$0	$0	$0	$0	$0	$0
State Government	$0	$0	$0	$0	$0	$0	$0	$0
Local Government	$0	$0	$0	$0	$0	$0	$0	$0
Foreign Government	$0	$0	$0	$0	$0	$0	$0	$0
Quasi-government research organization	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL GOVERNMENT FUNDING	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Industry								
U.S. Industry	$0	$0	$0	$0	$48,000	$0	$48,000	$48,000
Foreign Industry	$0	$0	$0	$0	$0	$0	$0	$0
Industrial Association	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL INDUSTRY FUNDING	**$0**	**$0**	**$0**	**$0**	**$48,000**	**$0**	**$48,000**	**$48,000**
University								
U.S. University	$0	$0	$0	$0	$0	$0	$0	$0
Foreign University	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL UNIVERSITY FUNDING	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Other								
Private Foundation	$0	$0	$0	$0	$0	$0	$0	$0
Medical Facility	$0	$0	$0	$0	$0	$0	$0	$0
Non Profit	$0	$0	$0	$0	$0	$0	$0	$0
Venture Capitalist	$0	$0	$0	$0	$0	$0	$0	$0
Other	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL OTHER FUNDING	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Total Value of Equipment	**$0**	**$0**	**$0**	**$0**	**$48,000**	**$0**	**$48,000**	**$48,000**
Value of New Facilities in Existing Buildings								
Government								

NSF Funding								
NSF ERC Base Award	$0	$0	$0	$0	$0	$0	$0	$0
Other NSF (Not ERC Program)	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL NSF FUNDING	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Other U.S. Government (Not NSF)	$0	$0	$0	$0	$0	$0	$0	$0
State Government	$0	$0	$0	$0	$0	$0	$0	$0
Local Government	$0	$0	$0	$0	$0	$0	$0	$0
Foreign Government	$0	$0	$0	$0	$0	$0	$0	$0
Quasi-government research organization	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL GOVERNMENT FUNDING	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Industry								
U.S. Industry	$0	$0	$0	$0	$0	$0	$0	$0
Foreign Industry	$0	$0	$0	$0	$0	$0	$0	$0
Industrial Association	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL INDUSTRY FUNDING	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
University								
U.S. University	$0	$0	$0	$0	$0	$0	$0	$0
Foreign University	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL UNIVERSITY FUNDING	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Other								
Private Foundation	$0	$0	$0	$0	$0	$0	$0	$0
Medical Facility	$0	$0	$0	$0	$0	$0	$0	$0
Non Profit	$0	$0	$0	$0	$0	$0	$0	$0
Venture Capitalist	$0	$0	$0	$0	$0	$0	$0	$0
Other	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL OTHER FUNDING	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Total Value of New Facilities in Existing Buildings	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Value of Visting Personnel								
Government								

NSF Funding								
NSF ERC Base Award	$0	$0	$0	$0	$0	$0	$0	$0
Other NSF (Not ERC Program)	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL NSF FUNDING	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Other U.S. Government (Not NSF)	$0	$0	$0	$0	$0	$0	$0	$0
State Government	$0	$0	$0	$0	$0	$0	$0	$0
Local Government	$0	$0	$0	$0	$0	$0	$0	$0
Foreign Government	$0	$0	$0	$0	$0	$0	$0	$0
Quasi-government research organization	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL GOVERNMENT FUNDING	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Industry								
U.S. Industry	$0	$0	$0	$0	$0	$0	$0	$0
Foreign Industry	$0	$0	$0	$0	$0	$0	$0	$0
Industrial Association	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL INDUSTRY FUNDING	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
University								
U.S. University	$0	$0	$0	$0	$0	$0	$0	$0
Foreign University	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL UNIVERSITY FUNDING	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Other								
Private Foundation	$0	$0	$0	$0	$0	$0	$0	$0
Medical Facility	$0	$0	$0	$0	$0	$0	$0	$0
Non Profit	$0	$0	$0	$0	$0	$0	$0	$0
Venture Capitalist	$0	$0	$0	$0	$0	$0	$0	$0
Other	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL OTHER FUNDING	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Total Value of Visting Personnel	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Value of Other Assets								
Government								

NSF Funding								
NSF ERC Base Award	$0	$0	$0	$0	$0	$0	$0	$0
Other NSF (Not ERC Program)	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL NSF FUNDING	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Other U.S. Government (Not NSF)	$0	$0	$0	$0	$0	$0	$0	$0
State Government	$0	$0	$0	$0	$0	$0	$0	$0
Local Government	$0	$0	$0	$0	$0	$0	$0	$0
Foreign Government	$0	$0	$0	$0	$0	$0	$0	$0
Quasi-government research organization	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL GOVERNMENT FUNDING	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Industry								
U.S. Industry	$3,800	$1,000	$2,700	$0	$320,000	$0	$320,000	$327,500
Foreign Industry	$0	$0	$0	$0	$60,000	$0	$60,000	$60,000
Industrial Association	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL INDUSTRY FUNDING	**$3,800**	**$1,000**	**$2,700**	**$0**	**$380,000**	**$0**	**$380,000**	**$387,500**
University								
U.S. University	$143,964	$174,647	$154,448	$120,384	$81,190	$0	$81,190	$674,633
Foreign University	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL UNIVERSITY FUNDING	**$143,964**	**$174,647**	**$154,448**	**$120,384**	**$81,190**	**$0**	**$81,190**	**$674,633**
Other								
Private Foundation	$0	$0	$0	$0	$0	$0	$0	$0
Medical Facility	$0	$0	$0	$0	$0	$0	$0	$0
Non Profit	$0	$0	$0	$0	$0	$0	$0	$0
Venture Capitalist	$0	$0	$0	$0	$0	$0	$0	$0
Other	$0	$12,962	$0	$0	$0	$0	$0	$12,962
TOTAL OTHER FUNDING	**$0**	**$12,962**	**$0**	**$0**	**$0**	**$0**	**$0**	**$12,962**
Total Value of Other Assets	**$147,764**	**$188,609**	**$157,148**	**$120,384**	**$461,190**	**$0**	**$461,190**	**$1,075,095**
Total In-Kind Support, All Sources	**$147,764**	**$188,609**	**$157,148**	**$120,384**	**$509,190**	**$0**	**$509,190**	**$1,123,095**

Total Cash Support, All Sources [2]	**$8,175,381**	**$16,131,253**	**$21,236,171**	**$26,356,329**	**$16,684,200**	**$2,148,806**	**$18,833,006**	**$57,282,367**
Percent Non-ERC Program Cash	**50%**	**60%**	**50%**	**58%**	**48%**	**100%**	**54%**	**53%**
Total Cash + In-Kind	**$8,323,145**	**$16,319,862**	**$21,393,319**	**$26,476,713**	**$17,193,390**	**$2,148,806**	**$19,342,196**	**$58,405,462**
Grand Total (Cash + In-Kind + Associated Projects)	**$14,848,470**	**$31,564,106**	**$37,759,087**	**$42,745,334**	**$17,193,390**	**$2,148,806**	**$34,726,921**	**$128,194,145**

[1] - No Residual amounts or multi-year support carried over from prior years are included in the Cumulative Total column because the funds are by definition included in the year in which they were received.

[2] - Cash Total = The sum of Unrestricted Cash, Restricted Cash, and Residual Funds for a particular NSF Award Year, but NOT Support for Associated Projects. This cash amount in Sources of Support Table is also the total for the 'Expenditure' column pertaining to the same Award Year in Annual Expenditures Table.

[3] - Starting in 2023, Associated Project support amounts are collected as Total Support and are not collected as Promised and Received amounts.

8.7 History of ERC Funding of the Center Table

HISTORY OF ERC FUNDING OF THE CENTER

Award Number	Award Type	Award Title	Award Duration	Amount	Status	Final Report Approved?
EEC-1941524	Base	NSF Engineering Research Center for Advancing Sustainability through Powered Infrastructure for Roadway Electrification (ASPIRE)	5 years	$3,500,000	In progress	N/A
EEC-1941524	Supplement - SLC COVID	NSF Engineering Research Center for Advancing Sustainability through Powered Infrastructure for Roadway Electrification (ASPIRE)	5 years	$6,390	In progress	N/A
EEC-1941524	Supplement - NSF Intern	NSF Engineering Research Center for Advancing Sustainability through Powered Infrastructure for Roadway Electrification (ASPIRE)	5 years	$48,148	Completed	N/A
EEC-1941524	Supplement - NSF Intern	NSF Engineering Research Center for Advancing Sustainability through Powered Infrastructure for Roadway Electrification (ASPIRE)	5 years	$36,967	Completed	N/A

EEC-1941524	Supplement - NSF Intern	NSF Engineering Research Center for Advancing Sustainability through Powered Infrastructure for Roadway Electrification (ASPIRE)	5 years	$32,627	Completed	N/A
EEC-1941524	Supplement - NSF Intern	NSF Engineering Research Center for Advancing Sustainability through Powered Infrastructure for Roadway Electrification (ASPIRE)	5 years	$55,000	Completed	N/A
EEC-1941524	Supplement - NSF Intern	NSF Engineering Research Center for Advancing Sustainability through Powered Infrastructure for Roadway Electrification (ASPIRE)	5 years	$55,000	Completed	N/A
EEC-1941524	Supplement - CED	NSF Engineering Research Center for Advancing Sustainability through Powered Infrastructure for Roadway Electrification (ASPIRE)	5 years	$378,219	In progress	N/A
EEC-1941524	Year 2 Increment	NSF Engineering Research Center for Advancing Sustainability through Powered Infrastructure for Roadway Electrification (ASPIRE)	5 years	$4,500,000	In progress	N/A
EEC-1941524	Year 3 Increment	NSF Engineering Research Center for Advancing Sustainability through Powered Infrastructure for Roadway Electrification (ASPIRE)	5 years	$6,000,000	In progress	N/A
EEC-1941524	Year 4 Advance Increment	NSF Engineering Research Center for Advancing Sustainability through Powered Infrastructure for Roadway Electrification (ASPIRE)	5 years	$1,985,000	In progress	N/A
EEC-1941524	Supplement - REM	NSF Engineering Research Center for Advancing Sustainability through Powered Infrastructure for Roadway Electrification (ASPIRE)	5 years	$107,010	In progress	N/A
EEC-1941524	Supplement - NSF Intern	NSF Engineering Research Center for Advancing Sustainability through Powered Infrastructure for Roadway Electrification (ASPIRE)	5 years	$54,940	Completed	N/A
EEC-1941524	Supplement - RET	NSF Engineering Research Center for Advancing Sustainability through Powered Infrastructure for Roadway Electrification (ASPIRE)	5 years	$20,000	Completed	N/A

EEC-1941524	Supplement - NSF Intern	NSF Engineering Research Center for Advancing Sustainability through Powered Infrastructure for Roadway Electrification (ASPIRE)	5 years	$55,000	In progress	N/A
EEC-1941524	Supplement - NSF Intern	NSF Engineering Research Center for Advancing Sustainability through Powered Infrastructure for Roadway Electrification (ASPIRE)	5 years	$55,000	In progress	N/A
EEC-1941524	Year 4 Increment	NSF Engineering Research Center for Advancing Sustainability through Powered Infrastructure for Roadway Electrification (ASPIRE)	5 years	$4,015,000	In progress	N/A
EEC-1941524	Year 5 Advance Increment	NSF Engineering Research Center for Advancing Sustainability through Powered Infrastructure for Roadway Electrification (ASPIRE)	5 years	$2,250,000	In progress	N/A
EEC-1941524	Supplement - REM	NSF Engineering Research Center for Advancing Sustainability through Powered Infrastructure for Roadway Electrification (ASPIRE)	5 years	$109,813	In progress	N/A
EEC-1941524	Year 5 Increment	NSF Engineering Research Center for Advancing Sustainability through Powered Infrastructure for Roadway Electrification (ASPIRE)	5 years	$3,450,000	In progress	N/A
Total				**$26,714,114**		

8.8 Cost Sharing by Institution Table

COST SHARING BY INSTITUTION

Institution	Award Year 1		Award Year 2	
	Committed	Amount transferred to ERC Account	Committed	Amount transferred to ERC Account
Utah State University (Lead)	$ 307,424.30	$ 483,752.41	$ 359,308.69	$ 659,181.21
Purdue University (Core)	$ 231,718.00	$ 72,432.55	$ 237,124.00	$ 291,992.76
The University of Texas at El Paso (Core)	$ 75,067.00	$ -	$ 97,997.00	$ -
University of Colorado Boulder (Core)	$ 163,127.00	$ 150,612.29	$ 169,702.00	$ 187,792.87
TOTAL	$ 777,336.30	$ 706,797.25	$ 864,131.69	$ 1,138,966.84

Institution	Award Year 3		Award Year 4	
	Committed	Amount transferred to ERC Account	Committed	Amount transferred to ERC Account
Utah State University (Lead)	$ 402,857.39	$ 615,311.28	$ 417,835.55	$ 574,153.11
Purdue University (Core)	$ 186,474.00	$ 212,163.90	$ 250,356.00	$ 258,998.60
The University of Texas at El Paso (Core)	$ 131,757.00	$ -	$ 132,073.00	$ 636,026.77
University of Colorado Boulder (Core)	$ 152,511.00	$ -	$ 157,909.00	$ 322,729.06
TOTAL	$ 873,599.39	$ 827,475.18	$ 958,173.55	$ 1,791,907.54

Institution	Current Award Year		Award Year 6	
	Committed	Amount transferred to ERC Account (to date)*	Committed	Amount transferred to ERC Account
Utah State University (Lead)	$ 414,968.07	$ 438,180.85	$ 546,356.46	$ -
Purdue University (Core)	$ 190,682.00	$ 216,658.69	$ 251,276.00	$ -
The University of Texas at El Paso (Core)	$ 133,366.00	$ 59,881.51	$ 138,150.00	$ -
University of Colorado Boulder (Core)	$ 163,538.00	$ 84,053.59	$ 137,101.00	$ -
TOTAL	$ 902,554.07	$ 798,774.64	$ 1,072,883.46	$ -

Institution	Award Year 7		Award Year 8	
	Committed	Amount transferred to ERC Account	Committed	Amount transferred to ERC Account
Utah State University (Lead)	$ 560,772.73	$ -	$ 571,741.31	$ -
Purdue University (Core)	$ 260,307.00	$ -	$ 265,462.00	$ -
The University of Texas at El Paso (Core)	$ 141,629.00	$ -	$ 145,215.00	$ -
University of Colorado Boulder (Core)	$ 141,778.00	$ -	$ 146,628.00	$ -
TOTAL	$ 1,104,486.73	$ -	$ 1,129,046.31	$ -

Institution	Award Year 9		Award Year 10	
	Committed	Amount transferred to ERC Account	Committed	Amount transferred to ERC Account
Utah State University (Lead)	$ 435,361.32	$ -	$ 336,587.18	$ -
Purdue University (Core)	$ 162,981.00	$ -	$ 112,037.00	$ -
The University of Texas at El Paso (Core)	$ 148,898.00	$ -	$ 149,869.00	$ -
University of Colorado Boulder (Core)	$ 151,650.00	$ -	$ 116,200.00	$ -
TOTAL	$ 898,890.32	$ -	$ 714,693.18	$ -

Institution	Cumulative Amount Transferred to ERC Account
Utah State University (Lead)	$ 2,770,578.86
Purdue University (Core)	$ 1,052,246.50
The University of Texas at El Paso (Core)	$ 695,908.28
University of Colorado Boulder (Core)	$ 745,187.81
TOTAL	$ 5,263,921.45

*This information is as of 06/30/2025

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8.9 Funding and Collaboration Activities by International Partner Universities Table

INTERNATIONAL PARTNER UNIVERSITIES--FUNDING AND COLLABORATION ACTIVITIES

International Partner University	Foreign Funding Entity	Current Award Year Foreign Funding	Type of Activity	Number of ERC Foreign Faculty (FF) and ERC Faculty (ERCF)	Number of U.S. ERC Students working in foreign research labs for more than 30 days	Number of Foreign Students working in ERC Lab for more than 30 days
University of Auckland	University of Auckland	US $170,504.19	Research	15 (FF) 0 (ERCF)	0	17
University of Auckland	Ministry of Business, Innovation, & Employmnet New Zealand	US $1,590,868	Research	15 (FF) 0 (ERCF)	0	17
University of Auckland	Anonymous Sponsor	US $6,454	Research	15 (FF) 0 (ERCF)	0	17
University of Auckland	Anonymous Sponsor	US $25,984	Research	15 (FF) 0 (ERCF)	0	17
University of Auckland	Anonymous Sponsor	US $31,185	Research	15 (FF) 0 (ERCF)	0	17
University of Auckland	Anonymous Sponsor	US $40,886	Research	15 (FF) 0 (ERCF)	0	17

8.10 Modes of Support

Table: Modes of Support, by Industry and Other Practitioner Organizations													
Organization	Sep 1, 2023 - Aug 31, 2024						Sep 1, 2024 - Aug 31, 2025						Promised Support
	Fees and Contributions	Sponsored Projects		Associated Projects		In-Kind Support	Fees and Contributions	Sponsored Projects		Associated Projects		In-Kind Support	
		Non-translational	Translational	Non-translational	Translational			Non-translational	Translational	Non-translational	Translational		
Industrial/Practitioner Member Organizations													
ABB E-Mobility	$0	$0	$0	$565,588	$0	$0	$15,000	$0	$0	$188,529	$0	$0	$0
AECOM Technology Corporation	$20,000	$0	$0	$0	$128,529	$0	$0	$0	$0	$0	$113,394	$0	$0
Asphalt Systems Inc	$0	$0	$0	$0	$0	$0	$7,500	$0	$0	$0	$0	$0	$0
CBMM Technology Suisse	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Central Florida Expressway Authority	$1	$0	$0	$0	$46,536	$0	$0	$0	$0	$0	$282,106	$0	$0
Concrete & Masonry & Hardscapes Association	$0	$0	$0	$0	$0	$0	$1	$0	$0	$42,497	$0	$0	$0
CRH Group Services Limited	$15,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Cummins, Inc.	$10,000	$0	$0	$0	$352,385	$0	$10,000	$0	$0	$0	$171,033	$0	$0
DarkPulse, Inc.	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Denso Corporation	$15,000	$0	$0	$0	$0	$0	$1	$7,000	$0	$61,507	$0	$0	$0
Eaton Corporation	$15,000	$0	$0	$0	$0	$0	$0	$0	$0	$198,294	$0	$0	$0
Electreon Wireless	$5,000	$0	$0	$0	$0	$0	$5,000	$7,000	$0	$0	$0	$0	$0
Electric Power Systems	$8,000	$0	$0	$0	$0	$0	$5,000	$0	$0	$0	$0	$0	$0
ENRX	$7,491	$0	$0	$0	$61,030	$0	$1	$6,991	$0	$0	$5,002	$0	$0

Esri	$15,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Ford Motor Company	$10,000	$0	$0	$0	$0	$0	$10,000	$0	$0	$0	$0	$0	$0
Geotab	$0	$0	$0	$0	$0	$0	$15,000	$0	$0	$0	$0	$60,000	$0
HNTB	$15,000	$0	$0	$0	$0	$0	$15,000	$0	$0	$0	$0	$0	$0
Hypercraft USA	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Hyster-Yale Group, Inc.	$0	$0	$0	$0	$0	$0	$20,000	$0	$0	$0	$0	$0	$0
Indiana Department of Transportation	$1	$0	$0	$129,662	$335,570	$0	$0	$0	$0	$0	$662,219	$0	$0
InductEV	$7,500	$0	$0	$0	$0	$0	$7,500	$0	$0	$0	$0	$0	$0
Integrated Roadways, LLC	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
John Deere	$10,000	$0	$0	$0	$0	$0	$10,000	$0	$0	$0	$0	$0	$0
Kenworth Trucks, Inc.	$10,000	$0	$0	$747,194	$0	$0	$15,000	$0	$0	$185,778	$0	$0	$0
Laurel Group	$0	$0	$0	$0	$0	$0	$1,500	$0	$0	$0	$0	$0	$0
Magment GmbH	$7,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
PacifiCorp - Rocky Mountain Power	$10,000	$0	$0	$651,846	$305,150	$0	$10,000	$0	$0	$117,229	$409,854	$0	$0
PC Krause and Associates, Inc.	$0	$0	$0	$0	$0	$0	$5,000	$0	$0	$0	$0	$0	$0
Pennsylvania Turnpike Authority	$0	$0	$0	$0	$0	$0	$7,001	$0	$0	$0	$0	$0	$0
Rekor	$0	$0	$0	$0	$0	$0	$15,000	$0	$0	$0	$0	$320,000	$0
Scania AB	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Schneider Electric	$0	$0	$0	$0	$0	$0	$45,000	$0	$0	$0	$0	$0	$0
Southwire	$15,	$0	$0	$0	$0	$0	$15,000	$0	$0	$0	$0	$0	$0

	000												
State of Utah	$0	$0	$2,100,000	$0	$8,830,595	$0	$1	$0	$0	$0	$8,806,468	$0	$0
Toyota Motor Engineering & Manufacturing North America, Inc.	$9,998	$0	$0	$0	$0	$0	$3,501	$0	$0	$60,338	$0	$0	$0
UDOT (Utah Department of Transportation)	$1	$0	$0	$18,148	$1,470,149	$0	$0	$0	$0	$53,852	$0	$0	$0
Utah Inland Port Authority	$0	$0	$0	$0	$0	$0	$3,501	$0	$0	$0	$0	$0	$0
WiTricity Corporation	$5,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
WSP	$0	$0	$0	$0	$0	$0	$15,000	$0	$0	$0	$0	$0	$0
Total Members	**$210,492**	**$0**	**$2,100,000**	**$2,112,438**	**$11,529,944**	**$0**	**$25,507**	**$20,991**	**$0**	**$908,024**	**$10,450,076**	**$380,000**	**$0**
Non-Member Organizations: Funders of Sponsored Projects, Funders of Associated Projects, and Contributing Organizations													
Non-Member Organizations: Funders of Sponsored Projects, Funders of Associated Projects, and Contributing Organizations													
Cache Valley Electric	$0	$0	$0	$0	$0	$0	$0	$1,500	$0	$0	$0	$0	$0
Colorado Department of Transportation	$0	$0	$0	$0	$0	$0	$0	$0	$0	$41,522	$0	$0	$0
Crater Lake Electrical JATC	$0	$0	$0	$0	$0	$0	$0	$0	$0	$148,920	$0	$0	$0
Department of Education	$0	$0	$0	$0	$0	$0	$0	$0	$0	$275,342	$0	$0	$0
Department of Energy	$0	$0	$0	$778,249	$0	$0	$0	$0	$0	$428,485	$200,000	$0	$0
INERGY	$0	$0	$0	$35,798	$0	$0	$0	$0	$0	$0	$0	$0	$0
Institute of Electrical and Electronics Engineers	$500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Ministry of Business, Innovation & Employment NZ	$0	$0	$0	$0	$912,249	$0	$0	$0	$0	$0	$1,590,868	$0	$0
Oldcastle Infrastructure	$0	$0	$0	$0	$0	$0	$7,000	$0	$0	$0	$0	$0	$0
Smartville Inc.	$0	$0	$0	$0	$0	$0	$0	$0	$0	$339,413	$0	$0	$0
State of Colorado	$0	$0	$0	$325,000	$0	$0	$0	$0	$0	$325,000	$0	$0	$0
Sunbelt Rentals	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$48,000	$0

Total Non-Members	$500	$0	$0	$1,139,047	$912,249	$0	$7,000	$1,500	$0	$1,558,682	$1,790,868	$48,000	$0
Total	$210,992	$0	$2,100,000	$3,251,485	$12,442,193	$0	$262,507	$22,491	$0	$2,466,706	$12,240,944	$428,000	$0

8.11 Annual Expenditures Table

Table: Annual Expenditures and Budgets

Cash Support	Sep-01-2020 - Aug-31-2021	Sep-01-2021 - Aug-31-2022	Sep-01-2022 - Aug-31-2023	Sep-01-2023 - Aug-31-2024	Sep-01-2024 - Aug-31-2025	Proposed Budget - Next Award Year
Cash Support (All Sources)	**$8,175,381**	**$11,166,136**	**$12,376,163**	**$15,839,760**	**$9,724,927**	**N/A**
Multi-year Support brought forward from Prior Year (All Sources)	**$0**	**$0**	**$0**	**$0**	**$0**	**N/A**
Residual Funds brought forward from Prior Year (All Sources)	**$0**	**$4,965,117**	**$8,860,008**	**$10,516,569**	**$9,108,079**	**N/A**
Total Cash Support	**$8,175,381**	**$16,131,253**	**$21,236,171**	**$26,356,329**	**$18,833,006**	**N/A**

Expenses	Sep-01-2020 - Aug-31-2021	Sep-01-2021 - Aug-31-2022	Sep-01-2022 - Aug-31-2023	Sep-01-2023 - Aug-31-2024	Sep-01-2024 - Aug-31-2025	Proposed Budget - Next Award Year
Salaries & Benefits						
A. Senior Personnel: PI/PD, Co-PIs, Faculty and Other Senior Associates	$864,816	$1,024,487	$1,596,535	$1,168,225	$935,267	$676,550
B. Other Personnel	$782,767	$2,388,609	$2,189,258	$3,097,914	$3,861,996	$2,198,319
Postdoctoral associates	$4,167	$69,342	$176,079	$140,672	$191,073	$193,986
Other professionals (technician, programmer, etc.)	$186,900	$781,820	$473,695	$1,208,840	$1,740,994	$498,204
Graduate Students	$426,334	$1,114,130	$1,134,109	$1,256,282	$1,365,014	$932,909
Undergraduate students	$95,315	$307,544	$229,869	$198,310	$344,378	$508,220
Secretarial - clerical	$45,300	$92,319	$93,722	$124,366	$102,382	$65,000
Other	$24,751	$23,454	$81,784	$169,444	$118,155	$0
C. Fringe Benefits	$455,505	$817,158	$917,162	$1,100,137	$1,314,995	$502,863
Total Salaries & Benefits (A+B+C)	**$2,103,088**	**$4,230,254**	**$4,702,955**	**$5,366,276**	**$6,112,258**	**$3,377,732**
Other Expenses						
D. Equipment	$11,626	$660,481	$2,529,250	$8,371,791	$2,156,468	$25,000
E. Travel	$10,822	$195,262	$315,878	$358,302	$319,462	$265,328
F. Participant Support	$27,000	$89,273	$70,938	$107,282	$96,086	$56,880
G. Other Direct Costs	$235,103	$736,477	$1,009,751	$1,048,614	$1,743,215	$425,430
H. Direct Costs Total (A through G)	**$2,387,639**	**$5,911,747**	**$8,628,772**	**$15,252,265**	**$10,427,489**	**$4,150,370**
I. Indirect Costs	**$822,625**	**$1,359,498**	**$2,090,830**	**$1,995,985**	**$2,250,074**	**$1,641,415**
TOTAL Expenditures and Budgets (A through I)	**$3,210,264**	**$7,271,245**	**$10,719,602**	**$17,248,250**	**$12,677,563**	**$5,791,785**

Totals and Residuals	Sep-01-2020 - Aug-31-2021	Sep-01-2021 - Aug-31-2022	Sep-01-2022 - Aug-31-2023	Sep-01-2023 - Aug-31-2024	Sep-01-2024 - Aug-31-2025	Proposed Budget - Next Award Year
Total Cash Support	**$8,175,381**	**$16,131,253**	**$21,236,171**	**$26,356,329**	**$18,833,006**	**N/A**
J. TOTAL Expenditures and Budgets (A through I)	$3,210,264	$7,271,245	$10,719,602	$17,248,250	$12,677,563	$5,791,785
K. Support Reserved for Future Years	$0	$0	$0	$0	$0	N/A
L. Residual Funds Remaining	$4,965,117	$8,860,008	$10,516,569	$9,108,079	$6,155,443	$0
Balance (Subtract J+K+L from Current Year Support)	**$0**	**$0**	**$0**	**$0**	**$0**	**N/A**

[1] - For Centers in operation for more than five years.

8.12 Unexpended Residual in the Current Award and Proposed Award Year Table

UNEXPENDED RESIDUAL IN THE CURRENT AWARD AND PROPOSED AWARD YEAR

	Previous Award Year to Current Award Year	Current Award Year to Proposed Award Year
Total Unexpended Residual Funds	$ 9,108,079.00	$ 6,155,443.00
Committed, Encumbered, Obligated Funds	$ -	$ 2,865,162.99
Residual Funds Without Specified Use	$ -	$ 3,290,280.01

*This information is according to the estimated support and estimated residual funds reported in the ERC system through 08/31/2025

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Appendix I: Glossary and Acronyms

AC – Alternating Current

AR – Augmented Reality

ASA – ASPIRE Student Association

ASEE – American Society for Engineering Education

ASPIRE – Advancing Self-Sufficiency through Powered Infrastructure for Roadway Electrification

CARB – California Air Resources Board

Co-PI – Co-Principal Investigator

CTIS – Center for Transportation Infrastructure Systems (at UTEP)

CU or UCB – University of Colorado Boulder

DC – Direct Current

DCFC – DC Fast Charging (for electric vehicles)

DEI – Diversity, Equity and Inclusion

DOE – Department of Energy

DWPT – Dynamic Wireless Power Transfer (in-motion wireless charging of EVs)

EAB – Executive Advisory Board

ERC – NSF funded program: Engineering Research Center

EV – Electric vehicle

EVR – Electrical Vehicle and Roadway Research Facility and Test Track located at USU

EWD – ERC foundational component: Engineering Workforce Development

FLED – Freight Logistics Electrification Demonstration (FLED) project with Utah Inland Port Authority

FHWA – Federal Highway Administration

GD&T – Geometric dimensioning and tolerancing

GHG – Greenhouse gas emissions

HD – Heavy duty

IIB – Industry and Innovation Board

IE – ERC foundational component: Innovation Ecosystem

INCLUDES – NSF funded program: Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science

INDOT – Indiana Department of Transportation

IP – Intellectual property

ITSA – Intelligent Transportation Society of America

IUSE – NSF funded program: Improving Undergraduate STEM Education

K-12 – Kindergarten to 12th grade

kWh – Kilowatt hour

LCA – Life cycle analysis

LCL – Inductor capacitor inductor (resonant stage in a power converter)

LD – Light duty

MD – Medium duty

MBIE – Ministry of Business Innovation and Employment

MERCII – Multi-ERC Instrument Inventory

MWh – Megawatt hour

NACFE – North American Council for Freight Efficiency

NREL – National Renewable Energy Laboratory

NSF – National Science Foundation

OEM – Original equipment manufacturer (e.g., Toyota as a vehicle manufacturer)

PCB – Printed circuit board

PD – Professional development

PFC – Power factor correction

PI – Principal Investigator

PPE – Personal Protective Equipment

PU – Purdue University

Strategic Pillars – ASPIRE's collective ERC foundational components: Research, Engineering Workforce Development, and Innovation Ecosystem

REU – NSF funded program: Research Experience for Undergraduates

SAB – Science Advisory Board

SLC – Student Leadership Council

SMART – ASPIRE's goal evaluation and assessment framework: Specific, Measurable, Achievable, Realistic, and Timeline

STEM – Science, Technology, Engineering and Mathematics

SWOT – Strengths, weaknesses, opportunities, and threats (i.e., SWOT analysis)

TAM – Transportation asset management

TAPD – ASPIRE's collective research thrusts: Transportation, Adoption, Power, and Data

TEA – Techno-economic analysis

THD – Total harmonic distortion

TRL – Technology Readiness Level

UCCS – University of Colorado Colorado Springs

UIPA – Utah Inland Port Authority

UoA – University of Auckland, New Zealand

UoU – University of Utah

USU – Utah State University

UTEP – University of Texas at El Paso

VR – Virtual Reality

WPT – Wireless power transfer

XFC – Extreme fast charging

Appendix II

ASPIRE Master Cooperative Agreement:
Includes IIB and IP Membership Agreement

ASPIRE
MASTER COOPERATIVE AGREEMENT:
CORE UNIVERSITY RESEARCH PARTNERS

This MASTER COOPERATIVE AGREEMENT ("*Agreement*") is dated as of September 1, 2020 ("*Effective Date*") and establishes the responsibilities and duties of Utah State University ("*USU*") and the below listed core university research partners in relation to the National Science Foundation ("*NSF*") Engineering Research Center for Advancing Sustainability through Powered Infrastructure for Roadway Electrification ("*ASPIRE*"):

1) The University of Texas at El Paso ("*UTEP*")
2) Purdue University ("*Purdue*"), and
3) The Regents of the University of Colorado on behalf of the University of Colorado Boulder ("*UCB*"), and
4) University of Auckland ("*UA*").

UTEP, Purdue, and UCB may be referred to herein as the "*Core Domestic Partner Universities*." UA may be referred to as the "*Core International Partner University*." The Core Domestic Partner Universities and Core International Partner University may be referred to together as "*Core Partner Universities*." Each of USU, UTEP, Purdue, UCB, and UA may be referred to herein as a "*Party*" or collectively as the "*Parties*."

WHEREAS, on August 3, 2020, the NSF awarded USU with a Cooperative Agreement Number 1941524 ("NSF Cooperative Agreement") (copy attached as **Exhibit A**), thereby establishing and funding ASPIRE as a Gen-4 NSF Engineering Research Center;

WHEREAS, UTEP, Purdue, UCB, and UA will each play a pivotal role in supporting USU in administrative, research, and developmental efforts associated with ASPIRE and compliance with the NSF Cooperative Agreement and expectations set forth therein;

NOW, THEREFORE, in consideration of the mutual covenants and obligations set forth herein, and for other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, the Parties hereby agree as follows:

1. Term. This Agreement shall begin on the Effective Date and shall continue until August 31, 2025 ("*Term*"), unless sooner terminated or extended in accordance with the terms of this Agreement. If the NSF extends the award period for ASPIRE, for example as anticipated for an additional five years, then the Term will be automatically extended to correspond with the NSF award period upon written noticiation by USU to the Core Partner Universities.

2. Roles of USU and the Core Partner Universities.

2.1. Lead Institution. USU will serve as the "lead institution" and primary coordinating agent for ASPIRE and the NSF. Dr. Regan Zane, of USU, will serve as the Principal Investigator and Center Director for ASPIRE.

2.2. Core Domestic Partner Universities. Each of UTEP, Purdue, and UCB will perform the roles and responsibilities and support the other Parties in performing their respective roles and responsibilities, as set forth in the NSF Cooperative Agreement.

2.3. Core International Partner University. UA will perform the roles and responsibilities and support the other Parties in performing their respective roles and responsibilities, as set forth in the NSF Cooperative Agreement.

2.4. Joint Research. This Agreement between the Parties is a joint research agreement made pursuant to 35 U.S.C. 103(c)(2).

2.5. Strategic Plan. The Parties agree to support execution of the ASPIRE Strategic Plan (as required in the NSF Cooperative Agreement) and its goals, objectives, milestones, targets, and performance metrics.

3. Governance.

3.1. Leadership Team. The "*ASPIRE Leadership Team*" shall comprise the persons and positions set forth in **Exhibit B**, which may be adjusted from time-to-time by ASPIRE's Director in consultation with the other members of the ASPIRE Leadership Team. Each Party will support its respective employees in fulfilling their assigned ASPIRE Leadership Team responsibilities. A current list of persons serving on the ASPIRE Leadership Team will be maintained on the ASPIRE website.

3.2. Council of Deans. Each of the Parties shall ensure that its respective dean of engineering is available for and serves as a member of the ASPIRE Deans Council, the purpose, operation, and function of which will be defined in the ASPIRE Council of Deans Charter and Bylaws and as described in the NSF Cooperative Agreement.

3.3. Student Association and Leadership. The Parties acknowledge that ASPIRE is required to create the ASPIRE Student Association ("*ASA*") and the ASPIRE Student Leadership Council ("*SLC*"). The SLC, comprising both undergraduate and graduate students, is responsible for organizing ASA activities that support ASPIRE's goals, including student professional development. The SLC will be led by a Chair and a Co-Chair. The SLC Chair will serve as a member of the ASPIRE Leadership Team. The SLC is also responsible for carrying out an annual SWOT analysis of ASPIRE and communicating the results to ASPIRE's Director, the ASPIRE Leadership Team, and the NSF Site Visit Team. Each Party will support the establishment of an ASA chapter on its campus and be responsible for the internal management and administration of its ASA chapter in keeping with said Party's applicable policies and procedures for student organizations. Each Party will ensure that its ASA chapter coordinates and cooperates with other ASA chapters and that its designated student representative(s) participate fully in the SLC. The purpose, operation, and function of the ASA and SLC, will be further defined in a Charter and Bylaws for the SLC and ASA and as described in the NSF Cooperative Agreement. Upon development, USU will ensure that each Party has access to the current Charter and Bylaws of the SLC and ASA and will notify each Party upon amendment thereof.

4. Funding.

4.1. Prime Contractor. USU will serve as the "lead institution" and primary coordinating agent for ASPIRE and the NSF. As designated in the NSF Cooperative Agreement, USU will administer the distribution of ASPIRE's NSF funding and any third-party funding, unless specifically required or designated otherwise by the third-party funder.

4.2. Subawards. In keeping with the NSF Cooperative Agreement, USU will distribute NSF funding to the Core Domestic Partner Universities and third-party funding to the Core Partner Universities. Each of the Core Partner Universities agrees to comply with the terms and conditions set forth in both this Agreement and in any subaward granted to a Core Partner by USU.

5. Affiliated Partner Universities. The Parties acknowledge that various Affiliated Partner Universities may participate with ASPIRE and will fulfill various roles as set forth in the NSF Cooperative Agreement and in subaward agreements. Each Affiliated Partner University will be approved by the Parties and be required to sign an Affiliate Partner University Cooperative Agreement, with terms and obligations similar to those set forth in this Agreement. Each of UTEP, Purdue, UCB, and UA hereby grant to USU the authority to enter into Affiliate Partner University Cooperative Agreements with approved affiliated partner universities, provided that the following conditions are met: (1) USU provides advance written notice to each of the Parties; and (2) the terms of the Affiliate Cooperative Agreements are substantially similar to the terms set forth in this Agreement (or to any future template agreement thereof approved in writing by the Parties). As of the Effective Date, the Parties agree that the following four universities are considered approved affiliated partner universities as designated in the NSF Cooperative Agreement: Cornell University, Colorado State University, Virginia Tech, and University of Colorado Colorado Springs.

6. Industry and Innovation Members.

6.1. Purpose. The Parties acknowledge that one of the purposes of ASPIRE is to support and facilitate collaboration between the Parties, Affiliated Partner Universities, and other companies, laboratories, and governmental agencies.

6.2. Membership Categories. The Center Director, in consultation with the ASPIRE Leadership Team, will establish and administer membership criteria, benefits, and associated membership agreements to involve companies, laboratories, and government agencies in ASPIRE. ASPIRE Membership categories and definitions, as introduced in the NSF Cooperative Agreement include: (1) "Industry Members" which include for-profit companies; (2) "Innovation Members" which include non-profit companies and governmental agencies; (3) "National Laboratory Members" which include national laboratories. Additional categories of membership may be established or modified as needed by the Leadership Team. Exemplary Industry and Innovation membership agreements are set forth in **Exhibit C** ("Membership Agreements"). A

current list of Industry Members, Innovations Members, and National Laboratory Members will be maintained on the ASPIRE website.

6.3. Benefits. The Parties agree to facilitate one another in and contribute to the provision of the benefits as set forth in the Membership Agreements. The benefits may be adjusted as needed by the ASPIRE Leadership Team.

6.4. Membership Fees. The Parties acknowledge that membership fees will be collected as set forth in the Membership Agreements. Membership fees will be collected, administered, and distributed by USU, as the lead institution. Each Party agrees that no overhead will be assessed on any membership fee monies that it might receive from USU. The membership fees shall not be considered sponsored research dollars and are not tied to specific deliverables, etc. (see Membership Agreements).

6.5. ASPIRE Member Sponsored Research. The Parties acknowledge that current Industry, Innovation, and National Laboratory Members may contract with USU as the lead institution to perform ASPIRE related sponsored research. The Parties agree that through at least the first five years of ASPIRE, ending August 31, 2025, that (i) USU will not charge overhead on subcontracts to other Parties on such contracts, and (ii) all Parties will provide a reduced overhead rate of 50% of their current standard negotiated rate on such contracts. The intention of these reduced overhead rates is to encourage ASPIRE Members to provide funding early in the APSIRE program development for sponsored research that leverages and builds on ASPIRE technologies and involves multiple Parties. Successful growth of sponsored research among the parties allows ASPIRE to grow its reputation and recognition as a one-stop-shop for ASPIRE related technology development.

7. Confidential Information

7.1. Confidential Information. Except as set out in Section 7.3 below, "*Confidential Information*" means all non-public, confidential, or proprietary information disclosed before, on, or after the Effective Date, by any Party or Affiliated Partner University ("*Disclosing Party*") to the another Party or Affiliated Partner University ("*Recipient*") or its affiliates, or to any of such Recipient's or its affiliates' employees, officers, directors, partners, shareholders, agents, attorneys, accountants, or advisors (collectively, "*Representatives*"), whether disclosed orally or disclosed or accessed in written, electronic, or other form or media, including, without limitation:

(a) all information concerning the Disclosing Party's and its affiliates', and their customers', suppliers', and other third parties' past, present, and future business affairs including, without limitation, finances, customer information, supplier information, products, services, organizational structure and internal practices, forecasts, sales and other financial results, records and budgets, and business, marketing, development, sales, and other commercial strategies;

(b) the Disclosing Party's unpatented inventions, ideas, methods, and discoveries, trade secrets, know-how, unpublished patent applications, and other confidential intellectual property;

(c) all designs, specifications, documentation, components, source code,

object code, images, icons, audiovisual components and objects, schematics, drawings, protocols, processes, and other visual depictions, in whole or in part, of any of the foregoing;

(d) any third-party confidential information (such as information from a company (e.g., an ASPIRE Industry Member) coordinating with ASPIRE, any of the Parties, or any Affiliated Partner University) included with, or incorporated in, any information provided by the Disclosing Party to the Recipient or its Representatives; and

(e) all notes, analyses, compilations, reports, forecasts, studies, samples, data, statistics, summaries, interpretations, and other materials ("*Notes*") prepared by or for the Recipient or its Representatives that contain, are based on, or otherwise reflect or are derived from, in whole or in part, any of the foregoing.

7.2. Marking. Written Confidential Information (including, but not limited to, descriptions, drawings, designs, etc.) shall be clearly marked as "confidential" or otherwise designated as "confidential" in the written communication(s) associated with the Confidential Information (*e.g.,* an email forwarding a link to a data set that includes confidential information should clearly inform the Recipient of the confidential nature of the data even if the data set cannot be "marked" as confidential because of the file type, etc.). The Parties agree to mark Confidential Information with an appropriate legend designating the owner/discloser of the Confidential Information (e.g., "USU Confidential," "Purdue Confidential," etc.) if the Confidential Information originates from or encompasses the work of a single Party or third party collaborating with ASPIRE. The Parties agree to mark Confidential Information (i) as "ASPIRE Confidential" or (ii) with the disclosing parties names (e.g., "USU and UCB Confidential") if the Confidential Information originates from or encompasses the work product of more than one Party (or a Party and an Affiliate Partner University). If certain Confidential Information has not been reduced to written form at the time of disclosure by the Disclosing Party, then such orally disclosed information shall be protected by the Receiving Party as Confidential Information, provided that the Disclosing Party shall: (i) provide a statement to the Receiving Party that the oral information shall be protected under this Agreement; and (ii) within thirty (30) days of such disclosure, reduce to writing a summary of the orally disclosed Confidential Information.

7.3. Exclusions from Confidential Information. Except as required by applicable federal, state, or local law or regulation, the term "Confidential Information" as used in this Agreement shall not include information that:

(a) at the time of disclosure is, or thereafter becomes, generally available to and known by the public other than as a result of, directly or indirectly, any violation of this Agreement by the Recipient or any of its Representatives;

(b) at the time of disclosure is, or thereafter becomes, available to the Recipient on a non-confidential basis from a third-party source, provided that such third party is not and was not prohibited from disclosing such Confidential Information to the Recipient by a legal, fiduciary, or contractual obligation to the Disclosing Party;

(c) was known by or in the possession of the Recipient or its Representatives, as established by documentary evidence, before being disclosed by or on behalf of the Disclosing Party under this Agreement; or

(d) was or is independently developed by the Recipient, as established by documentary evidence, without reference to or use of, in whole or in part, any of the Disclosing Party's Confidential Information.

7.4. Recipient Obligations. The Recipient shall:

(a) protect and safeguard the confidentiality of all such Confidential Information with at least the same degree of care as the Recipient would protect its own Confidential Information, but in no event with less than a commercially reasonable degree of care;

(b) not use the Disclosing Party's Confidential Information, or permit it to be accessed or used, for any purpose other than the Purpose or any related transactions between the Parties, or otherwise in any manner to the Disclosing Party's detriment, including without limitation, to reverse engineer, disassemble, decompile, or design around the Disclosing Party's proprietary services, products, and/or confidential intellectual property;

(c) not disclose any such Confidential Information to any person or entity, except to the Recipient's Representatives who: (i) need to know the Confidential Information to assist the Recipient, or act on its behalf, in relation to the Purpose or to exercise its rights under the Agreement; (ii) are informed by the Recipient of the confidential nature of the Confidential Information; and (iii) are subject to confidentiality duties or obligations to the Recipient that are no less restrictive than the terms and conditions of this Agreement; and

(d) be responsible for any breach of this Agreement caused by any of its Representatives.

i Additional Confidentiality Obligations. Except as required by applicable federal, state, or local law or regulation, or otherwise as mutually agreed in writing by the Parties, no Party shall itself disclose, nor permit any of its Representatives to disclose to any person: (i) that the Confidential Information has been made available to it or its Representatives, or that it has inspected any portion of the Confidential Information; (ii) that discussions or negotiations may be, or are, underway between the Parties regarding the Confidential Information or the Purpose, including the status thereof; or (iii) any terms, conditions, or other arrangements that are being discussed or negotiated in relation to the Confidential Information or the Purpose.

7.6. Required Disclosures.

(a) Legal Orders. Any Disclosure by the Recipient or its Representatives of any of the Disclosing Party's Confidential Information under applicable federal, state, or local law, regulation, or a valid order issued by a court or governmental agency of competent jurisdiction ("*Legal Order*") shall be subject to the terms of this Section. Before making any such disclosure, the Recipient shall make commercially reasonable efforts to provide the Disclosing Party with: (i) prompt written notice of such requirement so that the Disclosing Party may seek, at its sole cost and expense, a protective order or other remedy; and (ii) reasonable assistance, at the Disclosing Party's sole cost and

expense, in opposing such disclosure or seeking a protective order or other limitations on disclosure. If, after providing such notice and assistance as required herein, the Recipient remains subject to a Legal Order to disclose any Confidential Information, the Recipient (or its Representatives or other persons to whom such Legal Order is directed) shall disclose no more than that portion of the Confidential Information which, on the advice of the Recipient's legal counsel, such Legal Order specifically requires the Recipient to disclose and, on the Disclosing Party's request, shall use commercially reasonable efforts to obtain assurances from the applicable court or agency that such Confidential Information will be afforded confidential treatment.

(b) Open Records Requests. The Parties acknowledge that each is a governmental entity and, as such, are subject to various public records laws. If any Party receives a records request pursuant to any applicable open records law that relates to this Agreement or to Confidential Information as set forth herein, then said Party will notify the other Parties of the records request and coordinate to ensure the continued confidentiality of any Confidential Information.

7.7. Return or Destruction of Confidential Information. At any time during or after the Term (as set forth herein), at the Disclosing Party's written request, the Recipient and its Representatives shall promptly return to the Disclosing Party all copies, whether in written, electronic, or other form or media, of the Disclosing Party's Confidential Information, or destroy all such copies and certify in writing to the Disclosing Party that such Confidential Information has been destroyed. In addition, the Recipient shall also destroy all copies of any Notes created by the Recipient or its Representatives and certify in writing to the Disclosing Party that such copies have been destroyed. Notwithstanding the foregoing, the Recipient may retain copies of Confidential Information that are stored on the Recipient's IT backup and disaster recovery systems until the ordinary course deletion thereof. The Recipient shall continue to be bound by the terms and conditions of this Agreement with respect to such retained Confidential Information.

7.8. Non-Disclosure Agreements with Third Parties.

(a) Generally. The Parties agree and acknowledge that the programs, objectives, and mission of ASPIRE require an expeditious process for receiving non-public, confidential, or proprietary information of third parties ("*Third-Party Confidential Information*") and appropriately distributing such Third-Party Confidential Information among the employees and students of the Parties. The Parties agree that an executed confidentiality agreement with the third party having control over the Third-Party Confidential Information ("*Third-Party NDA*") a prerequisite to any Party receiving Third-Party Confidential Information pursuant to any ASPIRE program, objective, or mission.

(b) Multi-Party Agreements. When circumstances support, or a third party requires, that some or all of the Parties be signatories to a Third-Party NDA, the relevant Parties shall endeavor to expeditiously come to terms and execute such a Third-Party NDA. The Parties agree that (1) the terms set forth in ASPIRE's standard multi-party confidentiality agreement (*See* **Exhibit D**) are acceptable terms and (2) that it will expeditiously execute a Third-Party NDA that is modeled upon ASPIRE's standard multi-party confidentiality agreement. The Parties recognize that the standard multi-party confidentiality agreement will need to be adjusted and updated from time-to-time and agree to expeditiously review

and approve updated versions of the standard multi-party confidentiality agreement.

(c) USU and Third-Party Agreements. To facilitate rapid dissemination of Third-Party Confidential Information among the Parties, each of the Core Partner Universities and authorizes USU, as the lead institution, to enter into Third-Party NDA's, based upon ASPIRE's standard two-party confidentiality agreement (*See* **Exhibit D**). The Parties recognize that the standard two-party confidentiality agreement will need to be adjusted and updated from time-to-time and agree to expeditiously review and approve updated versions of the standard two-party confidentiality agreement. When the two-party confidentiality agreement is used, USU will endeavor to secure the third-party's pre-authorization to disclose Third-Party Confidential Information to the Core Partner Universities and Affiliated Partner Universities (*See, e.g.,* Section 5, "Permitted Disclosures" of the model two-party confidentiality agreement in Exhibit E). Additionally, to ensure proper management of Third-Party Confidential Information and an equitable allocation of responsibility by the Parties when the two-party confidentiality agreement is used, the Parties agree as follows:

i. That prior to USU disclosing any Third-Party Confidential Information to a Core Partner University, USU will provide the Core Partner University with an opportunity to inspect and review the terms of the associated Third-Party NDA;

ii. That the terms of the Third-Party NDA will prescribe the obligations and duties regarding the associated Third-Party Confidential Information and will control if a conflict of terms exist between said Third-Party NDA and this Agreement; iii. Upon a Core Partner University's receipt of any Third-Party Confidential Information associated with the Third-Party NDA, said receiving Core Partner University ("Responsible Party") shall severally (and not jointly) assume, and does hereby assume, ALL of the obligations, duties, and liabilities of USU set forth in the applicable Third Party NDA, as if said Responsible Party had executed the applicable Third-Party NDA itself;

iv. That breach of the terms of a Third-Party NDA by a Responsible Party will constitute a breach of this Agreement;

v. That in no event shall any Party have any liability or obligation with respect to the acts or omission of any other Party to this Agreement in connection with the misappropriation or mismanagement of Third-Party Confidential Information, breach of Section 7, its subsections, or any Third-Party NDA terms that are assumed by a Responsible Party.

7.9. Confidential Information and Party Representatives. The Parties acknowledge and agree that proper care and safeguards with respect to Confidential Information are critical to the reputation and business of ASPIRE. In support of this principle, each Party will ensure that its respective Representatives (e.g. employees, researchers, students, etc.), as set forth herein, are subject to confidentiality duties or obligations to protect and safeguard Confidential Information that are no less restrictive than the terms and conditions of this Section of this Agreement. A model participation and confidentiality agreement for Representatives is set forth in **Exhibit E**, which may be adjusted and modified from time to time as needed and determined by the ASPIRE Leadership Team and/or the legal counsel of any of the Parties.

7.10. Export Control. Each Party agrees to comply with applicable United States export control laws and regulations, including the U.S. Export Administration Regulations ("*EAR*") or International Traffic in Arms Regulations ("*ITAR*") with regard to the transfer of any Confidential Information (as set forth herein) or other products, information, materials, software, documentation, or technical data ("*Materials*") regulated by said laws and regulations. Each Party shall be solely responsible (i) for its own actions or inactions relating to compliance with applicable export control laws and regulations and (ii) for development of and adherence to internal polcies and practices ensuring compliance with applicable export control laws and regulations. If a Disclosing Party intends to transmit Materials to another Party that the Disclosing Party determines to be export controlled, the Disclosing Party must apprise the other party in advance of any export controlled Materials and identify and label the Materials as "export controlled" specifying which authority (e.g EAR or ITAR) governs the restriction and providing the Export Control Classification Number (ECCN) for all information restricted under the EAR. The Party to whom the Materials is intended to be transmitted reserves the right to elect not to receive export controlled Materials. If a Party chooses instead to accept export controlled Materials, then a plan for receipt, use, and dissemination of such export-controlled Materials must be developed and agreed to by a authorized business officer of the Party receiving the Materials prior to such disclosure. The principal investigator or other scientific or technical contact of the Party receiving the Materials may not elect, and does not have the authority to elect, to receive export-controlled Materials without the approval of an authorized business officer.

8. Data Sharing

8.1. Cooperation. The Parties agree to cooperate with one another to facilitate and enable the efficient sharing of data between the Parties and with various educational and industry organizations.

8.2. ASPIRE-Generated Data: Ownership and Sharing. Data generated as a result of an ASPIRE project ("*ASPIRE Data*") will be owned by the data-generating Party, unless otherwise agreed to in writing. ASPIRE Data may, at the discretion of the data owner and in consultation with the ASPIRE Leadership Team, be maintained internally within ASPIRE, or be made available to the public via, for example, open access databases. The Parties agree to share all ASPIRE Data with one another in a timely and prudent manner after its generation. The Parties agree that Affiliated Partner Universities, as defined herein, may contribute ASPIRE data and shall also have access to ASPIRE Data.

8.3. Data Generated by Non-ASPIRE Projects: Ownership and Sharing. The Parties recognize that data originating from non-ASPIRE projects may, at the discretion of the data owner and approval of the ASPIRE Leadership Team, be managed and shared among the Parties as "ASPIRE Data." Prior to sharing/uploading any such data, the owning Party shall ensure that it has the authority to share the data with the Parties and shall consult with the ASPIRE Leadership Team to ensure that the data serves to further to objectives and goals of ASPIRE.

8.4. Data Platform. The Parties will create and manage a secure cloud-based data sharing platform for ASPIRE Data and grant appropriate access to the Parties, approved Affiliated Partner Universities, and the individuals (researchers, students,

administrators, etc.) associated with the Parties and Affiliated Partner Universities. This platform will be designed and administered to encourage the free flow of ASPIRE Data while also respecting proprietary rights of data owner(s) and the duties and obligations relating to Confidential Information (as defined herein). The data sharing platform may also include, when appropriate, the Confidential Information of various third parties working with ASPIRE (e.g., Industry Members, Innovation Members, etc.). Each of the Parties agrees to store ASPIRE Data in the data sharing platform.

8.5. Marking. The Parties agree to mark ASPIRE Data upon upload to the platform with an appropriate legend designating the ASPIRE Data as "proprietary" to flag the ownership interests of the ASPIRE Data. Such a legend should also indicate the owner or owners of the data (e.g., "UA Proprietary"). When the ASPIRE Data is owned by more than one Party (or a Party and an Affiliate Partner University), the ASPIRE data may be marked (i) as "ASPIRE Proprietary" or (ii) with the disclosing parties names (e.g., "USU and UCB Proprietary"). The Parties agree to mark any ASPIRE Data that also qualifies as Confidential Information, as defined herein, as "confidential" in keeping with Section 7 (e.g., "Purdue Confidential and Proprietary").

8.6. Data Sharing with Third Parties. ASPIRE Data will at all times be owned by the data-generating Party. The Parties acknowledge that situations may arise where third parties (e.g., Industry Members or Innovation Member) have an interest in reviewing ASPIRE Data. In such situations, the Parties agree that the owning Party(ies) shall retain sole discretion as to the sharing of the ASPIRE Data in question. The Parties also agree to, pursuant to Section 7.2, any ASPIRE Data that is considered by a Party to be confidential must be designated as "confidential."

9. Publications. A primary objective of ASPIRE is the generation of new knowledge and its expeditious dissemination for the public's benefit. The Parties acknowledge and agree that ASPIRE and the universities and researchers associated therewith may publish or authorize publication of papers, theses, presentations, and other public disclosures based upon any ASPIRE projects and use the research results in research and educational programs; provided, however, that each Party agrees to notify the ASPIRE Leadership Team prior to publication to ensure that any intellectual property rights are not jeopardized through public disclosure. The Parties also agree to support and facilitate the creation of an online resource repository, which will include non-confidential materials prepared by ASPIRE researchers, including papers, presentations, posters, and meeting recordings.

10. Intellectual Property. The Parties agree to comply with the ASPIRE Intellectual Property Policy, which may be updated and adjusted from time to time by USU as coordinated with or required by the NSF and the Parties. The ASPIRE Intellectual Property Policy is incorporated herein by reference as **Exhibit F**.

11. Trademarks.

11.1. Institutional Marks. Each Party retains all right, title, and interest in and to its respective institutional trademarks, logos, designs, etc. The Parties agree that any use

of any other Party's institutional marks shall only be permitted with the written authorization of said Party.

11.2. ASPIRE Trademarks.

A. License. USU hereby grants to each of the other Parties, and those Parties agree to accept, a license to use the trademark "ASPIRE" and any logos or other trademarks associated therewith (the "Marks") to promote ASPIRE and each individual Party's role within ASPIRE. Any use of the Marks must comply with ASPIRE's Visual Identity Guide, which may be updated from time-to-time by USU.

B. Ownership. The Parties acknowledge and agree that (i) USU is the sole and exclusive owner of all right, title, and interest in and to the Marks, as well as any derivatives of the Marks; and (ii) that all rights relating to the Marks not granted herein are expressly reserved by USU. The Parties shall do nothing inconsistent with USU's ownership rights. The Parties further agree that all use of the Marks, as well as all goodwill associated therewith, shall inure to the benefit of and be on behalf of USU. The Parties agree that they will not challenge, directly or indirectly, USU's right, title, or interest in the Marks or the validity of the Marks. The Parties agree that USU has the sole right and discretion to control the filing and prosecution of all applications to register rights in the Mark in all countries of the world, and the maintenance of any and all such registrations. The Parties agree to cooperate, at USU's request and expense, in any action (including the conduct of legal proceedings) that USU deems necessary or desirable to establish or preserve USU's exclusive rights in and to the Marks. With the exception of USU, the other Parties agree that they shall not register or attempt to register the Mark.

C. Quality Maintenance. USU shall have the right to exercise quality control over the other Party's use of the Marks, as reasonably necessary to maintain the validity and strength of the Marks, and to protect the goodwill associated therewith. The Parties shall comply with all applicable laws and regulations with regard to use of the Marks and sales, distribution, and advertising of any associated goods and services.

D. Quality Standards. The Parties agree that their use of the Mark and associated goods and services shall conform to standards of quality established by USU.

E. Inspection. Upon reasonable notice to any Party, USU may review and inspect that Party's use of the Marks, and the inspected Party shall promptly comply with any reasonable requests from USU to correct or to improve the use of the Marks, as reasonably necessary to maintain the validity and strength of the Marks and to protect the goodwill associated therewith.

12. Conflicts of Interest

12.1. Responsibility. Each Party assumes and retains full responsibility for discovering and managing any conflicts of interests that pertain to (i) the research activities of its employees or students or (ii) the professional and academic activities of its employees . Each Party represents and warrants that it has a current conflict of

interest policy, will maintain a current conflict of interest policy throughout the Term, and agrees to adhere to said policy throughout the Term.

12.2. Disclosure. If a Party identifies a conflict of interest pertaining to one of its employees or students who is involved with ASPIRE, then it shall promptly inform the ASPIRE Leadership Team of both the existence of the conflict of interest and its associated conflict of interest management plan.

13. Diversity, Inclusion, and Non-Discrimination

13.1. Diversity and Inclusion. As detailed in the NSF Cooperative Agreement, the Parties recognize and acknowledge that ASPIRE, including USU and the Core University Partners individually, has a goal of promoting diversity and inclusion among the persons participating in ASPIRE, as benchmarked against the academic engineering national averages. Each Party agrees to promote diversity and inclusion of all underrepresented populations in engineering within its own organization with regard to its faculty, staff, and students participating in ASPIRE. Additionally, the Parties agree to promote and encourage diversity and a culture of inclusion in performing the duties and responsibilities described herein. USU and the Core Domestic Partner Universities agree to pursue full participation as members in the MIDFIELD national partnership program and to support collection of all data required by NSF for reporting on diversity and culture of inclusion. As specifically highlighted in the NSF Cooperative Agreement, all Parties agree to development of and participation in a faculty recruitment and mentoring plan that includes and emphasizes diversity, particularly in the power and transportation research thrust areas. Also, as highlighted in the NSF Cooperative Agreement, all Parties agree that the Deans, through their participation on the ASPIRE Deans Council, will nurture a culture of inclusion comprising broadening participation at all levels of ASPIRE (leadership team, faculty, undergraduate and graduate students, administrative staff) over the duration of NSF's support, and will stimulate the transdisciplinary nature of ASPIRE including the support and career advancement of its multi-disciplinary faculty engaged in convergent research.

13.2. Non-Discrimination. No Party will discriminate in any way based on race, color, religion, sex, national origin, age, genetic information, sexual orientation or gender identity/expression, disability, status as a protected veteran, or any other status protected by the local, state, or federal law of the United States.

14. Health and Safety. Each Party hereby assumes all responsibilities and liabilities associated with the health and safety of its employees, students, volunteers, and visitors. Each Party shall, at all times, abide by all appropriate fire and safety regulations associated with its facilities, laboratories, equipment, property, etc. and shall comply with all applicable health and safety laws and ordinances.

15. Engineering Workforce Development

15.1. Workforce Development. The Parties acknowledge that one of the purposes of ASPIRE is to support engineering workforce development at all levels and provide opportunities for all ASPIRE participants, including students, faculty, and other participants, as appropriate. ASPIRE is expected to build human capacity for the future

engineering workforce, and contribute to a diverse, globally competitive, and team-oriented engineering workforce that has experience in convergent research, technology advancement, industrial practice, and innovation. ASPIRE is expected to ensure an evidence base for all workforce development and educational activities which is continuously refined in response to feedback. The Parties agree to endeavor to support ASPIRE's efforts to that end according to the ASPIRE Strategic Plan developed and maintained by the ASPIRE Leadership Team, including collection of all data required by NSF for reporting on engineering workforce development.

15.2. University Course Materials. The Parties will collaborate in the development of undergraduate and graduate engineering course materials and curriculum ("*ASPIRE Course Materials and Curriculum*") with the intention of expanding educational and professional development opportunities for all ASPIRE participants. Each Party agrees to disclose to the ASPIRE Leadership Team in a timely manner any ASPIRE Course Materials and Curriculum developed in connection with ASPIRE funds. Course materials and content independently developed by the Parties may also be designated as ASPIRE Course Material and Curriculum after presentation to and approval by the ASPIRE Leadership Team. Such materials will be considered ASPIRE Data and shared among the Parties through the ASPIRE data sharing platform. The copyrights associated with any such materials shall be held by the respective developers of such materials. However, each Party shall have a license to use any and all ASPIRE Course Materials and Curriculum for academic purposes.

15.3. University Courses. The Parties agree to collaborate to provide all ASPIRE participants with access, either by audit or through credited course work, to their respective courses that employ or use APSIRE Course Materials and Curriculum. The administration of any such courses shall be coordinated between the Parties in good faith, with a primary objective of providing as many students as possible with access to such courses. The Parties agree that the Deans, through their participation on the ASPIRE Deans Council, will endeavor to break down barriers that limit access to ASPIRE participants to such courses.

15.4. Educational Pathways. The Parties acknowledge that ASPIRE is expected to create inclusive and diverse educational pathways for the engineering workforce at every level of education or professional development (*e.g.*, pre-college, undergrad, graduate, trades, and continuing education, etc.) to participate in ASPIRE programs. The Parties agree that the Deans, through their participation on the ASPIRE Deans Council, will endeavor to improve educational pathways into ASPIRE-related programs on their respective campuses, for example through guaranteed admission agreements with pre-college collaborators, collaborations with community colleges and trade schools, and articulation agreements to provide credit for military service, work experience in relevant trades, and/or community college courses.

16. Family Education Rights and Privacy Act ("FERPA").

16.1. Compliance. Each of the Parties will comply with FERPA in each Party's respective handling of Confidential Student Information which may circulate between the Parties.

16.2. Definition. "Confidential Student Information" is defined as information that is personally identifiable to a student who is or was enrolled at USU, UTEP, Purdue,

UCB, or UA by any of the following means: the student's name, the name of the student's parent or other family members; the address of the student or student's family; a personal identifier, such as an identification number, or biometric record; other indirect identifiers, including but not limited to the student's date of birth, place of birth, and mother's maiden name; or any other information that, alone or in combination, is linked or linkable to a specific student that would allow a reasonable person in the school community to identify the student with reasonable certainty and includes information supplied to one Party by another as well as any information provided by any Party's students and third parties to the another Party.

16.3. Marking. Confidential Student Information shall be clearly marked as "FERPA confidential" or otherwise designated as being subject to FERPA in the written communication(s) or documents(s) associated with any Confidential Student Information.

16.4. Confidentiality. Each Party represents and certifies that it: (1) will protect and hold in strict confidence all Confidential Student Information it receives from or on behalf of any other Party (or its students), including without limitation, academic information, professional training and/or certifications, evaluations of students, health and other insurance information, and the results of criminal background checks and/or drug testing or treatment information; (2) will not, except with the written consent of the student, use Confidential Student Information for any purpose other than to carry out the purposes of the Agreement; and (3) will not disclose Confidential Student Information except to authorized individuals within its organization who have a legitimate need to know Confidential Student Information to carry out the purposes of the Agreement.

16.5. Control and Breach. With respect to the use and maintenance of Confidential Student Information originating from a given Party ("Controlling Party"), each Party agrees that it is under the direct control of the Controlling Party. If any Party ("Determining Party") reasonably determines in good faith that another Party ("Breaching Party") has materially breached any of its confidentiality obligations under this Agreement or has violated FERPA, then such Determining Party, in its sole discretion, will have the right to require the Breaching Party to submit to a plan of monitoring and reporting; provide the Breaching Party with a fifteen (15) day period to cure the breach; or terminate the Agreement immediately. Before exercising any of these options, the Determining Party will provide written notice to the Breaching Party describing the violation and the action it intends to take. If the Family Policy Compliance Office of the U.S. Department of Education determines that the Breaching Party improperly disclosed personally identifiable information obtained from the Determining Party's education records, the Determining Party may not allow the Breaching Party access to education records for at least five years.

17. **Liability**. Each Party shall be responsible for its own acts and omissions and shall be liable for payment of that portion of any and all claims, liabilities, injuries, suits, and demands and expenses of all kinds that may result or arise out of any alleged malfeasance or neglect caused or alleged to have been caused by such Party or its employees, agents, or subcontractors, in the performance or omission of any act or responsibility of said Party under this Agreement. No Party shall be liable for any special, consequential, lost profit, expectation, punitive or other indirect damages in connection with any claim arising out of or relating to this Agreement, whether grounded in tort (including

negligence), strict liability, contract, or otherwise. The Parties recognize that the Effective Date is set before the signature dates. Each Party waives any claim that it might have from a breach of any term of this Agreement by any Party that occurred after the Effective Date but prior to the respective dates of signature of each Party.

18. Notice

18.1. Notice. Any payment, notice, or other communication required or permitted to be given to any Party hereto shall be in writing and shall be deemed to have been properly given and effective: (a) on the date of delivery if delivered in person during recipient's normal business hours; or (b) on the date of attempted delivery if delivered by courier, express mail service or first-class mail, registered or certified. Such notice shall be sent or delivered to the following addresses as applicable:

For Technical Purposes:	For Administrative/Legal Purposes:
Attn: Dr. Regan Zane Utah State University	Attn: Office of General Counsel Utah State University
9805 Old Main Hill Logan, UT 84322 Email: regan.zane@usu.edu Phone: 435-797-9118	1465 Old Main Hill Logan, UT 84322 Email: legal@usu.edu Phone: 435
Attn: Dr. Soheil Nazarian The University of Texas El Paso 500 W University Ave El Paso, TX 79968-8900 Email: nazarian@utep.edu Phone: 915-747-6911	Attn: Dr. Roberto A. Osegueda The University of Texas El Paso 500 W University Ave El Paso, TX 79968-8900 Email:ORSPRA@utep.edu Phone: 915-747-5680
Attn: Dr. Konstantina Gkritza Purdue University HAMP G167B 510 Stadium Mall Dr, West Lafayette, IN 47907 Email: nadia@purdue.edu Phone: (765) 494-4597	Attn: Director, SPS Contracting Purdue University 155 South Grant Street West Lafayette, IN 47906 Email: spscontr@purdue.edu Phone: 765-494-3863
Attn: Qin (Christin) Lv University of Colorado Boulder 1111 Engineering Drive 430 UCB Boulder, CO 80309-0430 Email: qin.lv@colorado.edu Phone: 303.492.8821	Attn: Office of Contracts & Grants University of Colorado Boulder 3100 Marine Street Room 481, 572 UCB Email: ocgcontracts@colorado.cu Phone: 303.492.6221
Attn: Prof. Grant Covic University of Auckland Department of Electrical, Computer, and Software Engineering Building 405 Private Bag 92019 Auckland 1142 Email: ga.covic@auckland.ac.nz Phone: +64 9 9238102	University of Auckland c/o UniServices – Contracts & Growth (Engineering) Level 10, 49 Symonds St, Auckland, New Zealand Email: contracts@auckland.ac.nz Phone: +64 9 373 7522

19. Miscellaneous

19.1. Choice of Law and Venue. The Agreement and any dispute related thereto will be governed by the laws of the United States and subject to the jurisdiction of the United States federal and state courts. Venue for any lawsuits, claims, or other

proceedings between the Parties relating to or arising under the Agreement shall be handled in a United States court of competent jurisdiction.

19.2. Legal Compliance. Each of the Parties shall at all times comply with all federal, state, and local laws, ordinances, regulations, and orders that are applicable its participation in ASPIRE and to this Agreement and its performance hereunder, including, but not limited to laws, ordinances, regulations, and orders relating to discrimination, anti-trust, scientific research, employment, students, workplace safety, etc. Without limiting the generality of the foregoing, each Party shall at all times, at its own expense, obtain and maintain all certifications, credentials, authorizations, licenses, and permits necessary to conduct its business relating to the exercise of its rights and the performance of its obligations under this Agreement.

19.3. Government Records.

A. USU: Government Records and Management Act. The Parties acknowledge that USU is a governmental entity subject to the Utah Government Records Access and Management Act, Utah Code Ann., Section 63G-2-101 et seq., as amended ("GRAMA"); that certain records within USU's possession or control, including without limitation, the Agreement (but not including (i) proprietary software or (ii) materials to which access is limited by the laws of copyright or patent), may be subject to public disclosure; and that USU's confidentiality obligations shall be subject in all respects to compliance with GRAMA. If USU receives a request pursuant to GRAMA that involves any record that includes the Confidential Information of any of the Core University Partners, then it will inform and coordinate with the Party owning the Confidential Information prior to answering any such a request.

B. UTEP: The Parties acknowledge that UTEP is a governmental entity subject to the Record Retention laws governed by Texas Government Code Chapter 441. Requests for any records shall be handled according to the Texas Public Information Act.

C. Purdue: Purdue University is a state agency subject to Indiana's Access to Public Records Act, which includes the following exemptions from disclosure: (1) information concerning research conducted under the auspices of a state educational institution, including information concerning any negotiations made with respect to the research and received from the Party involved in the research, is exempt from disclosure; and (2) records containing trade secrets. Ind. Code § 5- l 4-3-4(a)(4),(6). Should a request to disclose be made for this agreement or for any Confidential Information disclosed pursuant to its terms, and should Purdue determine that it may be required or compelled pursuant to law to disclose the information, Purdue will first notify the other party(ies) and allow an opportunity for the party(ies) to assert a legitimate basis for nondisclosure

D. UCB: The Parties acknowledge that UCB is subject to the Colorado Open Records Act (C.R.S. §§ 24-72-201 et seq.) ("CORA") and that UCB's obligations under CORA supersede its obligations under this Agreement. Appropriately marked Confidential Information shall be treated by UCB as

confidential/proprietary to the extent permissted under C.R.S. §§ 2472-204. Notwithstanding, nothing herein shall preclude UCB's release or use as required for business reporting or under CORA.

E. UA: The Parties acknowledge that UA is a crown entity subject to the Official Information Act 1982 (NZ) which may mean information is subject to public disclosure ("*OIA*"). If UA receives a request pursuant to OIA that involves any record that includes the Confidential Information of any of the Core University Partners, then it will inform and coordinate with the Party owning the Confidential Information prior to answering any such a request, to the extent that it is able to do so in compliance with the OIA.

19.4. Governmental Immunity.

A. USU: The Parties further acknowledge that USU is a governmental entity under the Governmental Immunity Act of Utah, Utah Code Ann., Section 63G-7-101 et seq., as amended (the "Act"). Nothing in the Agreement shall be construed as a waiver by USU of any protections, rights, or defenses applicable to USU under the Act, including without limitation, the provisions of Section 63G-7-604 regarding limitation of judgments. It is not the intent of USU to incur by contract any liability for the operations, acts, or omissions of Licensee or any third party and nothing in the Agreement shall be so interpreted or construed. Without limiting the generality of the foregoing, and notwithstanding any provisions to the contrary in the Agreement, any indemnity obligations of USU contained in the Agreement are subject to the Act and are further limited only to claims that arise directly and solely from the negligent acts or omissions of USU. Any limitation or exclusion of liability or remedies in the Agreement for any damages other than special, indirect or consequential damages, shall be void and unenforceable.

B. UTEP: The parties expressly agree that, notwithstanding any provision in this Agreement stating that UTEP waives or releases a right to make a claim against any Party or exculpates any Party from liability, such waiver, release, or exculpation shall be effective only to the extent authorized by the Constitution and laws of the State of Texas. Notwithstanding any provision in this Agreement stating that a Party will pay court costs, costs of suit and/or attorney's fees incurred by the other Party or any other person, UTEP shall be obligated to pay attorney's fees only to the extent authorized by the Constitution and laws of the State of Texas. Notwithstanding any provision in this Agreement specifying remedies to which the Parties shall be entitled, or stating that UTEP consents to the jurisdiction of any court, no provision in this Agreement shall constitute nor is it intended to constitute a waiver of UTEP's or the State of Texas' sovereign immunity to suit. THE PARTIES ARE AWARE THAT THERE ARE CONSTITUTIONAL AND STATUTORY LIMITATIONS ON THE AUTHORITY OF UTEP (A TEXAS STATE AGENCY) TO ENTER INTO CERTAIN TERMS AND CONDITIONS THAT MAY BE PART OF THIS AGREEMENT, INCLUDING, BUT NOT LIMITED TO, THOSE TERMS AND CONDITIONS RELATING TO LIENS ON UTEP'S PROPERTY; DISCLAIMERS AND LIMITATIONS OF WARRANTIES; DISCLAIMERS AND LIMITATIONS OF LIABILITY FOR DAMAGES; WAIVERS, DISCLAIMERS AND LIMITATIONS OF LEGAL RIGHTS, REMEDIES, REQUIREMENTS AND PROCESSES;

LIMITATIONS OF PERIODS TO BRING LEGAL ACTION; GRANTING CONTROL OF LITIGATION OR SETTLEMENT TO ANOTHER PARTY; LIABILITY FOR ACTS OR OMISSIONS OF THIRD PARTIES; PAYMENT OF ATTORNEYS' FEES; DISPUTE RESOLUTION; INDEMNITIES; AND CONFIDENTIALITY (COLLECTIVELY, THE "LIMITATIONS"), AND TERMS AND CONDITIONS RELATED TO THE LIMITATIONS WILL NOT BE BINDING ON UTEP EXCEPT TO THE EXTENT AUTHORIZED BY THE LAWS AND CONSTITUTION OF THE STATE OF TEXAS.

C. Purdue: The Parties acknowledge and agree that Purdue is a governmental entity of the State of Indiana. Nothing in the Agreement shall be construed as a waiver by Purdue of any immunities, rights, or defenses applicable to Purdue. It is not Purdue's intent to incur by contract any liability for the operations, acts, or omissions of any third party and nothing in the Agreement shall be so interpreted or construed. Without limiting the generality of the foregoing, and notwithstanding any provisions to the contrary in the Agreement, any of Purdue's indemnity obligations contained in the Agreement are subject to the Indiana Constitution and Indiana State Laws and are further limited only to claims that arise directly and solely from the grossly negligent acts or omissions of Purdue.

D. UCB: The Parties understand and agree that the liability for claims and injuries to persons or property arising out of the negligence of UCB, its departments, institutions, agencies, boards, officials and employees, related to actions that lie in tort or could lie in tort, is controlled and limited by the Colorado Governmental Immunity Act, Colorado Revised Statue § 24-10-101 et seq (CGIA). Any provision of this Agreement, whether or not incorporated herein by reference shall be controlled, limited and otherwise modified so as to limit any liability of UCB and the State of Colorado to the above cited laws. It is specifically understood and agreed that nothing contained in this paragraph or elsewhere in this Agreement shall be construed as an express or implied waiver by UCB of its governmental immunity or of the governmental immunity of the State of Colorado, as an express or implied acceptance by UCB of liabilities arising as a result of actions which lie in tort or could lie in tort in excess of the liabilities allowable under CGIA. Parties also agree that nothing in this Agreement shall be construed as a pledge of the full faith and credit of the State of Colorado, as the assumption by UCB of a debt, contract or liability of the other Parties, Affiliated Partner Universities, Industry Members, Innovation Members or National Laboratory Members in violation of Section 1 of the Constitution of Colorado.

19.5. Insurance.

A. USU. USU carries insurance through the State Risk Manager of the State of Utah up to the limits required by the State Risk Manager and applicable law. Nothing in the Agreement shall require USU to carry different or additional insurance, and any obligations of USU contained in the Agreement to name a party as additional insured shall be limited to naming such party as additional insured with respect to USU's negligent acts or omissions.

B. UTEP: UTEP is self-insured for general liability and workers compensation coverage under a self-managed program as authorized by Texas Labor Code, Chapter 503. It is the stated policy of the State of Texas not to acquire commercial general liability insurance for torts committed by employees of the state who are acting within the scope of their employment. Rather, Chapter 101 of the Civil Practice and Remedies Code states "that a

governmental unit in the state is liable for property damage, personal injury and death proximately caused by the wrongful act or omission of negligence of an employee acting within his scope of employment ...” Liability of the state government under this chapter is limited to money damages in a maximum amount of $250,000 for each person and $500,000 for each single occurrence for bodily injury or death and $100,000 for each single occurrence for injury to or destruction of property. Nothing in this Agreement shall require UTEP to carry different or additional insurance, and any obligations of UTEP contained in the Agreement to name a party as additional insured shall be limited to naming such party as additional insured with respect to UTEP’s negligent acts or omissions.

C. Purdue: Nothing in this Agreement shall require Purdue to carry different or additional insurance to that which it carries in its ordinary course of activities, and it shall not be required to name any party as additional insured.

D. UCB: Nothing in this Agreement shall require UCB to obtain or maintain different or additional insurance to that which it carries in its ordinary course of activities, and it shall not be required to name any party as additional insured.

E. UA: Nothing in this Agreement shall require UA to carry different or additional insurance to that which it carries in its ordinary course of activities, and it shall not be required to name any party as additional insured.

19.6. Assignment. No Party may assign, transfer, or otherwise dispose of its rights, interests, or duties hereunder, in whole or in part, to any third party without prior written approval from the other Parties.

19.7. Relationship of Parties. In assuming and performing the obligations of this Agreement, the Parties are each acting as independent parties and none shall be considered or represent itself as a joint venture, partner, agent or employee of the other.

19.8. No Third-Party Beneficiaries. The Parties do not confer any rights or remedies upon any other third-party other than the Parties to this Agreement and their respective successors and permitted assigns.

19.9. Headings. No headings in this Agreement affect its interpretation.

19.10. Exhibits. Exhibits A, B, C, D, E, and F are incorporated by reference in their entirety in this Agreement. Exhibit A and B are provided for referential purposes. Exhibits C, D, and E are template agreements and, when used by ASPIRE, are intended to operate independent of this Agreement; as such, these template agreements include their own defined terms. Exhibit F includes additional defined terms that coordinate with the defined terms in this Agreement. If during the Term, any of the Exhibits are updated, USU will provide timely and written notification to the Partner Universities of any updates or adjustments.

19.11. Amendment and Supplement. Any amendment and/or supplement of this Agreement shall come into force only after a written agreement is signed by both Parties. The amendment and supplement duly executed by both Parties shall be part of this Agreement and shall have the same legal effect as this Agreement.

19.12. Merger. This Agreement embodies the entire understanding of the Parties and supersedes all previous communications, representations, or understandings, either oral or written, between the Parties relating to the subject matter thereof.

19.13. Severability. The provisions of this Agreement are severable, and in the event that any provision of this Agreement shall be determined to be invalid or

unenforceable under any controlling body of the law, such invalidity or unenforceability shall not in any way affect the validity or enforceability of the remaining provisions herein.

--SIGNATURES ON NEXT PAGE--

IN WITNESS THEREOF the Parties hereto have caused this Agreement to be duly executed on their behalf by a duly authorized representative as of the Effective Date set forth above.

UTAH STATE UNIVERSITY

By:_____
David T. Cowley
Vice President for Business and Finance Date: _____

PURDUE UNIVERSITY

By:_____
Ken Sandel
Senior Director, SPS
Date: _____

UNIVERSITY OF COLORADO
BOULDER

By:_____
Terri Fiez
Vice Cancellor for Research & Innovation
Date:_____

By:_____
Gary L. Henry
Director of Contracts
Date:_____

UNIVERSITY OF TEXAS AT EL PASO

By:_____
Roberto A. Osegueda
Vice President for Research
Date:_____

UNIVERSITY OF AUCKLAND

By:_____
Prof. James Metson
Deputy Vice-Chancellor (Research)
Date: _____

EXHIBIT A: NSF Cooperative Agreement

NATIONAL SCIENCE FOUNDATION

Award Notice

Award Number (FAIN): 1941524
Managing Division Abbreviation: EEC **Amendment Number:** 000

AWARDEE INFORMATION

Award Recipient: Utah State University
Awardee Address: Sponsored Programs Office 1415 Old Main Hill ~ Room 64 Logan, UT 843221415
Official Awardee Email Address:sponsoredprograms@usu.edu
Unique Entity Identifier (DUNS ID): 072983455

AMENDMENT INFORMATION

Amendment Type: New Project
Amendment Date: 08/03/2020
Amendment Number: 000
Proposal Number: 1941524
Amendment Description:

The National Science Foundation hereby awards a Cooperative Agreement for support of the project described in the proposal referenced above as modified by revised budget dated 05/08/2020, and email dated 07/27/2020.

AWARD INFORMATION

Award Number (FAIN): 1941524
Award Instrument: Cooperative Agreement
Award Date: 08/03/2020
Award Period of Performance: Start Date: 09/01/2020 End Date: 08/31/2025
Project Title: NSF Engineering Research Center for Advancing Sustainability through Powered Infrastructure for Roadway Electrification (ASPIRE)
Managing Division Abbreviation: EEC
Research and Development Award: Yes
Funding Opportunity: NSF 19-503 Gen-4 Engineering Research Centers
CFDA Number and Name: 47.041 Engineering Grants

FUNDING INFORMATION

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Amount Obligated by this Amendment: $3,500,000
Total Intended Award Amount: $26,000,000
Total Approved Cost Share or Matching Amount: $4,375,795
Total Amount Obligated to Date: $3,500,000
Expenditure Limitation: Not Applicable

Contingent on the availability of funds and scientific progress of the project, NSF expects to continue support at approximately the following level:

Fiscal Year	Increment Amount
2021	$4,500,000
2022	$6,000,000
2023	$6,000,000
2024	$6,000,000

PROJECT PERSONNEL

Principal Investigator: Regan A Zane	**Email:** regan.zane@usu.edu	**Institution:** Utah State University
Co-Principal Investigator: Soheil Nazarian	**Email:** nazarian@utep.edu	**Institution:** University of Texas at El Paso
Co-Principal Investigator: Christopher Fawson	**Email:** chris.fawson@usu.edu	**Institution:** Utah State University
Co-Principal Investigator: Konstantina Gkritza	**Email:** nadia@purdue.edu	**Institution:** Purdue University
Co-Principal Investigator: Qin Lv	**Email:** Qin.Lv@Colorado.EDU	**Institution:** University of Colorado at Boulder

NSF CONTACT INFORMATION

Managing Grants Official (Primary Contact) **Name:** Denise B. Robinson **Email:** drobinso@nsf.gov	**Awarding Official** **Name:** Martha I. Dodson **Email:** mdodson@nsf.gov	**Managing Program Officer** **Name:** Dana L. Denick **Email:** DDENICK@nsf.gov

GENERAL TERMS AND CONDITIONS

This Cooperative Agreement (CA) is entered into between the United States of America, represented by the National Science Foundation (NSF), and the above named Awardee pursuant to the authority of the National Science Foundation Act of 1950, as amended (42 USC 1861-1875). This CA is provided electronically to the Awardee. The Awardee is responsible for full compliance with all Programmatic and Financial/Administrative Terms and Conditions as initially stated or as updated over the life of this CA. The Awardee's request to draw down funds

under this CA will represent acceptance by the Awardee of all Terms and Conditions of the CA. The Authorized Organizational Representative (AOR) will be electronically notified of any changes to these Terms and Conditions and is encouraged to immediately review these changes and contact the Grants and Agreements Official or Program Officer within thirty days with any questions.

CA-FATC
This award is subject to the Cooperative Agreement Financial & Administrative Terms and Conditions (CA-FATC), dated 02/12/2019, available at https://www.nsf.gov/awards/managing/co-op_conditions.jsp.

This award is made in accordance with the provisions of NSF Solicitation: NSF 19-503 Gen-4 Engineering Research Centers.

To view the Award Document in FastLane go to:
https://www.fastlane.nsf.gov/researchadmin/emailLoginHome.do?awardId=1941524&amendmentId=000

FATC AND PTC

Financial and Administrative Terms and Conditions (FATC)

Award Specific FATC:

1. ANTICIPATED FUNDING SCHEDULE:

Performance Year	Funding Year	Base Award
First (2020 –2021)	FY 2020	$ 3,500,000
Second (2021-2022)	FY 2021	$ 4,500,000
Third (2022-2023)	FY 2022	$ 6,000,000
Fourth (2023-2024)	FY 2023	$ 6,000,000
Fifth (2024-2025)	FY 2024	$ 6,000,000
	5 Year Total	$26,000,000

2. Funding and Funding Schedule

It is the intent of the Foundation to provide up to $26,000,000 to support the ERC for a period of 60 months. The project will begin on 9/1/2020. This Agreement may continue in effect through August 31, 2025 upon evaluation/review as stated in the General Programmatic Terms and Conditions of this Cooperative Agreement. Continued funding will be provided by Amendment to this Cooperative Agreement by the NSF Grants and Agreements Official. The following Table indicates: (1) the year funded, (2) the type of review, (3) the fiscal year of funding action, (4) the performance period funded. This Table includes the initial five-year period of this Agreement, plus the five-year renewal period.

Prior to participation in the project, obtain from the Head of School/Principal or district-level authority responsible for curriculum, written approval prior to involvement of pre-college students in pre-college education research and development, pilot-testing, evaluation, and revision of experimental and innovative pre-college curriculum.

b. Include in every publication, testing, or distribution agreement involving instructional materials developed under this grant (including, but not limited to, teachers' manuals, textbooks, films, tapes, or other supplementary material) a requirement that such material be made available within the school district using it for inspection by parents or guardians of children engaged in educational programs or projects using such material of that school district.

7. All materials produced as part of this project, including electronic components such as World Wide Web pages, must include a clear indication of source(s) of support (both NSF and any other contributors).

8. Funds provided for participant support may not be diverted by the Awardee to other categories of expense without the prior written approval of the cognizant NSF Program Officer. Since participant support cost is not a normal account classification, the awardee organization must be able to separately identify participant support costs. It is highly recommended that separate accounts, sub-accounts, sub-task, or sub-ledgers be established to accumulate these costs. The Awardee should have written policies and procedures to segregate participant support costs.

9. Costs of entertainment, amusement, diversion and social activities, and any costs directly associated with such costs (such as meals, lodging, rentals, transportation, and gratuities) are unallowable. When certain meals are an integral and necessary part of a conference or meeting (i.e., working meals where business is transacted), grant funds may be used for such meals. Grant funds may also be used to furnish a reasonable amount of coffee or soft drinks for conference or meeting participants and attendees during coffee breaks. No NSF funds may be spent on meals or coffee breaks for intramural meetings of an organization or any of its components, including, but not limited to, laboratories, departments, and centers.

Programmatic Terms and Conditions (PTC)

Award Specific Programmatic Terms and Conditions

The terms and conditions stated herein are the minimum requirements to fulfill the responsibilities to achieve the goals expected under ERC solicitation NSF 19-503. All referenced documents including websites are made a part of this Cooperative Agreement. The absence of a compelling strategy for achieving demonstrable impact in and of the key features of a Gen-4 Engineering Research Center (ERC) incorporated in this agreement and described in full details in NSF 19-503 is a sufficient reason to deny continued funding.

The following includes revisions to the generic ERC terms and conditions that impact all ERCs since NSF 19-503 was issued.

1. Project Description

The NSF Engineering Research Center for Advancing Sustainability through Powered Infrastructure for Roadway Electrification (ASPIRE) will take a systems-of-systems approach to ubiquitous charging with wireless and wired charging solutions. This unique approach will focus on the integration of systems and interoperability across vehicle classes and user groups. ASPIRE's bold vision offers key contributions toward bringing society to a tipping point with respect to transportation electrification. ASPIRE will integrate and advance smart powered parking, fast charging,

and dynamic wireless charging through the co-optimization of grid and transportation networks; providing an opportunity to reimagine transportation and energy infrastructure. ASPIRE's comprehensive research program is designed to benefit from deep collaboration at the nexus of electrical-mechanical-thermal design of vehicles, charging systems, pavements, power systems, and data fusion; integrating dynamic optimization of the networked and co-dependent systems, econometrics, policy, user acceptance, and environmental/societal impacts. The ERC's holistic convergent research approach is tightly interwoven with development of a diverse engineering workforce that is critical to advancing and sustaining the envisioned equitable transformations across the automotive, transportation, and electric utility industries.

Project Governance and Governing Responsibilities

The Awardee will ensure that an efficient and effective project governing structure is in place throughout the award period to support all critical significant project activities. The Awardee will also ensure efficient and effective performance of all project responsibilities by the governing components throughout the award period.

2. Key Personnel

Except for the Principal Investigator(s) (PIs) or Co-PIs identified in this award, requests to make any changes to personnel, organizations, and/or partnerships specifically named in the proposal, that have been approved as part of this award, shall be submitted in writing to the cognizant NSF Program Official for approval prior to any changes taking effect. Requests for prior approval of changes to the PI(s) must be submitted through FastLane/Research.gov for review by the cognizant NSF Program Official and approval by an NSF Grants Officer.

The following positions are considered Key Personnel and are essential to the work of this ERC. Any contemplated changes in Key Personnel for these positions should be discussed with the NSF Program Officer. Written approval from the NSF Program Officer must be secured before any change is implemented. Any anticipated change in the people serving as the Center Director or the Deputy Director to be effective within the next performance year must be disclosed in the ERC's annual report, and a succession plan must be provided in the report.

- PI/Center Director: Regan Zane, Utah State University
- Managing Director: Tallis Blalack, Utah State University
- Innovation Director: David Christensen, Utah State University
- Administrative Director: Angie Griffeth, Utah State University
- DCI Director: Rosalee Clawson, Purdue University
- EWD Director: Donna Riley, Purdue University
- Co-PI/Transportation Thrust Lead: Soheil Nazarian, University of Texas El Paso
- Co-PI/Adoption Thrust Lead: Nadia Gkritza, Purdue University
- Co-PI/Data Thrust Lead: Qin (Christine) Lv, University of Colorado Boulder
- Co-PI/International: Chris Fawson, Utah State University

- EWD Co-Director: Dragan Maksimovic, University of Colorado Boulder
- Pre-college Director: Jacquelyn Sullivan, University of Colorado Boulder
- DCI Co-Director: Ivonne Santiago, University of Texas El Paso
- Innovation Co-Director: Jana Milford, University of Colorado Boulder
- Innovation Co-Director: Imad Abdallah, University of Texas El Paso
- Transportation Thrust Co-Lead: Marv Halling, Utah State University
- Adoption Thrust Co-Lead: Antje Graul, Utah State University
- Power Thrust Lead: Steven Pekarek, Purdue University
- Power Thrust Co-Lead: Paras Mandal, University of Texas El Paso
- Data Thrust Co-Lead: Jacob Gunther, Utah State University

In the case of the departure of the Center Director, the lead university, and the affected university, in consultation with NSF, will find a replacement suitable to NSF. Before a change is implemented within the lead university, written approval from the NSF Program Officer must be secured. In the case of the departure of (a) the Center Director from the lead university, or (b) one of the PIs from a core partner university, and NSF does not find the person recommended by the Center to be suitable, the Foundation reserves the right to recommend termination of the ERC or the core partner's affiliation with the ERC.

The Center Director/PI will commit (75% - 100%) of their time during the ramp up phase, and at least 50% of their time during the steady-state phase of the project to the administration of the Center through ERC funding, cost share funding, or through commitment by the PI's home institution. The ERC Administrative Director should be supported at 100% for the duration of the Center.

3. Partner Institutions

- Lead University: Utah State University
- Core Partners:
  - Purdue University
  - University of Texas, El Paso
  - University of Colorado Boulder
- Affiliated Institutions:
  - Cornell University
  - Colorado State University

- o Virginia Tech
- o University of Colorado Colorado Springs
- o University of Aukland, New Zealand

4. Requirements for the Implementation of the ERC Key Features

Unless otherwise noted, the following requirements for the implementation of the ERC Key Features are required throughout the lifetime of the ERC. Please consult the NSF 19-503 solicitation for more details beyond the requirements stated below.

a. Center-Wide Integrated Strategic Plan: The ERC must have an Integrated Strategic Plan guided by an overarching vision, mission, and goals driven by a significant societal impact that is continuously refined. Additional details are included in the Start-up Strategic Plan Guidelines available at https://www.erc-reports.org/public/library

i. Logic Model: ERCs are expected to develop and maintain a logic model of the overall ERC that illustrates key components of the integrated strategic plan, including inputs, activities, expected outputs and outcomes, desired long-term impacts, and connections among logic model elements.

ii. Evaluation and Assessment Plan: ERCs are expected to develop and maintain an evaluation plan including formative aspects that allow the center to make evidence-based decisions about changes in its activities and summative aspects to provide evidence of impact across all components of the center.

b. Center Governance: The ERC must have a Governance Model that supports the Center's activities through a strong leadership team, well-coordinated management systems, clear roles, responsibilities, and accountability, and well-integrated and active advisory boards.

i. Organizational Chart: ERCs are expected to develop and maintain an organizational chart that demonstrates diverse representation among the leadership of the ERC with an indication of key positions that have yet to be filled and the probable time frame in which they are expected to be filled.

ii. Advisory Boards: Advisory boards are formed to reinforce and support the proper functioning of the ERC's foundational components. Careful consideration must be given to defining each advisory board's functional role and selecting quality board members capable of overseeing that role. Advisory Boards should comprise outside experts who are selected by the ERC Leadership Team and meet collectively as a board at least twice per year to provide guidance to the Center in support of the overall ERC's vision. The structure of the advisory board, such as membership, as well as their corresponding definition of roles, charge to the advisory board, by-laws and operating modes, and modes of engagement with the ERC should be documented.

iii. Council of Deans: Led by the Dean of Engineering from the lead university, this Council of Deans from the lead and core partner institutions meet collectively as a group to provide administrative support of the ERC and to help facilitate multiple elements of the ERC across the lead and core partner universities. If a Non-Lead PI is also an administrator at the Institution eligible to serve on the Council of Deans, she/he should designate an alternate for serving on the Council of Deans while serving as the Non-Lead PI. The two roles cannot be performed by the same person.

iv. Student Leadership Council (SLC): The SLC is responsible for organizing student activities to achieve the ERC's goals, including student professional development. The SLC will be comprised of the Center's undergraduate and graduate students and will have a Chair and a Co-Chair. The Chair will serve as a member of the ERC's Leadership Team. The SLC also is responsible for carrying out an annual SWOT analysis of the ERC and communicating the results to the ERC Director, the ERC's leadership team, and the NSF Site Visit Team (SVT).

c. Facilities and Headquarters: As part of its laboratories and testbed operations, the ERC will institute a formal safety training and monitoring program for all ERC students, faculty, and staff involved in its laboratories and testbeds. These programs will incorporate content that is specific to the laboratory, the project, and/or the testbeds. The intent is to build a culture of safety in laboratory operations and in maintaining a safe workplace in all laboratories.

d. Research: ERCs must ensure that the overall ERC Strategic Plan includes clearly defined goals, objectives, milestones, targets, and performance metrics as pertains to the ERC Research Program.

i. ERC 3-Plane Strategic Planning Chart: ERCs are expected to develop and maintain a 3-Plane Strategic Planning Chart with an updated summary of how the ERC plans to implement activities at each level, including the organization of the research program into thrusts and testbeds to overcome gaps and barriers

ii. Project roadmap and milestones: ERCs are expected to develop and maintain a roadmap that clearly identifies key check points for science and technology developments and have provisions for project re-planning as needed.

iii. Convergence: ERCs are expected to ensure the integration of all thrust areas around the testbeds and stimulate both scientific contributions, in the spirit of convergent research and effective teaming, in all domains while developing the technologies necessary to achieve the goals of the center .

iv. Team Science: ERCs are expected to ensure that the project roadmap, strategic plan and team formation, leadership, and management integrate the whole team across multiple campuses. Include best practices from team science and organizational psychology for successful integration of the transdisciplinary team, encouraging them to become the "culture" of this ERC.

e. Engineering Workforce Development: ERCs must ensure that the overall ERC Strategic Plan includes clearly defined goals, objectives, milestones, targets, and performance metrics as pertains to the ERC Engineering Workforce Development Program.

i. Professional Development: ERCs are expected to ensure that the Engineering Workforce Development program occurs at all levels of the Center and provides opportunities for all ERC members including students, faculty, and external partners as appropriate.

ii. Future Workforce: ERCs are expected to ensure that the Engineering Workforce Development program builds human capacity for the future engineering workforce, and should contribute to a diverse, globally competitive, and team-oriented engineering workforce that has experience in convergent research, technology advancement, industrial practice, and innovation.

iii. Evidence-based Program: ERCs are expected to ensure an evidence base for all workforce development and educational activities which is continuously refined in response to feedback.

iv. Research Experiences for Undergraduates (REU): At least 6 non-ERC students must enroll in an REU program budgeted at a minimum of $42K per year from the ERC base budget. The ERC is encouraged to

submit proposals to the annual Research Experiences for Undergraduates (REU) Site and Research Experiences for Teachers (RET) Site competitions to expand the Center's workforce development impact.

f. Diversity and Culture of Inclusion: ERCs must ensure that the overall ERC Strategic Plan includes clearly defined goals, objectives, milestones, targets, and performance metrics as pertains to the ERC Diversity and Culture of Inclusion Program.

i. Diversity: ERCs are expected to ensure that all participants (leadership, faculty, staff, and students) involved in an ERC shall be diverse in gender, race, ethnicity, and persons with disabilities at levels that are benchmarked against the academic engineering-wide national averages. The vision for diversity should go well beyond numbers and include a description of the integration and roles of diverse participants in the ERC. All ERC institutions and partners are expected to contribute to enhancing the diversity and inclusion of all underrepresented populations in engineering, including gender identity and expression, race and ethnicity (African Americans/Blacks, Hispanic Americans, American Indians, Alaska Natives, Native Hawaiians, and Native Pacific Islanders), disability, LGBTQ+, first generation college and socio-economic status.

ii. Culture of Inclusion: ERCs are expected to create and maintain an inclusive culture for the ERC in which all members feel valued and welcomed, creatively contribute, and gain mutual benefit from participating. A culture of inclusion has many important aspects that are essential for deep collaboration, including the participation of members from a diversity of scientific backgrounds and training (necessary for true convergent research and innovation), participation of members of groups historically underrepresented in engineering and STEM, and a diversity of partner institutions (including industry and practitioner) that will bring different perspectives to bear on the goals of the ERC.

iii. Minority-Serving Institution(s) (MSI): ERCs are expected to include at least one university, as the lead or core domestic partner universities, that serves populations of historically underrepresented students interested in STEM (defined as minority serving institutions, women's colleges, or institutions where the majority of the students are students with disabilities). Participants from any MSI should be engaged across all ERC foundational components.

iv. Institutional Support: Develop a partnership among the affiliated Deans of Engineering, other Deans, and the Chairs of Departments of the affiliated ERC faculty to nurture a culture of inclusion comprising broadening participation at all levels of the Center (leadership team, faculty, undergraduate and graduate students, administrative staff) over the duration of NSF's support. In addition, the Deans should stimulate the transdisciplinary nature of the ERC including the support and career advancement of its multi-disciplinary faculty engaged in convergent research.

g. Innovation Ecosystem: ERCs must ensure that the overall ERC Strategic Plan includes clearly defined goals, objectives, milestones, targets, and performance metrics as pertains to the ERC Innovation Ecosystem Program.

i. Membership Agreement: The membership agreement defines the scope and function of the ERC's partnership with industry/practitioner organizations, the types of membership (e.g. full, affiliate, contributing) the respective membership fees, and the ERC's Intellectual Property (IP) policy.

ii. Membership Fees: Industrial/Practitioner membership fees are treated as Program Income and must be allocated for use for Center purposes. Membership fees that are not expended within one year after they are received must be placed in a Center account and reported to NSF and industry as 'unexpended funds' that are held in reserve for future use. Progress reports on the expenditure of these funds should be

included in the Center's annual report. Industrial/Practitioner members may provide additional support for activities such as sponsored research projects, equipment donations, intellectual property donations, or educational grants.

iii. Costs: Costs for organizing meetings with industry/practitioner members will be borne by the ERC or the participants through a registration fee, as deemed appropriate. Costs for attending these meetings by industry/practitioner members will be borne by their organizations.

iv. Intellectual Property (IP) Policy: The Intellectual Property (IP) policy is expected to be fully prepared in accordance with NSF's Intellectual Property guidelines (NSF Award and Administration Guide, Chapter VI.D, "Intellectual Property") and shared with the NSF program officer within 90 days of the ERC start date.

v. Right of First Refusal: ERCs will classify their IP generated from research under the scope of the ERC's strategic plan as either core IP (IP resulting from center-controlled unrestricted funds) or Project IP (IP resulting from restricted funds that flow through the Center or flow directly to a PI). For Core IP, full member firms/practitioner organizations will be offered first options to negotiate a license. If there is no license forthcoming the Core IP can be offered to any non-member business firm . The ERC should perform a risk analysis to determine the most effective avenue for translating the technology into use (i.e. via (1) development by member firms or if the member firms do not license the ERC's IP, (2) licensing the IP to small or large firms; or (3) spinning out start-up firms that leverage government (state, local, or federal) or Angel investor resources (i.e. SBIR, STTR, SBA, etc.)).

vi. Foreign Firms: Foreign firms may be members of the ERC as long as they participate in accordance with the same membership agreement as U.S. firms do, provided they are in compliance with their domestic laws governing intellectual property.

vii. Industrial Consortia: Industrial consortia may join the ERC, but benefits of membership do not accrue to firms that are consortia members, unless they are also paying membership fees to the ERC as members separate from the consortia.

viii. Conflicts of Interest: Conflicts of interest; if other NSF funds are sought for translational research to accelerate product development, there is potential for a fiduciary conflict of interest to occur if the small business firm makes a sub-award to someone on the ERC leadership team. According to the NSF PAPPG Awards and Administration Guide (AAG) Chapter IV.A, it is the responsibility of the university to screen the project for ERC personnel with conflicts of interest. When conflicts are disclosed for any ERC personnel, the university impacted must develop a conflict management plan for each disclosure.

5. NSF Ongoing Project Oversight

The Awardee will ensure full commitment and cooperation among the governing structure components, and all project staff during ongoing NSF project management and oversight activities. The Awardee will ensure availability of all key institutional partners during any desk or on-site review as well as timely access to all project documentation. If necessary, the Center Director will meet annually at NSF with the NSF ERC Program Officer assigned to the ERC for oversight to discuss progress and other issues. The timing of the visit is to be determined by mutual agreement between the Center Director and ERC Program Officer.

a. Quarterly Teleconferences: During the first 18 months of NSF support and as needed, the NSF Program Officers will hold quarterly teleconferences with the PI/Center Director and other staff to monitor progress.

b. Annual Review: NSF will carry out annual site visits to review the progress and plans of the Center. Renewal reviews will be carried out in year five based on the performance of the ERC, and in consultation with the ERC Director. For the annual review, site visits will be conducted a minimum of six weeks prior to the anniversary date of the award to review performance and to provide advice to the ERC. If the ERC has been placed in the continue support category for two consecutive years by the SVT, the Program Director will have the option of electing to have a reverse site visit at NSF or an abbreviated site visit at the lead institution. The level of continued NSF support will be negotiated with the Awardee annually and will depend upon a review of progress through the annual site review or other means, the performance metrics, the industrial support level, and the Program Officer's assessment of progress, and the availability of funds for the program.

c. Periodic Cost-share Certification: Based on the cost-share requirement that is appropriate for the lead and core institution's Carnegie's classification at the time of submission of the letter of intent (LOI), the expenditure of cost-share from the universities should be documented and certified in Fastlane annual, and periodically as needed. The cost-share expenditure should also be documented in the annual report.

d. Renewal Proposal Review: A renewal proposal is to be submitted as the Year 4 ERC Annual Report during the fourth year of the Center's operation (usually as part of 4th year site visit), the ERC will be evaluated in the manner described above to determine whether NSF will continue to support full ERC operations or provide decreased funding to phase out NSF support of the ERC over Years 5 & 6 of the Center's operation. NSF will specify the format of the progress report/renewal proposal, the review process, and review criteria approximately six months before the date agreed upon for submission. If NSF decides to continue full ERC operations, a new level of funding support will be negotiated for years 6 through 10. Funding for years 9 and 10 will be phased down at a rate of 67% of the prior year to prepare the ERC for self-sufficiency after graduation from NSF support at the end of year 10. If the Awardee chooses not to submit a renewal proposal, NSF support to the ERC will be terminated at the end of the first five years of the Center's operation.

e. Termination of the Cooperative Agreement: NSF reserves the right to recommend termination of the agreement as a result of an annual review indicating insufficient progress in organizing the ERC to achieve its vision, or not addressing one or more key features of the Center. In the case of termination, NSF support to the Center will be phased down over the next year. The duration and the budget for the ERC phase out year will be solely determined by the NSF.

f. ERC Graduation: NSF may carry out a summative site visit or reverse site visit at the end of the 10th year of support to determine the long-term value added by the ERC.

g. ERC Self-Sufficiency: After the end of the Cooperative Agreement and upon graduation, NSF expects the ERC to continue in a self-sufficient mode, maintaining the ERC key features and thriving in an ERC culture with support from funds outside of the NSF ERC Program. Under no circumstances will the graduated ERC receive ERC Program support to continue its full Center operations after the Cooperative Agreement expires.

h. No Cost Extension: ERCs are not permitted a no-cost extension at the end of NSF support. The NSF support will be for 5 years plus an additional 5 years upon successful renewal.

6. Programmatic Activity Requirements

The Awardee will ensure full commitment and cooperation with ERC programmatic activities, including participation in ERC meetings and workshops, and reporting and communication of ERC outcomes.

a. ERC Kick-off Meetings: ERCs are expected to participate in an on-site or virtual ERC Kick-off Meeting to clarify NSF's expectations of the new Center. NSF may also convene a cohort kick-off meeting for the class of ERCs to establish relationships and resources to aid new ERCs in addressing issues related to starting Center operations.

b. ERC Biennial Meeting: The purpose of ERC Biennial Meeting is to share successes and failures across the ERCs, receive updates on the ERC Program, and provide input for future ERC Program improvements. Members of the ERC Leadership Team are required to participate. Costs for attending these meetings should be included in the budget submitted to NSF.

c. Joint NSF Awardee Activities: The ERC will participate in evaluation and other types of studies of the ERC Program initiated by NSF. Such studies include but are not limited to the outcomes and impacts of the ERC Program. The ERC will also participate in workshops organized by NSF to study various issues common to the system of centers. Costs for attending these meetings must be included in the budget submitted to NSF.

d. ERC Website: The Center will establish a Center website containing some elements with public access to make available any information about the Center's goals, activities, and accomplishments. The Center will develop and use an identifying logo that is consistent with the Awardee's policies and procedures and approved by the Awardee as a graphic identity to be used on brochures, newsletters, and on the Center's website.

e. Reporting Requirements: Please see the ERCWeb/ERC Library website at https://www.erc-reports.org/public/library for ERC Guidelines documents.

i. Electronic Access: The Awardee shall establish and maintain an electronic access capability via the Internet to transfer the quantitative and qualitative data to an NSF database. The access to this electronic information will be protected and only NSF will have and grant access.

ii. Annual Report: The Awardee shall submit an Annual Report which will contain specific information including, but not limited to, the following: the progress and plans of the ERC in all areas in achieving its vision with supporting data developed from the data submitted to the ERC Program's data base of indicators of progress and impact, information on revenues and expenditures, and proposed budgets. The annual report is due at least five weeks prior to the annual site visit and at least 11 weeks prior to the anniversary date of the award. The annual report must be prepared according to the online document "Guidelines for Preparing ERC Annual Reports and Renewal Proposals," which is available at ERCWeb/ERC Library website

iii. Data Tables: NSF maintains a database, ERCWeb, to collect and report quantitative and qualitative data for all the ERCs. Each center is required to enter data into the database annually as instructed the "Guidelines for Preparing ERC Annual Reports and Renewal Proposals" and the "Guidelines for ERCWeb Data Entry." Many of the data tables required in the Annual Report are produced from the data submitted to the ERC database. When it is time to assemble the Annual Report, the Center inserts several tables produced by the ERCWeb database, as well as Center-created tables and figures, into the Annual Report as directed.

iv. Year 4 Annual Report/ Renewal Proposal: The Awardee must submit a renewal proposal that contains: (1) a cumulative progress report covering the period from the beginning of the ERC to the date of submission of the renewal proposal; (2) a budget request for support for years 6-10; and (3) plans for Center activities during the years 6-10. NSF will specify the format of the progress report/renewal proposal, the review process, and review criteria approximately six months before the date agreed upon for submission.

v. Final Report: A final report prepared according to guidelines provided by the ERC will be due within 120 days of the expiration date of this Cooperative Agreement. Guidelines for the ERC final report can be found at the ERC Web/ERC Library website.

vi. Project Outcomes Report: A project outcomes report for the general public must be submitted electronically within 120 days following the expiration date of the Cooperative Agreement. This report serves as a brief summary, prepared specifically for the public, of the nature and outcomes of the project. This report will be posted electronically by NSF exactly as it is submitted. Grantees are to ensure that the report does not contain any confidential, proprietary business information; unpublished conclusions or data that might compromise the ability to publish results in the research literature; or invention disclosures that might adversely affect the patent rights or those of the organization, in a subject invention under the award. Project Outcomes Reports are not to contain any personally identifiable information such as home contact information, individual demographic data or individually identifiable information collected from human research participants.

vii. Other Reports: To assist NSF in evaluating the ERC program during years of NSF support and post-graduation, the PI is expected to respond to information requests beyond annual reporting. NSF will provide guidelines for the collection and reporting of data and project information for these evaluations.

7. NSF Requirements

ERCs are expected to comply with the NSF Proposal & Award Policies and Procedures Guide (PAPPG). Part II of the NSF PAPPG sets forth NSF policies and procedures regarding the award, administration, and monitoring of grants and cooperative agreements, located at:

https://www.nsf.gov/pubs/policydocs/pappg20_1/index.jsp.

a. Data Management Plan: The ERC will develop and implement, in coordination with NSF, an ERC-specific and appropriate comprehensive data management plan and policies consistent with the NSF guidelines available at https://www.nsf.gov/bfa/dias/policy/dmp.jsp. The specific guidance from the Directorate for Engineering (ENG) should be followed. It will include, but not be limited to, data curation, storage and sharing of research data, computational methods, algorithms and tools, software, experimental protocols, uncertainty quantifications, etc. including provisions for proprietary and/or private information, as appropriate for the project.

b. Dissemination: ERCs are expected to widely disseminate findings according to the guidance given in the NSF PAPPG Chapter XI section D.4. “Dissemination and Sharing of Research Results”

c. Public Access Policy: NSF's policy on public access to copyrighted material (Public Access Policy) reflects the Foundation's commitment to making certain that, to the extent possible, the U.S. public, industry and the scientific community have access to the results of federally funded scientific research. Pursuant to this policy, the ERC will comply with the requirements for access to copyrighted material as described in the NSF PAPPG Chapter XI section D.2. “Copyright” and at https://www.nsf.gov/news/special_reports/public_access/.

8. Specific Focus Areas for this ERC

a. To be submitted within 90 days of the ERC start date:

i. Strategic Plan and Logic Model

ii. Evaluation and Assessment plan

iii. Center Governance Model and Organizational Chart

iv. Innovation Ecosystem Membership Agreement

v. Intellectual Property Policy

vi. Establishment of charters for boards, councils, and committees

vii. Data Management Plan

viii. Center-Level Risk Management Plan

b. To be completed within 6 months from the ERC start date:

i. Ensure that all positions within the ERC Leadership team are filled. Verify that time and effort commitments to the ERC are consistent with their roles on the team.

ii. Ensure that projects have started, and project management includes planned coordination to enhance the synergy across complementary activities.

iii. Ensure that all technology elements (laboratories, equipment, testbeds) across partner institutions are in place to support the collaborative and integrative elements of the Center that are essential for success.

iv. Ensure development of data access agreements, emphasizing access to user-level data

v. Ensure development of faculty recruitment and mentoring plan, emphasizing diversity in power and transportation thrusts

A. Senior Personnel	
Senior Personnel Count	12.00
Senior Personnel Calendar Months	9.42
Senior Personnel Academic Months	0.00
Senior Personnel Summer Months	5.95
Senior Personnel Amount	$153,045
B. Other Personnel	
Post Doctoral Scholars	
Post Doctoral Count	1.00
Post Doctoral Calendar Months	3.00
Post Doctoral Academic Months	0.00
Post Doctoral Summer Months	0.00
Post Doctoral Amount	$12,500

14

Other Professionals	
Other Professionals Count	6.00
Other Professionals Calendar Months	26.56
Other Professionals Academic Months	0.00
Other Professionals Summer Months	0.50
Other Professionals Amount	$143,207
Graduate Students	
Graduate Students Count	7.00
Graduate Students Amount	$102,201
Undergraduate Students	
Undergraduate Students Count	4.00
Undergraduate Students Amount	$24,180
Secretarial - Clerical	
Secretarial - Clerical Count	0.00
Secretarial - Clerical Amount	$0
Other	
Other Count	0.00
Other Amount	$0
Total Salaries and Wages (A+B)	$435,133
C. Fringe Benefits	$147,230
Total Salaries, Wages, Fringe Benefits (A + B + C)	$582,363
D. Equipment	$0
E. Travel	
Domestic	$99,952
International	$0
F. Participant Support Costs	
Participant Support Costs Stipends	$0
Participant Support Costs Travel	$0
Participant Support Costs Subsistence	$0
Participant Support Costs Other	$0
Total Number of Participants	0.00
Total Participant Costs (F)	$0
G. Other Direct Costs	
Materials Supplies	$48,456
Publication Costs	$700
Consultant Services	$10,000
Computer Services	$0
Subawards	$2,226,701
Other	$76,646

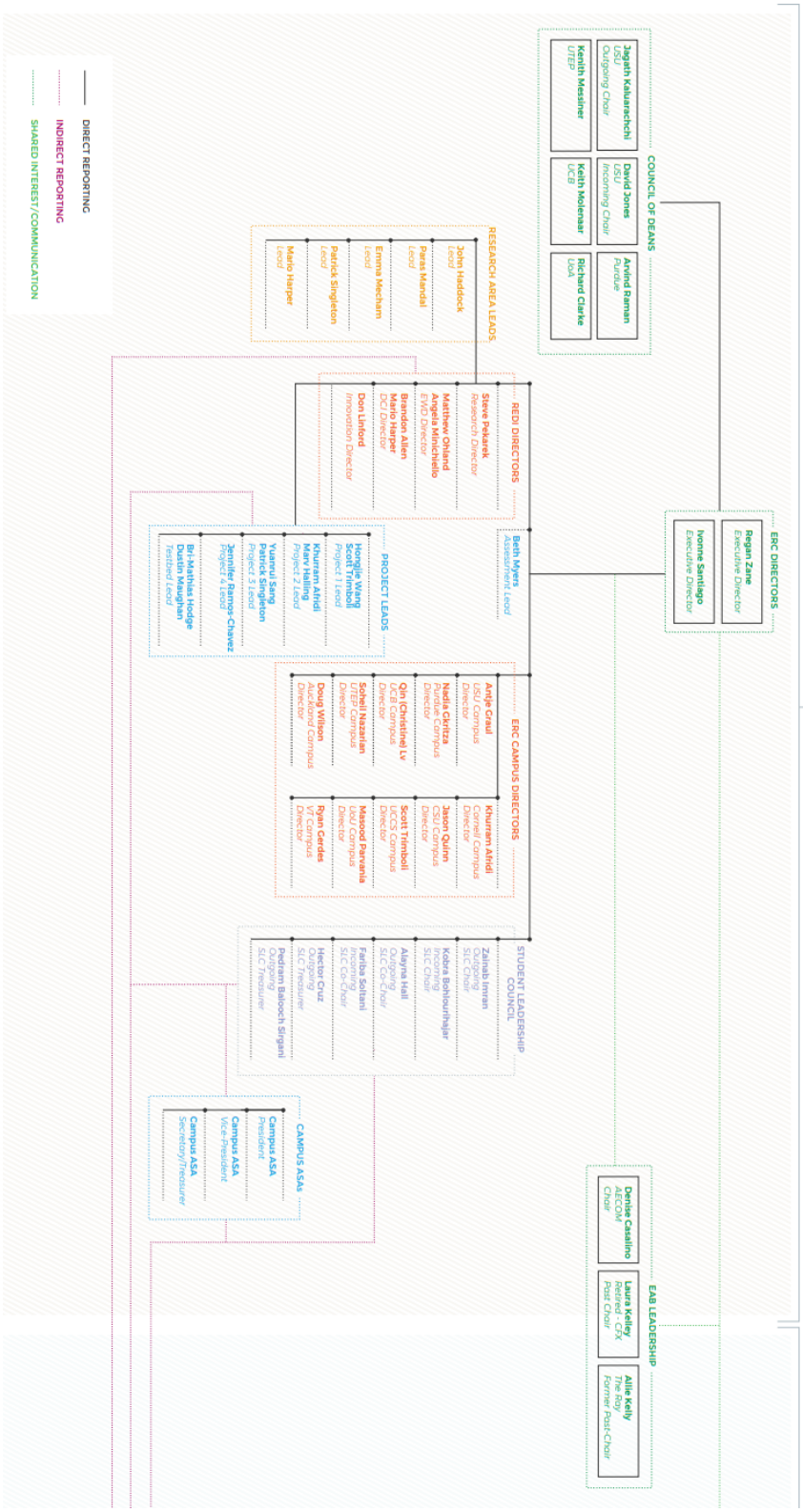
Total Other Direct Costs (G)	$2,362,503
H. Total Direct Costs (A Through G)	**$3,044,818**
I. Indirect Costs*	**$455,182**
J. Total Direct and Indirect Costs (H + I)	$3,500,000
K. Fees	$0
L. Total Amount of Request (J) OR (J + K)	**$3,500,000**
M. Cost Sharing Proposed Level	$4,375,795

*Indirect Cost Rates

Item Name	Indirect Cost Rate
MTDC	45.0000%

These rates are at the time of award and are based upon the budget submitted to the NSF. It does not include any out-year adjustments. The NSF will not modify awards simply to correct indirect cost rates cited in the award notice. See the Proposal & Award Policies & Procedures Guide (PAPPG) Chapter X.A.3.a. for guidance on re-budgeting authority.

EXHIBIT B: Leadership Team Organizational Chart



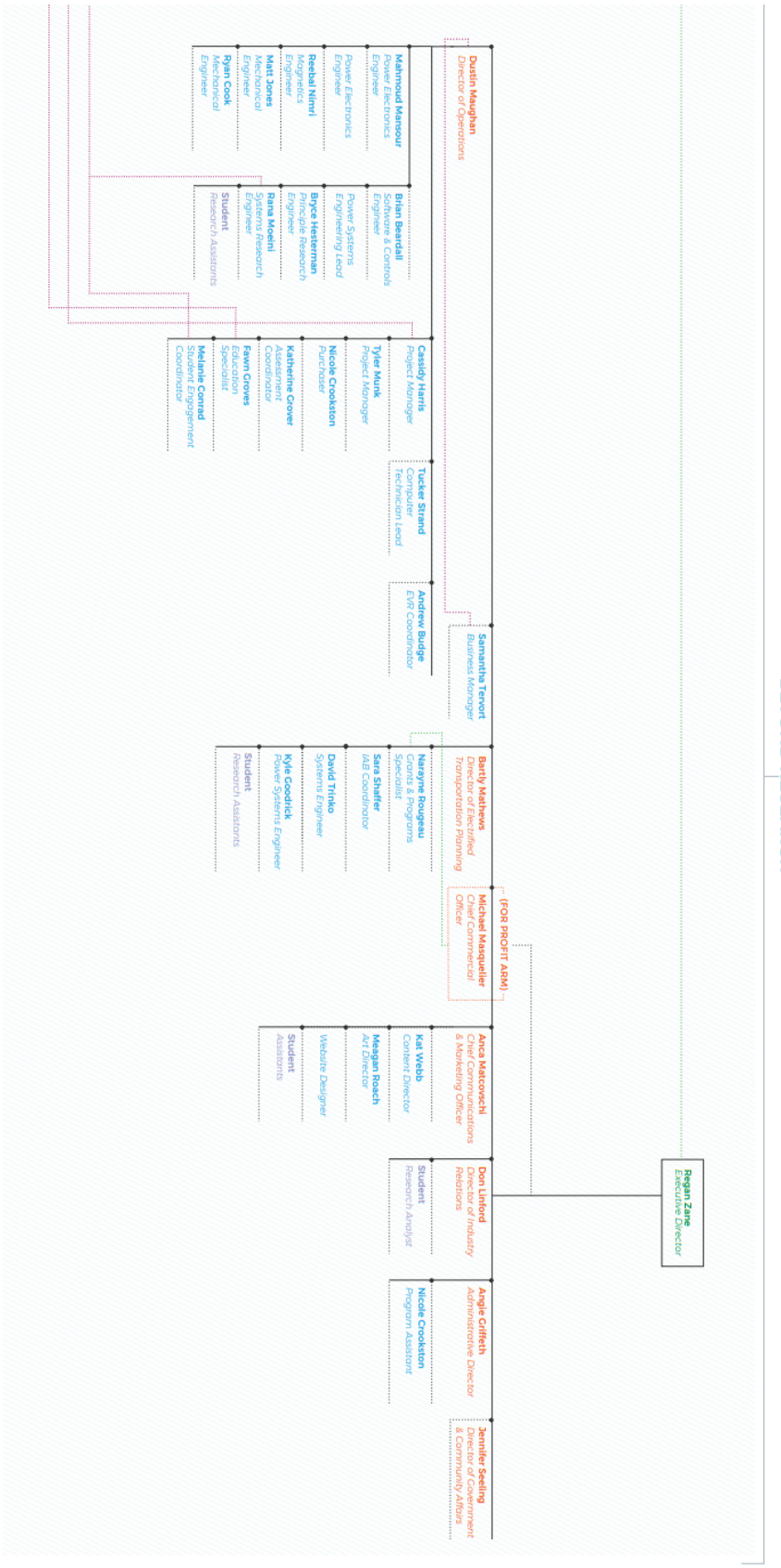

BEYOND RESEARCH
ASPIRE
Regan Zane
Executive Director
Dustin Maughan
Director of Operations
Samantha Tervort
Business Manager
Mahmoud Mansour
Power Electronics Engineer
Brian Beardall
Software & Controls Engineer
Reebal Nimri
Power Electronics Engineer
Power Systems Engineering Lead
Bryce Hesterman
Magnetics Principle Research Engineer
Matt Jones
Mechanical Engineer
Rana Moeini
Systems Research Engineer
Ryan Cook
Mechanical Engineer
Student
Research Assistants
Cassidy Harris
Project Manager
Tucker Strand
Computer Technician Lead
Andrew Budge
EV2 Coordinator
Tyler Munk
Project Manager
Nicole Crookston
Purchaser
Katharine Grover
Assessment Coordinator
Fawn Groves
Education Specialist
Melanie Conrad
Student Engagement Coordinator
Barry Mathews
Director of Electrified Transportation Planning
Narayne Rougeau
Grants & Programs Specialist
Sara Shaffer
IAB Coordinator
David Trinko
Systems Engineer
Kyle Goodrick
Power Systems Engineer
Student
Research Assistants
(FOR PROFIT ARM)
Michael Masquelier
Chief Commercial Officer
Anca Matcovschi
Chief Communications & Marketing Officer
Kat Webb
Content Director
Meagan Roach
Art Director
Website Designer
Student
Assistants
Don Linford
Director of Industry Relations
Student
Research Analyst
Angie Griffeth
Administrative Director
Nicole Crookston
Program Assistant
Jennifer Seeling
Director of Government & Community Affairs

EXHIBIT C: Membership Agreements Templates:

Industry Membership Agreement Template and Appendices A and B

Innovation Membership Agreement Template and Appendices A and B

National Laboratory Membership Memorandum of Understanding Template and Appendix A

INDUSTRY MEMBERSHIP AGREEMENT

The National Science Foundation ("*NSF*") has established the Advancing Sustainability through Powered
Infrastructure for Roadway Electrification Engineering Research Center ("*ASPIRE*") at Utah State
University ("*USU*") (the lead university) in collaboration with core partners Purdue University, University of Texas at El Paso, University of Colorado Boulder, and University of Auckland and additional affiliated partner universities to pursue research, education, diversity and inclusion, and commercialization activities to advance transportation electrification.

This ASPIRE INDUSTRY MEMBERSHIP AGREEMENT ("*Agreement*") establishes the terms and conditions for the following company to participate as an industry member of ASPIRE:

1. Member Information:

Company Name:	("Company")		
Address:			
Company Representative:			
Phone:		Email:	

2. Annual Membership Fee: In consideration for privileges and benefits set forth in this Agreement, Company agrees to pay the annual membership fee of **$15,000 per year** (the membership fee for Industry Members who qualify as a small business according to the U.S. Small Business
Administration size standards shall be **$7,500/year**). The annual fee shall be due within thirty (30) days of Company receiving an invoice. If Company desires to pay for more than one annual period at a time, then Company is invited to contact ASPIRE so that the invoice may be adjusted accordingly.

3. Term and Renewal: Membership will begin on the date of receipt of payment ("*Effective Date*") and will continue for an initial period of one (1) year. This Agreement will automatically renew for additional one-year periods upon payment of the Company's annual membership fee, which shall be invoiced on or around the anniversary of the Effective Date. If Company fails to render timely payment, then its membership will be suspended, the various benefits and privileges set forth herein revoked, and this Agreement will automatically terminate.

4. General Membership Benefits:

a. Industry and Innovation Board. As an Industry Member, Company may designate a
Company representative (who may be adjusted from time-to-time by Company) to serve on ASPIRE's Industry and Innovation Board ("IIB"). The IIB meets at least annually. ASPIRE will periodically establish strategic research, educational, workforce development, diversity and inclusion, or other projects in furtherance of ASPIRE's mission ("*ASPIRE Projects*"). The IIB will provide perspective, feedback, and review of ASPIRE Projects. Exemplary IIB activities include: (i) providing input on ASPIRE's strategic research and education plan, ongoing ASPIRE

Project performance, and proposed ASPIRE Project plans; and (ii) participation in NSF annual reviews of ASPIRE's performance and plans.

b. Annual Meeting. Company will have up to four (4) seats reserved at the ASPIRE Annual Meeting and Technology Showcase. This Annual Meeting includes (i) electrified transportation panels and discussions; (ii) technology breakout sessions and working groups; (iii) student hardware demonstrations and poster session; (iv) technology demonstrations; technology short courses taught by ASPIRE faculty; (v) industry member recruiting booths and technology demonstrations. Additional seats may be added at a nominal fee, and/or virtual attendance accommodations may be made available.

c. Conference Discount. Company is eligible for discounted registration at the International Conference on Electric Roads and Vehicles (CERV) held biennially in Park City, Utah.

d. Brown Bag Series. Company will be invited to attend the ASPIRE Brown Bag Series,

which includes monthly technical and networking presentations and thought leadership roundtables.

e. ASPIRE Repository. Company may access ASPIRE's online resource repository, which

includes the non-confidential materials prepared by ASPIRE researchers, including papers, presentations, posters, and meeting recordings.

f. Facility Access. Company may have priority access to ASPIRE facilities for vehicle, technology, and grid testing and evaluation. Such access is subject to applicable facility use fees.

g. ASPIRE News. Company will receive regular updates on ASPIRE via the website,

quarterly newsletters, and early access to ASPIRE publications, presentations, and dissertations.

5. **Participation as an Industry Research Collaborator**: As an Industry Member, Company may elect to participate in ASPIRE Projects as an "Industry Research Collaborator." Participation as an Industry Research Collaborator is initiated by Company paying an annual participation fee of forty thousand dollars ($40,000.00) for each selected ASPIRE Project and executing an accompanying ASPIRE Project Industry Research Collaborator Participation Agreement ("*Participation Agreement*") (*See* Appendix B for the template Participation Agreement). Industry Research Collaborators are provided with (i) an opportunity to participate in regular (e.g., monthly) meetings for each selected ASPIRE Project and (ii) a first opportunity (through the process set forth herein and as further defined in the Participation Agreement) to negotiate commercial rights to intellectual property that is developed and disclosed during the course of any selected ASPIRE Project. ASPIRE Projects may have multiple Industry Research Collaborators, depending on the interest of Industry Members.

6. **Commercial Rights to ASPIRE Intellectual Property**: Industry Research Collaborators participating in an ASPIRE Project are given the first opportunity to negotiate commercial rights to "Project IP", which is defined as intellectual property

(e.g., patentable subject matter, copyrightable subject matter, etc.) arising from an ASPIRE Project that has commercial potential and is developed and disclosed during the annual period set forth in the applicable Participation Agreement. Ownership of Project IP will correspond directly with inventorship or authorship (as applicable), as determined according to U.S. law. The privileges and timelines for securing commercial rights to Project IP are as follows:

a. Notification. Upon ASPIRE's receipt of an invention disclosure containing Project IP, ASPIRE will, in turn and in a timely manner, provide participating Industry Research Collaborators with a copy of the invention disclosure under terms of confidentiality.

b. Evaluation. Each participating Industry Research Collaborator will have thirty (30) days from the date of receiving the invention disclosure ("Evaluation Period") to both evaluate the invention disclosure and notify ASPIRE in writing if it is interested in pursuing commercial rights to the Project IP.

c. Negotiation. Upon ASPIRE's receipt of an Industry Research Collaborator's notification of its interest, the Project IP owners(s) will be informed, and the Industry Research Collaborator and owner-institution(s) will engage in good faith negotiations for a period of up to ninety (90) days from the notification of interest date ("Negotiation Period").

d. Extension of Opportunity to other Industry Members. If (i) no Industry Research Collaborator notifies ASPIRE of its interest during the Evaluation Period, (ii) the Project IP owner(s) and interested Industry Research Collaborators fail to come to terms during the Negotiation Period, or (iii) any commercial rights to Project IP remain available after the Negotiation Period, then ASPIRE will notify Industry Members generally of the availability of any such Project IP. If, after a period of sixty (60) days from the general notification date, interested Industry Members and the Project IP owner(s) have not come to terms for commercial Rights to the Project IP, then the Project IP may be offered to any interested party (including third parties that are not Industry Members).

7. **Additional Terms and Conditions**: Company agrees to the additional terms and conditions set forth in Appendix A, which is incorporated by reference in its entirety.

IN WITNESS THEREOF, COMPANY HEREBY CAUSES THIS AGREEMENT TO BE DULY EXECUTED ON ITS BEHALF BY A DULY AUTHORIZED REPRESENTATIVE AS OF THE DATE SET FORTH BELOW.

Name: Signature:_____
Title: Date:_____

Accepted and Acknowledged by ASPIRE Leadership Team. Initials/Date: _____/_____

Appendix A: Additional Terms and Conditions

a. Limitations. Membership as an ASPIRE Industry Member does not confer by implication, any estoppel, or otherwise any license or rights under any patents, software, or intellectual property owned by USU or any other ASPIRE member, partner, or collaborator.

b. Payment in Kind. Under certain circumstances, ASPIRE may accept services, equipment, or goods as paymentin-kind towards fees due. Unless otherwise negotiated, the value of the in-kind services, equipment, or goods will generally be at least five times that of the fee. Any in-kind payments must be pre-approved by ASPIRE's Leadership Team.

c. Warranties. NOTHING IN THIS AGREEMENT SHALL BE CONSTRUED AS A WARRANTY OR REPRESENTATION BY USU OR ANY OTHER ASPIRE MEMBER, PARTNER, OR COLLABORATOR (A)
OF THE MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE WITH REGARD TO THE
BENEFITS SET FORTH HEREIN OR ANY WORK PRODUCT, DELIVERABLE, OR MATERIALS
ASSOCIATED HEREWITH; OR (B) OF THE VALIDITY, ENFORCEABILITY, OR SCOPE OF ASPIREDEVELOPED OR ASSOCIATED INTELLECTUAL PROPERTY; OR (C) THAT ANY WORK PRODUCT,
DELIVERABLE, OR MATEIRAL ASSOCIATED HEREWITH WILL BE FREE FROM INFRINGEMENT OF
ANY THIRD-PARTY INTELLECTUAL PROPERTY RIGHTS. ALL BENEFITS, WORKPRODUCT,
DELIVERABLES, AND MATERIALS ARE PROVIDED "AS IS."

d. Termination. Company acknowledges that USU may, at its sole discretion, terminate this Agreement at any time if the NSF withdraws funding or modifies its requirements for ASPIRE to operate as an NSF Engineering Research Center.

e. Trademarks. "ASPIRE" and the associated logos are the intellectual property of USU. Company will only use the ASPIRE trademarks after receiving the express written authorization of USU.

f. Publications. A primary objective of ASPIRE and ASPIRE Projects is the generation of new knowledge and its expeditious dissemination for the public's benefit. Company acknowledges and agrees that ASPIRE and the universities and researchers associated therewith may publish or authorize publication of papers, theses, presentations, and other public disclosures based upon any ASPIRE Project and use the research results in research and educational programs.

g. Confidentiality. Company acknowledges that execution of a confidentiality agreement is a pre-requisite for (i) participation in ASPIRE Project meetings, (ii) the review of Project IP invention disclosures, or (iii) the review of confidential information produced by USU or any other ASPIRE member, partner, or collaborator.

h. Non-Discrimination. Company will not discriminate in any way based on race, color, religion, sex, national origin, age, genetic information, sexual orientation or gender identity/expression, disability, status as a protected veteran, or any other status protected by local, state, or federal law.

i. Choice of Law and Venue. The Agreement will be governed by the laws of the State of Utah, without regard to conflicts of laws principles. Venue for any lawsuits, claims, or other proceedings between the Parties relating to or arising under the Agreement shall be exclusively in the State of Utah.

j. Governmental Entities. Company acknowledges that (i) USU is, and other ASPIRE-participating universities may be, governmental entities and (ii) all governmental entities associated with ASPIRE are subject to various public records laws, governmental immunity acts, etc. Nothing in this Agreement shall be construed to waive any of the protections, rights, defenses, privileges, or mandated duties of any governmental entity that is participating or affiliated with ASPIRE.

k. Assignment. Company may not assign, transfer, or otherwise dispose of its rights, interests, or duties hereunder, in whole or in part, to any third party without prior written approval from USU.

l. Relationship of Parties. In assuming and performing the obligations of this Agreement, Company, USU, and any other ASPIRE member, partner, or collaborator are each acting as independent parties and none shall be considered or represent itself as a joint venture, partner, agent or employee of the other.

m. Amendment and Supplement. Any amendment and/or supplement of this Agreement shall come into force only after a written agreement is signed by USU and Company. USU reserves the right to adjust the terms and conditions set forth in this Agreement for any upcoming annual period by providing Company with advance written notice prior to the applicable anniversary date of the Effective Date.

n. Merger. This Agreement embodies the entire understanding of the parties and supersedes all previous communications, representations, or understandings, either oral or written, between the parties relating to the subject matter thereof.

o. Severability. The provisions of this Agreement are severable, and in the event that any provision of this Agreement shall be determined to be invalid or unenforceable under any controlling body of the law, such invalidity or unenforceability shall not in any way affect the validity or enforceability of the remaining provisions herein.

Appendix B:

ASPIRE Project Industry Research Collaborator Participation Agreement

This INDUSTRY RESEARCH COLLABORATOR PROJECT PARTICIPATION AGREEMENT
("*Participation Agreement*") establishes the terms and conditions for the following company to participate as an Industry Research Collaborator in the below described ASPIRE Project:

Member Information:

Company Name:	("Company")	
Address:		
Company Representative:		

Phone:		Email:	

Project Information:

ASPIRE Project Title:	("Project")		
Brief Description:			
Annual Period:	- <<INSERT STARTING AND ENDING DATES>>		
ASPIRE Project Lead:			
Phone:		Email:	
Company's Primary Project Participant:			
Phone:		Email:	

As an Industry Research Collaborator in the above-designated ASPIRE Project, Company agrees as follows:

1. **Annual Payment**. Company agrees to pay the annual Industry Research Collaborator participation fee of forty thousand dollars ($40,000.00). The annual participation fee shall be due within thirty (30) days of Company receiving an invoice.

2. **Project Meetings**. As an Industry Research Collaborator, Company may participate in regular (e.g., monthly) Project meetings throughout the Annual Period (as set forth above), the details of which will be coordinated by the above-designated ASPIRE Project Lead. During Project meetings, Company will be apprised of Project progress and be able to advise and participate in specific objectives relating to the Project.

3. **Intellectual Property**. As an Industry Research Collaborator, Company will be given a first opportunity to negotiate commercial rights to "Project IP", which is defined as intellectual property (e.g., patentable subject matter, copyrightable subject matter, etc.) arising from the Project that has commercial potential and is developed and disclosed during the Annual Period. Ownership of Project IP will correspond directly with inventorship or authorship (as applicable), as determined according to U.S. law.

The privileges and timelines for securing commercial rights to Project IP are as follows:

(a) Notification. Upon ASPIRE's receipt of an invention disclosure containing Project IP, ASPIRE will, in turn and in a timely manner, provide Company with a copy of the invention disclosure under terms of confidentiality. ASPIRE retains the sole discretion to define what constitutes an "invention disclosure" for purposes of this Participation Agreement.

(b) Evaluation. Company will have thirty (30) days from the date of receiving the invention disclosure ("Evaluation Period") to both evaluate the invention disclosure and notify ASPIRE in writing if it is interested in pursuing commercial rights to the Project IP.

(c) Negotiation. Upon ASPIRE's receipt of Company's notification of its interest, the Project IP owners(s) will be informed and the Company and owner-institution(s) will engage in good faith negotiations for up to ninety (90) days from the date of Company's notification of its interest ("Negotiation Period").

(d) Expiration of IP Benefits. If Company does not notify ASPIRE of its interest during the Evaluation Period or if the Project IP owner(s) and Company do not come to terms within the Negotiation Period, then the Project IP owner(s) will be free to engage in negotiations and enter into contracts with other parties regarding commercial rights to the Project IP. Company acknowledges and agrees that (i) the above described benefits are not a guarantee of obtaining commercial rights or exclusive rights to Project IP; (ii) that other institutions may participate in the Project as an Industry Research Collaborator and, under such circumstances, only non-exclusive or coexclusive commercial rights will be available; and (iii) the Project may fail to yield Project IP.

4. Confidentiality. Company acknowledges that execution of a confidentiality agreement is a prerequisite for (i) participation in ASPIRE Project meetings, (ii) the review of Project IP invention disclosures, or (iii) the review of confidential information produced by USU or any other ASPIRE member, partner, or collaborator.

5. Renewal and Expiration. Company may renew its participation as an Industry Research Collaborator in this Project (if the Project is extended beyond one year) by paying the annual participation fee for the next annual period and executing a renewed Industry Research Collaborator Project Participation Agreement. If Company elects to not continue its participation in this Project, then its right to participate in Project meetings or to receive Project IP invention disclosures as set forth above expires on the last date of the Annual Period.

IN WITNESS THEREOF, COMPANY HEREBY CAUSES THIS PARTICIPATION AGREEMENT TO BE DULY EXECUTED ON ITS BEHALF BY A DULY AUTHORIZED REPRESENTATIVE AS OF THE DATE SET FORTH BELOW.

Name: Signature:_____
Title: Date:_____

Accepted and Acknowledged by ASPIRE Leadership Team. Initials/Date: _____/_____

Innovation Membership Agreement

The National Science Foundation ("*NSF*") has established the Advancing Sustainability through Powered
Infrastructure for Roadway Electrification Engineering Research Center ("*ASPIRE*") at Utah State
University ("*USU*") (the lead university) in collaboration with core partners Purdue University, University of Texas at El Paso, University of Colorado Boulder, and University of Auckland and additional affiliated partner universities to pursue research, education, diversity and inclusion, and commercialization activities to advance transportation electrification.

This ASPIRE INNOVATION MEMBERSHIP AGREEMENT ("*Agreement*") establishes the terms and conditions for the following entity to participate as an innovation member of ASPIRE:

1. Member Information:

Member Name:	("Member")		
Address:			
Member Representative:			
Phone:		Email:	

2. Annual Membership Fee: ASPIRE Innovation Members are government and non-profit entities and, as such, are exempt from paying membership fees. Innovation Members complete a membership application that is reviewed and approved (*"Approval")* by the ASPIRE Leadership Team and Executive Advisory Board. Upon membership approval, Member receives the privileges and benefits set forth in this Agreement.

3. Term and Renewal: Membership will begin on the date of Approval ("*Effective Date*") and will continue for an initial period of one (1) year. This Agreement will automatically renew for additional oneyear periods with annual review and continuing Approval. Member or ASPIRE may terminate this Agreement at any time by providing written notification of termination, which will be effective upon the receipt of the notification by the other party.

4. General Membership Benefits:

a. Industry and Innovation Board. As an Innovation Member, Member may designate a Member representative (who may be adjusted from time-to-time by Member) to serve on ASPIRE's Industry and Innovation Board ("IIB"). The IIB meets at least annually. ASPIRE will periodically establish strategic research, educational, workforce development, diversity and inclusion, or other projects in furtherance of ASPIRE's mission ("*ASPIRE Projects*"). The IIB will provide perspective, feedback, and review of ASPIRE Projects. Exemplary IIB activities include: (i) providing input on ASPIRE's strategic research and education plan, ongoing ASPIRE Project performance, and proposed ASPIRE Project plans; and (ii) participation in NSF annual reviews of ASPIRE's performance and plans.

b. Annual Meeting. Member will have up to four (4) seats reserved at the ASPIRE Annual Meeting and Technology Showcase. This Annual Meeting includes (i) electrified transportation panels and discussions; (ii) technology breakout sessions and working groups; (iii) student hardware demonstrations and poster session; (iv) technology demonstrations; technology short courses taught by ASPIRE faculty; (v) Innovation member recruiting booths

and technology demonstrations. Additional seats may be added at a nominal fee, and/or virtual attendance accommodations may be made available.

c. Conference Discount. Member is eligible for discounted registration at the International Conference on Electric Roads and Vehicles (CERV) held biennially in Park City, Utah.

d. Brown Bag Series. Member will be invited to attend the ASPIRE Brown Bag Series, which includes monthly technical and networking presentations and thought leadership roundtables.

e. ASPIRE Repository. Member may access ASPIRE's online resource repository, which includes the non-confidential materials prepared by ASPIRE researchers, including papers, presentations, posters, and meeting recordings.

f. Facility Access. Member may have priority access to ASPIRE facilities for vehicle, technology, and grid testing and evaluation. Such access is subject to applicable facility use fees.

g. ASPIRE News. Member will receive regular updates on ASPIRE via the website, quarterly newsletters, and early access to ASPIRE publications, presentations, and dissertations.

5. Participation as an Innovation Research Collaborator: As an Innovation Member, Member may elect to participate in ASPIRE Projects as an "Innovation Research Collaborator." Participation as an Innovation Research Collaborator is initiated by Member paying an annual participation fee of forty thousand dollars ($40,000.00) for each selected ASPIRE Project and executing an accompanying ASPIRE Project Innovation Research Collaborator Participation Agreement ("*Participation Agreement*") (*See* Appendix B for the template Participation Agreement). Innovation Research Collaborators are provided with an opportunity to participate in regular (e.g., monthly) meetings for each selected ASPIRE Project. ASPIRE Projects may have multiple Innovation Research Collaborators and Industry Research Collaborators, depending on the interest of Innovation and Industry Members.

6. Additional Terms and Conditions: Member agrees to the additional terms and conditions set forth in Appendix A, which is incorporated by reference in its entirety.

IN WITNESS THEREOF, MEMBER HEREBY CAUSES THIS AGREEMENT TO BE DULY EXECUTED ON ITS BEHALF BY A DULY AUTHORIZED REPRESENTATIVE AS OF THE DATE SET FORTH BELOW.

Name: Signature:_____
Title: Date:_____

Accepted and Acknowledged by ASPIRE Leadership Team. Initials/Date: _____/_____

Appendix A: Additional Terms and Conditions

a. Limitations. Membership as an ASPIRE Innovation Member does not confer by implication, any estoppel, or otherwise any license or rights under any patents, software, or intellectual property owned by USU or any other ASPIRE member, partner, or collaborator.

b. Payment in Kind. Under certain circumstances, ASPIRE may accept services, equipment, or goods as paymentin-kind towards fees due. Unless otherwise negotiated, the value of the in-kind services, equipment, or goods will generally be at least five times that of the fee. Any in-kind payments must be pre-approved by ASPIRE's Leadership Team.

c. Warranties. NOTHING IN THIS AGREEMENT SHALL BE CONSTRUED AS A WARRANTY OR REPRESENTATION BY USU OR ANY OTHER ASPIRE MEMBER, PARTNER, OR COLLABORATOR (A)
OF THE MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE WITH REGARD TO THE
BENEFITS SET FORTH HEREIN OR ANY WORK PRODUCT, DELIVERABLE, OR MATERIALS
ASSOCIATED HEREWITH; OR (B) OF THE VALIDITY, ENFORCEABILITY, OR SCOPE OF ASPIREDEVELOPED OR ASSOCIATED INTELLECTUAL PROPERTY; OR (C) THAT ANY WORK PRODUCT,
DELIVERABLE, OR MATEIRAL ASSOCIATED HEREWITH WILL BE FREE FROM INFRINGEMENT OF
ANY THIRD-PARTY INTELLECTUAL PROPERTY RIGHTS. ALL BENEFITS, WORKPRODUCT,
DELIVERABLES, AND MATERIALS ARE PROVIDED "AS IS."

d. Termination. Member acknowledges that USU may, at its sole discretion, terminate this Agreement at any time if the NSF withdraws funding or modifies its requirements for ASPIRE to operate as an NSF Engineering Research Center.

e. Trademarks. "ASPIRE" and the associated logos are the intellectual property of USU. Member will only use the ASPIRE trademarks after receiving the express written authorization of USU.

f. Publications. A primary objective of ASPIRE and ASPIRE Projects is the generation of new knowledge and its expeditious dissemination for the public's benefit. Member acknowledges and agrees that ASPIRE and the universities and researchers associated therewith may publish or authorize publication of papers, theses, presentations, and other public disclosures based upon any ASPIRE Project and use the research results in research and educational programs.

g. Confidentiality. Member acknowledges that execution of a confidentiality agreement is a pre-requisite for (i) participation in ASPIRE Project meetings, (ii) the review of intellectual property disclosures resulting from ASPIRE Projects, or (iii) the review of confidential information produced by USU or any other ASPIRE member, partner, or collaborator.

h. Non-Discrimination. Member will not discriminate in any way based on race, color, religion, sex, national origin, age, genetic information, sexual orientation or gender identity/expression, disability, status as a protected veteran, or any other status protected by local, state, or federal law.

i. Choice of Law and Venue. The Agreement will be governed by the laws of the State of Utah, without regard to conflicts of laws principles. Venue for any lawsuits, claims, or other

proceedings between the Parties relating to or arising under the Agreement shall be exclusively in the State of Utah.

j. Governmental Entities. Member acknowledges that USU is, and other ASPIRE-participating universities may be, governmental entities and (ii) all governmental entities associated with ASPIRE are subject to various public records laws, governmental immunity acts, etc. Nothing in this Agreement shall be construed to waive any of the protections, rights, defenses, privileges, or mandated duties of any governmental entity that is participating or affiliated with ASPIRE.

k. Assignment. Member may not assign, transfer, or otherwise dispose of its rights, interests, or duties hereunder, in whole or in part, to any third party without prior written approval from USU.

l. Relationship of Parties. In assuming and performing the obligations of this Agreement, Member, USU, and any other ASPIRE member, partner, or collaborator are each acting as independent parties and none shall be considered or represent itself as a joint venture, partner, agent or employee of the other.

m. Amendment and Supplement. Any amendment and/or supplement of this Agreement shall come into force only after a written agreement is signed by USU and Member. USU reserves the right to adjust the terms and conditions set forth in this Agreement for any upcoming annual period by providing Member with advance written notice prior to the applicable anniversary date of the Effective Date.

n. Merger. This Agreement embodies the entire understanding of the parties and supersedes all previous communications, representations, or understandings, either oral or written, between the parties relating to the subject matter thereof.

o. Severability. The provisions of this Agreement are severable, and in the event that any provision of this Agreement shall be determined to be invalid or unenforceable under any controlling body of the law, such invalidity or unenforceability shall not in any way affect the validity or enforceability of the remaining provisions herein.

Appendix B:
ASPIRE Project Innovation Research Collaborator Participation Agreement

This INNOVATION RESEARCH COLLABORATOR PROJECT PARTICIPATION AGREEMENT
("*Participation Agreement*") establishes the terms and conditions for the following Member to participate as an Innovation Research Collaborator in the below described ASPIRE Project:

Member Information:

Member Name:	("Member")		
Address:			
Member Representative:			
Phone:		Email:	

Project Information:

ASPIRE Project Title:	("Project")		
Brief Description:			
Annual Period:	- <<INSERT STARTING AND ENDING DATES>>		
ASPIRE Project Lead:			
Phone:		Email:	
Member's Primary Project Participant:			
Phone:		Email:	

As an Innovation Research Collaborator in the above-designated ASPIRE Project, Member agrees as follows:

1. **Annual Payment**. Member agrees to pay the annual Innovation Research Collaborator participation fee of forty thousand dollars ($40,000.00). The annual participation fee shall be due within thirty (30) days of Member receiving an invoice.
2. **Project Meetings**. As an Innovation Research Collaborator, Member may participate in regular (e.g., monthly) Project meetings throughout the Annual Period (as set forth above), the details of which will be coordinated by the above-designated ASPIRE Project Lead. During Project meetings, Member will be apprised of Project progress and be able to advise and participate in specific objectives relating to the Project.
3. **Confidentiality**. Member acknowledges that execution of a confidentiality agreement is a prerequisite for (i) participation in ASPIRE Project meetings, (ii) the review of intellectual property disclosures resulting from the Project, or (iii) the review of confidential information produced by USU or any other ASPIRE member, partner, or collaborator.
4. **Renewal and Expiration**. Member may renew its participation as an Innovation Research

Collaborator in this Project (if the Project is extended beyond one year) by paying the annual participation fee for the next annual period and executing a renewed Innovation Research Collaborator Project
Participation Agreement. If Member elects to not continue its participation in this Project, then its right to participate in Project meetings or to receive Project IP invention disclosures as set forth above expires on the last date of the Annual Period.

IN WITNESS THEREOF, COMPANY HEREBY CAUSES THIS PARTICIPATION AGREEMENT TO BE DULY EXECUTED ON ITS BEHALF BY A DULY AUTHORIZED REPRESENTATIVE AS OF THE DATE SET FORTH BELOW.

Name: Signature:_____
Title: Date:_____

Accepted and Acknowledged by ASPIRE Leadership Team. Initials/Date: _____/_____

NATIONAL LABORATORY MEMBERSHIP MEMORANDUM OF UNDERSTANDING

The National Science Foundation ("*NSF*") has established the Advancing Sustainability through Powered

Infrastructure for Roadway Electrification Engineering Research Center ("*ASPIRE*") at Utah State
University ("*USU*") (the lead university) in collaboration with core partners Purdue University, University of Texas at El Paso, University of Colorado Boulder, and University of Auckland and additional affiliated partner universities to pursue research, education, diversity and inclusion, and commercialization activities to advance transportation electrification.

This National Laboratory Membership Memorandum of Understanding ("*MOU*") establishes the below listed National Laboratory as a member of ASPIRE:

1. Member Information:

Laboratory Name:	("Member")		
Address:			
Member Representative:			
Phone:		Email:	

2. Term and Renewal: Membership will begin on the date of Member's signature ("*Effective Date*") and will continue for an initial period of one (1) year. This MOU will automatically renew for additional one-year periods with annual review and continuing approval. Member or ASPIRE may terminate this MOU at any time by providing written notification of termination, which will be effective upon the receipt of the notification by the other party.

3. General Membership Benefits:

a. Industry and Innovation Board. As a National Laboratory Member, Member may designate a Member representative (who may be adjusted from time-to-time by Member) to serve on ASPIRE's Industry and Innovation Board ("IIB"). The IIB meets at least annually. ASPIRE will periodically establish strategic research, educational, workforce development, diversity and inclusion, or other projects in furtherance of ASPIRE's mission ("*ASPIRE Projects*"). The IIB will provide perspective, feedback, and review of ASPIRE Projects. Exemplary IIB activities include: (i) providing input on ASPIRE's strategic research and education plan, ongoing ASPIRE Project performance, and proposed ASPIRE Project plans; and (ii) participation in NSF annual reviews of ASPIRE's performance and plans.

b. Annual Meeting. Member will have up to four (4) seats reserved at the ASPIRE Annual Meeting and Technology Showcase. This Annual Meeting includes (i) electrified transportation panels and discussions; (ii) technology breakout sessions and working groups; (iii) student hardware demonstrations and poster session; (iv) technology demonstrations; technology short courses taught by ASPIRE faculty; (v) Innovation member recruiting booths and technology

demonstrations. Additional seats may be added at a nominal fee, and/or virtual attendance accommodations may be made available.

c. Conference Discount. Member is eligible for discounted registration at the International Conference on Electric Roads and Vehicles (CERV) held biennially in Park City, Utah.

d. Brown Bag Series. Member will be invited to attend the ASPIRE Brown Bag Series, which includes monthly technical and networking presentations and thought leadership roundtables.

e. ASPIRE Repository. Member may access ASPIRE's online resource repository, which includes the non-confidential materials prepared by ASPIRE researchers, including papers, presentations, posters, and meeting recordings.

f. Facility Access. Member may have priority access to ASPIRE facilities for vehicle, technology, and grid testing and evaluation. Such access is subject to applicable facility use fees.

g. ASPIRE News. Member will receive regular updates on ASPIRE via the website, quarterly newsletters, and early access to ASPIRE publications, presentations, and dissertations.

4. Participation as an Innovation Research Collaborator: As a National Laboratory Member,

Member may be invited to participate in ASPIRE Projects as an "National Laboratory Research Collaborator." If such an invitation is accepted, then the National Laboratory Research Collaborator will be provided with an opportunity to participate in regular (e.g., monthly) meetings for the designated ASPIRE Project. ASPIRE Projects may have multiple National Laboratory Research Collaborators, Innovation Research Collaborators, and Industry Research Collaborators, depending on the interest of ASPIRE's members.

5. Additional Terms and Conditions: Member agrees to the additional terms and conditions set forth in Appendix A, which is incorporated by reference in its entirety.

Name: Signature:_____

Title: Date:_____

Accepted and Acknowledged by ASPIRE Leadership Team. Initials/Date: _____/_____

Appendix A: Additional Terms and Conditions

a. Limitations. Membership as an ASPIRE Innovation Member does not confer by implication, any estoppel, or otherwise any license or rights under any patents, software, or intellectual property owned by USU or any other ASPIRE member, partner, or collaborator.

b. Payment in Kind. Under certain circumstances, ASPIRE may accept services, equipment, or goods as payment in-kind towards fees due. Unless otherwise negotiated, the value of the in-kind services, equipment, or goods will generally be at least five times that of the fee. Any in-kind payments must be pre-approved by ASPIRE's Leadership Team.

c. Warranties. NOTHING IN THIS MOU SHALL BE CONSTRUED AS A WARRANTY OR
REPRESENTATION BY USU OR ANY OTHER ASPIRE MEMBER, PARTNER, OR COLLABORATOR (A)
OF THE MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE WITH REGARD TO THE
BENEFITS SET FORTH HEREIN OR ANY WORK PRODUCT, DELIVERABLE, OR MATERIALS
ASSOCIATED HEREWITH; OR (B) OF THE VALIDITY, ENFORCEABILITY, OR SCOPE OF ASPIREDEVELOPED OR ASSOCIATED INTELLECTUAL PROPERTY; OR (C) THAT ANY WORK PRODUCT,
DELIVERABLE, OR MATEIRAL ASSOCIATED HEREWITH WILL BE FREE FROM INFRINGEMENT OF
ANY THIRD-PARTY INTELLECTUAL PROPERTY RIGHTS. ALL BENEFITS, WORKPRODUCT,
DELIVERABLES, AND MATERIALS ARE PROVIDED "AS IS."

d. Termination. Member acknowledges that USU may, at its sole discretion, terminate this MOU at any time if the NSF withdraws funding or modifies its requirements for ASPIRE to operate as an NSF Engineering Research Center.

e. Trademarks. "ASPIRE" and the associated logos are the intellectual property of USU. Member will only use the ASPIRE trademarks after receiving the express written authorization of USU.

f. Publications. A primary objective of ASPIRE and ASPIRE Projects is the generation of new knowledge and its expeditious dissemination for the public's benefit. Member acknowledges and agrees that ASPIRE and the universities and researchers associated therewith may publish or authorize publication of papers, theses, presentations, and other public disclosures based upon any ASPIRE Project and use the research results in research and educational programs.

g. Confidentiality. Member acknowledges that execution of a confidentiality agreement is a pre-requisite for (i) participation in ASPIRE Project meetings, (ii) the review of intellectual property disclosures resulting from ASPIRE Projects, or (iii) the review of confidential information produced by USU or any other ASPIRE member, partner, or collaborator.

h. Non-Discrimination. Member will not discriminate in any way based on race, color, religion, sex, national origin, age, genetic information, sexual orientation or gender

identity/expression, disability, status as a protected veteran, or any other status protected by local, state, or federal law.

i. Choice of Law and Venue. The MOU will be governed by the laws of the State of Utah, without regard to conflicts of laws principles. Venue for any lawsuits, claims, or other proceedings between the Parties relating to or arising under the MOU shall be exclusively in the State of Utah.

j. Governmental Entities. Company acknowledges that (i)USU is, and other ASPIRE-participating universities may be, governmental entities and (ii) all governmental entities associated with ASPIRE are subject to various public records laws, governmental immunity acts, etc. Nothing in this Agreement shall be construed to waive any of the protections, rights, defenses, privileges, or mandated duties of any governmental entity that is participating or affiliated with ASPIRE.

k. Assignment. Member may not assign, transfer, or otherwise dispose of its rights, interests, or duties hereunder, in whole or in part, to any third party without prior written approval from USU.

l. Relationship of Parties. In assuming and performing the obligations of this MOU, Member, USU, and any other ASPIRE member, partner, or collaborator are each acting as independent parties and none shall be considered or represent itself as a joint venture, partner, agent or employee of the other.

m. Amendment and Supplement. Any amendment and/or supplement of this MOU shall come into force only after a written MOU is signed by USU and Member. USU reserves the right to adjust the terms and conditions set forth in this MOU for any upcoming annual period by providing Member with advance written notice prior to the applicable anniversary date of the Effective Date.

n. Merger. This MOU embodies the entire understanding of the parties and supersedes all previous communications, representations, or understandings, either oral or written, between the parties relating to the subject matter thereof.

o. Severability. The provisions of this MOU are severable, and in the event that any provision of this MOU shall be determined to be invalid or unenforceable under any controlling body of the law, such invalidity or unenforceability shall not in any way affect the validity or enforceability of the remaining provisions herein.

EXHIBIT D: Mutual Confidentiality Agreement Template

Mutual Confidentiality Agreement Template (USU and Third-Party)
-Multi-Party Mutual Confidentiality Agreement Template

MUTUAL CONFIDENTIALITY AGREEMENT

This Mutual Confidentiality Agreement ("*Agreement*"), effective as of ("*Effective Date*"), is entered into by and between **("*Company*")**, a <<STATE OF ORGANIZATION>> <<ENTITY TYPE>> having its principal place of business at <<BUSINESS ADDRESS>> and Utah State University ("*USU*"), having a place of business at Old Main Hill, Logan, UT 84322. USU is the lead institution for the National Science Foundation Engineering Research Center for Advancing Sustainability through Powered Infrastructure for Roadway Electrification ("*Aspire*"). The Company and USU may be referred to herein as a "*Party*" or collectively as the "*Parties*."

WHEREAS, , the Parties desire to share certain information relating to <<DESCRIPTION OF INFORMATION>> that is non-public, confidential, or proprietary in nature.

NOW, THEREFORE, in consideration of the mutual covenants, terms, and conditions set out herein, the Parties agree as follows:

1. Confidential Information. Except as set out in Section 3 below, "*Confidential Information*" means all non-public, confidential, or proprietary information disclosed before, on, or after the Effective Date, by either Party ("*Disclosing Party*") to the other Party ("*Recipient*") or its affiliates, or to any of such Recipient's or its affiliates' employees, officers, directors, partners, shareholders, agents, attorneys, accountants, or advisors (collectively, "*Representatives*"), whether disclosed orally or disclosed or accessed in written, electronic, or other form or media, including, without limitation:

(a) all information concerning the Disclosing Party's and its affiliates', and their customers', suppliers', and other third parties' past, present, and future business affairs including, without limitation, finances, customer information, supplier information, products, services, organizational structure and internal practices, forecasts, sales and other financial results, records and budgets, and business, marketing, development, sales, and other commercial strategies;

(b) the Disclosing Party's unpatented inventions, ideas, methods, and discoveries, trade secrets, know-how, unpublished patent applications, and other confidential intellectual property;

(c) all designs, specifications, documentation, components, source code, object code, images, icons, audiovisual components and objects, schematics, drawings, protocols, processes, and other visual depictions, in whole or in part, of any of the foregoing;

(d) any third-party confidential information included with, or incorporated in, any information provided by the Disclosing Party to the Recipient or its Representatives; and

(e) all notes, analyses, compilations, reports, forecasts, studies, samples, data,

statistics, summaries, interpretations, and other materials prepared by or for the Recipient or its Representatives that contain, are based on, or otherwise reflect or are derived from, in whole or in part, any of the foregoing.

2. Marking. Written Confidential Information (including, but not limited to, descriptions, drawings, designs, etc.) shall be clearly marked as "confidential." If certain Confidential Information has not been reduced to written form at the time of disclosure by the Disclosing Party, then such orally disclosed information shall be protected by the Receiving Party as Confidential Information, provided that the Disclosing Party shall: (i) provide a statement to the Receiving Party that the oral information shall be protected under this Agreement; and (ii) within thirty (30) days of such disclosure, reduce to writing a summary of the orally disclosed Confidential Information.

3. Exclusions from Confidential Information. Except as required by applicable federal, state, or local law or regulation, the term "Confidential Information" as used in this Agreement shall not include information that:

(a) at the time of disclosure is, or thereafter becomes, generally available to and known by the public other than as a result of, directly or indirectly, any violation of this Agreement by the Recipient or any of its Representatives;

(b) at the time of disclosure is, or thereafter becomes, available to the Recipient on a non-confidential basis from a third-party source, provided that such third party is not and was not prohibited from disclosing such Confidential Information to the Recipient by a legal, fiduciary, or contractual obligation to the Disclosing Party;

(c) was known by or in the possession of the Recipient or its Representatives, as established by documentary evidence, before being disclosed by or on behalf of the Disclosing Party under this Agreement; or

(d) was or is independently developed by the Recipient, as established by documentary evidence, without reference to or use of, in whole or in part, any of the Disclosing Party's Confidential Information.

4. Recipient Obligations. The Recipient shall:

(a) protect and safeguard the confidentiality of all such Confidential Information with at least the same degree of care as the Recipient would protect its own Confidential Information, but in no event with less than a commercially reasonable degree of care;

(b) not use the Disclosing Party's Confidential Information, or permit it to be accessed or used, in any manner to the Disclosing Party's detriment, including without limitation, to reverse engineer, disassemble, decompile, or design around the Disclosing Party's proprietary services, products, and/or confidential intellectual property;

(c) not (except as specifically permitted in Section 5 herein) disclose any such Confidential Information to any person or entity, except to the Recipient's Representatives who: (i) need to know the Confidential Information to assist the Recipient, or act on its behalf, or to exercise its rights under the Agreement; (ii) are informed by the Recipient of the confidential nature of the Confidential Information; and (iii) are subject to confidentiality duties or obligations to the Recipient that are no less restrictive than the terms and conditions of this Agreement; and

be responsible for any breach of this Agreement caused by any of its Representatives.

5. Permitted Disclosures.

(a) ASPIRE Partner Universities. Company acknowledges that ASPIRE comprises multiple cooperating universities, including the following "*Core Partner Universities*": (1) University of Texas El Paso; (2) Purdue University; (3) University of Colorado Boulder; and (4) Auckland University; and various additional "*Affiliated Partner Universities*," a current list of which may be requested at any time during the Term (Core Partner Universities and Affiliated Partner Universities may be referred to collectively as "*ASPIRE Partner Universities*"). ASPIRE Partner Universities each enter into a cooperative agreement with USU which defines and outlines, *inter alia*, duties and responsibilities for safeguarding the Confidential Information of USU, the ASPIRE Partner Universities, and third-party companies working with ASPIRE. Pursuant to such cooperative agreements, when an ASPIRE Partner University receives Company's Confidential Information, the ASPIRE Partner University assumes severally all of the duties and obligations of USU set forth in this Agreement. The responsibilities set forth in such cooperative agreements are commensurate with those set forth herein and may be inspected upon written request by the Company.

(b) Authorization to Disclose. Company hereby authorizes USU to disclose Company's Confidential Information to any ASPIRE Partner University Representative who (i) needs to know the Confidential Information to assist USU and/or the ASPIRE Partner University, or act on its behalf; (ii) is informed by the USU or Company of the confidential nature of the Confidential Information; and (iii) is personally subject to confidentiality duties or obligations to USU or the ASPIRE Partner University that are no less restrictive than the terms and conditions of this Agreement.

(c) Right to Limit Disclosure. Company reserves the right to limit or direct the disclosure of its Confidential Information among USU and the ASPIRE Partner Universities by providing to USU, upon the initial disclosure of any Confidential Information, written instructions detailing any disclosure limitations.

6. Additional Confidentiality Obligations. Except as required by applicable federal, state, or local law or regulation, or otherwise as mutually agreed in writing by the Parties, neither Party shall itself disclose, nor permit any of its Representatives to disclose to any person: (i) that the Confidential Information has been made available to it or its Representatives, or that it has inspected any portion of the Confidential Information; (ii) that discussions or negotiations may be, or are, underway between the Parties regarding the Confidential Information, including the status thereof; or (iii) any terms, conditions, or other arrangements that are being discussed or negotiated in relation to the Confidential Information.

7. Export Control. The Parties agree to comply with applicable United States export control laws and regulations, including the U.S. Export Administration Regulations ("*EAR*") or International Traffic in Arms Regulations ("*ITAR*") with regard to the transfer of any Confidential Information (as set forth herein) regulated by said laws and regulations. Each Party shall be solely responsible (i) for its own actions or inactions relating to compliance with applicable export control laws and regulations and (ii) for development of and adherence to internal polcies and practices ensuring compliance with applicable export control laws and regulations. If a Party intends to transmit Confidential Information to the other Party that the transmitting Party determines to be export controlled, the transmiting Party must apprise the other Party in advance of any export controlled Confidential Information and identify and label the Confidential Information as "export controlled" specifying which authority (EAR or ITAR) governs the restriction and providing the Export Control Classification Number (ECCN) for all information restricted under the EAR. The Party to whom the Confidential Information is intended to be transmitted reserves the right to elect not to receive export controlled Confidential Information. If a Party chooses instead to

accept export controlled Confidential Information, then a plan for receipt, use, and dissemination of such export-controlled Confidential Information must be developed and agreed to by a authorized business officer of the Party receiving the Confidential Information prior to such disclosure. The principal investigator or other scientific or technical contact of the Party receiving the Confidential Information may not elect, and does not have the authority to elect, to receive export controlled Confidential Information without the approval of an authorized business officer.

8. Required Disclosures.

(a) Legal Orders. Any Disclosure by the Recipient or its Representatives of any of the Disclosing Party's Confidential Information under applicable federal, state, or local law, regulation, or a valid order issued by a court or governmental agency of competent jurisdiction ("*Legal Order*") shall be subject to the terms of this Section. Before making any such disclosure, the Recipient shall make commercially reasonable efforts to provide the Disclosing Party with: (i) prompt written notice of such requirement so that the Disclosing Party may seek, at its sole cost and expense, a protective order or other remedy; and (ii) reasonable assistance, at the Disclosing Party's sole cost and expense, in opposing such disclosure or seeking a protective order or other limitations on disclosure. If, after providing such notice and assistance as required herein, the Recipient remains subject to a Legal Order to disclose any Confidential Information, the Recipient (or its Representatives or other persons to whom such Legal Order is directed) shall disclose no more than that portion of the Confidential Information which, on the advice of the Recipient's legal counsel, such Legal Order specifically requires the Recipient to disclose and, on the Disclosing Party's request, shall use commercially reasonable efforts to obtain assurances from the applicable court or agency that such Confidential Information will be afforded confidential treatment.

(b) Open Records Requests. Company acknowledges that (i) USU is a governmental entity and that other ASPIRE Partner Universities may be governmental entities and (ii) all governmental entities associated with ASPIRE are subject to various public records laws. If USU or another ASPIRE Partner University receives a public records request pursuant to any applicable open records law that relates to this Agreement or to Confidential Information as set forth herein, then USU will notify Company of the records request and coordinate to ensure the continued confidentiality of any Confidential Information.

9. Return or Destruction of Confidential Information. At any time during or after the Term (as set forth herein), at the Disclosing Party's written request, the Recipient and its Representatives shall promptly return to the Disclosing Party all copies, whether in written, electronic, or other form or media, of the Disclosing Party's Confidential Information, or destroy all such copies and certify in writing to the Disclosing Party that such Confidential Information has been destroyed. In addition, the Recipient shall also destroy all copies of any notes created by the Recipient or its Representatives and certify in writing to the Disclosing Party that such copies have been destroyed. Notwithstanding the foregoing, the Recipient may retain copies of Confidential Information that are stored on the Recipient's IT backup and disaster recovery systems until the ordinary course deletion thereof. The Recipient shall continue to be bound by the terms and conditions of this Agreement with respect to such retained Confidential Information.

10. Term and Termination. The term of this Agreement shall commence on the Effective Date and shall expire <<NUMBER>> years from the Effective Date ("*Term*"), provided that either Party may terminate this Agreement at any time by providing written notice to the other Party (such termination to be effective thirty (30) days from the date of notice). Notwithstanding anything to the contrary herein, each Party's rights and obligations under this Agreement shall survive any expiration or

termination of this Agreement for a period of <<NUMBER>> years from the date of such expiration or termination, even after the return or destruction of Confidential Information by the Recipient.

11. No Representations or Warranties. Neither the Disclosing Party nor any of its Representatives make any representation or warranty, expressed or implied, as to the accuracy or completeness of the Confidential Information disclosed to the Recipient hereunder. Neither the Disclosing Party nor any of its Representatives shall be liable to the Recipient or any of its Representatives relating to or resulting from the Recipient's use of any of the Confidential Information or any errors therein or omissions therefrom.

12. No Transfer of Rights, Title, or Interest. Each Party hereby retains its entire right, title, and interest, including all intellectual property rights, in and to all of its Confidential Information. Any disclosure of such Confidential Information hereunder shall not be construed as an assignment, grant, option, license, or other transfer of any such right, title, or interest whatsoever to the Recipient or any of its Representatives.

13. No Other Obligation. The Parties agree that neither Party shall be under any legal obligation of any kind whatsoever, or otherwise be obligated to enter into any business or contractual relationship, investment, or transaction, by virtue of this Agreement, except for the matters specifically agreed to herein. Either Party may at any time, at its sole discretion with or without cause, terminate discussions and negotiations with the other Party.

14. Remedies. Each Party acknowledges and agrees that money damages might not be a sufficient remedy for any breach or threatened breach of this Agreement by such Party or its Representatives. Therefore, in addition to all other remedies available at law (which neither Party waives by the exercise of any rights hereunder), the non-breaching Party shall be entitled to seek specific performance and injunctive and other equitable relief as a remedy for any such breach or threatened breach. Company recognizes the technical and research value of permitting USU to disclose Company's Confidential Information to permitted ASPIRE Partner Universities (*See* Section 5). Company further agrees that if a breach of the terms of this Agreement occurs, then the Company's exclusive remedy for any such breach shall be between the Company and the breaching party, whether that be USU or a permitted ASPIRE Partner University, and that USU shall not be included in any claim when the breach of duties or obligations resulted from the actions or inactions of a permitted ASPIRE Partner University.

15. Miscellaneous.

(a) Choice of Law and Venue. The Agreement will be governed by the laws of the State of Utah, without regard to conflicts of laws principles. Venue for any lawsuits, claims, or other proceedings between the Parties relating to or arising under the Agreement shall be exclusively in the State of Utah.

(b) Governmental Immunity. Company acknowledges that (i) USU is a governmental entity Company further acknowledges that (i) USU is a governmental entity under the Governmental Immunity Act of Utah, Utah Code Ann., Section 63G-7-101 et seq. and that (ii) ASPIRE Partner Universities may be governmental entities under their respective statues. Nothing in the Agreement shall be construed as a waiver by USU or any ASPIRE Partner University which receives Confidential Information pursuant to this Agreement of any protections, rights, or defenses applicable under the applicable statutes regarding governmental immunity, including without limitation, any the provisions regarding limitation of judgments. It is not the intent of USU to incur by contract any liability

for the operations, acts, or omissions of Company or any third party and nothing in the Agreement shall be so interpreted or construed. Any limitation or exclusion of liability or remedies in the Agreement for any damages other than special, indirect or consequential damages, shall be void and unenforceable.

(c) Insurance. Nothing in the Agreement shall require the Parties to carry different or additional insurance.

(d) Notice. Any payment, notice, or other communication required or permitted to be given to either party hereto shall be in writing and shall be deemed to have been properly given and effective: (a) on the date of delivery if delivered in person during recipient's normal business hours; or (b) on the date of attempted delivery if delivered by courier, express mail service or first-class mail, registered or certified. Such notice shall be sent or delivered to the respective addresses listed in the opening clause of this Agreement.

(e) Assignment. No Party may assign, transfer, or otherwise dispose of its rights, interests, or duties hereunder, in whole or in part, to any third party without prior written approval from the other Party.

(f) Relationship of Parties. In assuming and performing the obligations of this Agreement, the Parties are each acting as independent parties and neither shall be considered or represent itself as a joint venture, partner, agent or employee of the other.

(g) Third-Party Beneficiaries. The Parties hereby designate ASPIRE Partner Universities, which are not signatories to this Agreement, but who receive Confidential Information as set forth herein pursuant to Section 5 of this Agreement, as third-party beneficiaries of this Agreement. The Parties do not confer any rights or remedies upon any other third-party other than the Parties to this Agreement and their respective successors and permitted assigns.

(h) Headings. No headings in this Agreement affect its interpretation.

(i) Amendment and Supplement. Any amendment and/or supplement of this Agreement shall come into force only after a written agreement is signed by both Parties. The amendment and supplement duly executed by both Parties shall be part of this Agreement and shall have the same legal effect as this Agreement.

(j) Severability. The provisions of this Agreement are severable, and in the event that any provision of this Agreement shall be determined to be invalid or unenforceable under any controlling body of the law, such invalidity or unenforceability shall not in any way affect the validity or enforceability of the remaining provisions herein.

(k) Waivers. No waiver by any Party of any of the provisions hereof shall be effective unless explicitly set out in writing and signed by the Party so waiving. No waiver by any Party shall operate or be construed as a waiver in respect of any failure, breach, or default not expressly identified by such written waiver, whether of a similar or different character, and whether occurring before or after that waiver. No failure to exercise, or delay in exercising, any right, remedy, power, or privilege arising from this Agreement shall operate or be construed as a waiver thereof; nor shall any single or partial exercise of any right, remedy, power, or privilege hereunder preclude any other or further exercise thereof or the exercise of any other right, remedy, power, or privilege.

(l) Signatures and Counterparts. This Agreement may be executed in counterparts, each of which shall be deemed an original, but all of which together shall be deemed to be one and the same agreement. A signed copy of this Agreement delivered by facsimile, email, or other means of electronic transmission shall be deemed to have the same legal effect as delivery of an original signed copy of this Agreement.

(m) Merger. This Agreement embodies the entire understanding of the Parties and supersedes all previous communications, representations, or understandings, either oral or written, between the Parties relating to the subject matter thereof.

IN WITNESS THEREOF the Parties hereto have caused this Agreement to be duly executed on their behalf by a duly authorized representative as of the Effective Date set forth above.

UTAH STATE UNIVERSITY

By:_____ Print Name:
Title:
Date: _____

By:_____
Print Name:
Title:
Date:_____

MUTUAL CONFIDENTIALITY AGREEMENT (MULTI-PARTY)

This Mutual Confidentiality Agreement ("*Agreement*"), effective as of ("*Effective Date*"), is entered into by and between **("***Company 1***")**, a <<STATE OF ORGANIZATION>> <<ENTITY TYPE>> having its principal place of business at <<BUSINESS ADDRESS>> and the following universities: (1) Utah State University ("*USU*"), having a place of business at Old Main Hill, Logan, UT 84322; (2) (" "), having a place of business at ; and (3) (" "), having a place of business at <<ADD ADDITIONAL PARTIES AS NEEDED>> (the above listed universities are referred to individually as "University" and collectively as "Universities"). The Universities are participants in the National Science Foundation Engineering Research Center for Advancing Sustainability through Powered Infrastructure for Roadway Electrification ("*Aspire*"). The Company and each University may be referred to herein as a "*Party*" or collectively as the "*Parties*."

WHEREAS, the Parties desire to share certain information relating to <<DESCRIPTION OF INFORMATION>> that is non-public, confidential, or proprietary in nature.

NOW, THEREFORE, in consideration of the mutual covenants, terms, and conditions set out herein, the Parties agree as follows:

1. Confidential Information. Except as set out in Section 3 below, "*Confidential Information*" means all non-public, confidential, or proprietary information disclosed before, on, or after the Effective Date, by a Party ("*Disclosing Party*") to another Party ("*Recipient*") or its affiliates, or to any of such Recipient's or its affiliates' employees, officers, directors, partners, shareholders, agents, attorneys, accountants, or advisors (collectively, "*Representatives*"), whether disclosed orally or disclosed or accessed in written, electronic, or other form or media, including, without limitation:

(a) all information concerning the Disclosing Party's and its affiliates', and their customers', suppliers', and other third parties' past, present, and future business affairs including, without limitation, finances, customer information, supplier information, products, services, organizational structure and internal practices, forecasts, sales and other financial results, records and budgets, and business, marketing, development, sales, and other commercial strategies;

(b) the Disclosing Party's unpatented inventions, ideas, methods, and discoveries, trade secrets, know-how, unpublished patent applications, and other confidential intellectual property;

(c) all designs, specifications, documentation, components, source code, object code,

images, icons, audiovisual components and objects, schematics, drawings, protocols, processes, and other visual depictions, in whole or in part, of any of the foregoing;

(d) any third-party confidential information included with, or incorporated in, any information provided by the Disclosing Party to the Recipient or its Representatives; and

(e) all notes, analyses, compilations, reports, forecasts, studies, samples, data, statistics, summaries, interpretations, and other materials prepared by or for the Recipient or its Representatives that contain, are based on, or otherwise reflect or are derived from, in whole or in part, any of the foregoing.

2. Marking. Written Confidential Information (including, but not limited to, descriptions, drawings, designs, etc.) shall be clearly marked as "confidential." If certain Confidential Information has not been reduced to written form at the time of disclosure by the Disclosing Party, then such orally disclosed information shall be protected by the Receiving Party as Confidential Information, provided that the Disclosing Party shall: (i) provide a statement to the Receiving Party that the oral information shall be

protected under this Agreement; and (ii) within thirty (30) days of such disclosure, reduce to writing a summary of the orally disclosed Confidential Information.

3. Exclusions from Confidential Information. Except as required by applicable federal, state, or local law or regulation, the term "Confidential Information" as used in this Agreement shall not include information that:

(a) at the time of disclosure is, or thereafter becomes, generally available to and known by the public other than as a result of, directly or indirectly, any violation of this Agreement by the Recipient or any of its Representatives;

(b) at the time of disclosure is, or thereafter becomes, available to the Recipient on a non-confidential basis from a third-party source, provided that such third party is not and was not prohibited from disclosing such Confidential Information to the Recipient by a legal, fiduciary, or contractual obligation to the Disclosing Party;

(c) was known by or in the possession of the Recipient or its Representatives, as established by documentary evidence, before being disclosed by or on behalf of the Disclosing Party under this Agreement; or

(d) was or is independently developed by the Recipient, as established by documentary evidence, without reference to or use of, in whole or in part, any of the Disclosing Party's Confidential Information.

4. Recipient Obligations. The Recipient shall:

(a) protect and safeguard the confidentiality of all such Confidential Information with at least the same degree of care as the Recipient would protect its own Confidential Information, but in no event with less than a commercially reasonable degree of care;

(b) not use the Disclosing Party's Confidential Information, or permit it to be accessed or used, in any manner to the Disclosing Party's detriment, including without limitation, to reverse engineer, disassemble, decompile, or design around the Disclosing Party's proprietary services, products, and/or confidential intellectual property;

(c) not (except as specifically permitted in Section 5 herein) disclose any such Confidential Information to any person or entity, except to the Recipient's

Representatives who: (i) need to know the Confidential Information to assist the Recipient, or act on its behalf, or to exercise its rights under the Agreement; (ii) are informed by the Recipient of the confidential nature of the Confidential Information; and (iii) are subject to confidentiality duties or obligations to the Recipient that are no less restrictive than the terms and conditions of this Agreement; and

(d) be responsible for any breach of this Agreement caused by any of its Representatives.

5. Permitted Disclosures.

(a) ASPIRE Partner Universities. Company acknowledges that ASPIRE comprises multiple cooperating universities, including the following "*Core Partner Universities*": (1) University of Texas El Paso; (2) Purdue University; (3) University of Colorado Boulder; and (4) Auckland University; and various additional "*Affiliated Partner Universities,*" a current list of which may be requested at any time during the Term (Core Partner Universities and Affiliated Partner Universities may be referred to collectively as "*ASPIRE Partner Universities*"). ASPIRE Partner Universities each enter into a cooperative agreement with USU which defines and outlines, *inter alia*, duties and responsibilities for safeguarding the Confidential Information of USU, the ASPIRE Partner Universities, and third-party companies working with ASPIRE. Pursuant to such cooperative agreements, when an ASPIRE Partner University receives Company's Confidential Information, the ASPIRE Partner University assumes severally all of the duties and obligations of USU set forth in this Agreement.

(b) Authorization to Disclose. Company hereby authorizes USU to disclose Company's Confidential Information to any ASPIRE Partner University Representative who (i) needs to know the Confidential Information to assist USU and/or the ASPIRE Partner University, or act on its behalf; (ii) is informed by the USU or Company of the confidential nature of the Confidential Information; and (iii) is personally subject to confidentiality duties or obligations to USU or the ASPIRE Partner University that are no less restrictive than the terms and conditions of this Agreement.

(c) Right to Limit Disclosure. Company reserves the right to limit or direct the disclosure of its Confidential Information among USU and the ASPIRE Partner Universities by providing to USU, upon the initial disclosure of any Confidential Information, written instructions detailing any disclosure limitations.

6. Additional Confidentiality Obligations. Except as required by applicable federal, state, or local law or regulation, or otherwise as mutually agreed in writing by the Parties, no Party shall itself disclose, nor permit any of its Representatives to disclose to any person: (i) that the Confidential Information has been made available to it or its Representatives, or that it has inspected any portion of the Confidential Information; (ii) that discussions or negotiations may be, or are, underway between the Parties regarding the Confidential Information, including the status thereof; or (iii) any terms, conditions, or other arrangements that are being discussed or negotiated in relation to the Confidential Information.

7. Export Control. Each Party agrees to comply with applicable United States export control laws and regulations, including the U.S. Export Administration Regulations ("*EAR*") or International Traffic in Arms Regulations ("*ITAR*") with regard to the transfer of any Confidential Information (as set forth herein) regulated by said laws and regulations. Each Party shall be solely responsible (i) for its own actions or inactions relating to compliance with applicable export control laws and regulations and (ii) for development of and adherence to internal polcies and practices ensuring compliance with applicable export control laws and regulations. If a Party intends to transmit Confidential Information

to another Party that the transmitting Party determines to be export controlled, the transmiting Party must apprise the other Party in advance of any export controlled Confidential Information and identify and label the Confidential Information as "export controlled" specifying which authority (EAR or ITAR) governs the restriction and providing the Export Control Classification Number (ECCN) for all information restricted under the EAR. The Party to whom the Confidential Information is intended to be transmitted reserves the right to elect not to receive export controlled Confidential Information. If a Party chooses instead to accept export controlled Confidential Information, then a plan for receipt, use, and dissemination of such export-controlled Confidential Information must be developed and agreed to by a authorized business officer of the Party receiving the Confidential Information prior to such disclosure. The principal investigator or other scientific or technical contact of the Party receiving the Confidential Information may not elect, and does not have the authority to elect, to receive export controlled Confidential Information without the approval of an authorized business officer.

8. Required Disclosures.

(a) Legal Orders. Any Disclosure by the Recipient or its Representatives of any of the Disclosing Party's Confidential Information under applicable federal, state, or local law, regulation, or a valid order issued by a court or governmental agency of competent jurisdiction ("*Legal Order*") shall be subject to the terms of this Section. Before making any such disclosure, the Recipient shall make commercially reasonable efforts to provide the Disclosing Party with: (i) prompt written notice of such requirement so that the Disclosing Party may seek, at its sole cost and expense, a protective order or other remedy; and (ii) reasonable assistance, at the Disclosing Party's sole cost and expense, in opposing such disclosure or seeking a protective order or other limitations on disclosure. If, after providing such notice and assistance as required herein, the Recipient remains subject to a Legal Order to disclose any Confidential Information, the Recipient (or its Representatives or other persons to whom such Legal Order is directed) shall disclose no more than that portion of the Confidential Information which, on the advice of the Recipient's legal counsel, such Legal Order specifically requires the Recipient to disclose and, on the Disclosing Party's request, shall use commercially reasonable efforts to obtain assurances from the applicable court or agency that such Confidential Information will be afforded confidential treatment.

(b) Open Records Requests. Company acknowledges that (i) USU is a governmental entity and that other Parties may be governmental entities and (ii) all governmental entities associated with ASPIRE are subject to various public records laws. If USU or another Party receives a public records request pursuant to any applicable open records law that relates to this Agreement or to Confidential Information as set forth herein, then said Party receiving the request will notify the other Parties of the records request and coordinate to ensure the continued confidentiality of any Confidential Information.

9. Return or Destruction of Confidential Information. At any time during or after the Term (as set forth herein), at the Disclosing Party's written request, the Recipient and its Representatives shall promptly return to the Disclosing Party all copies, whether in written, electronic, or other form or media, of the Disclosing Party's Confidential Information, or destroy all such copies and certify in writing to the Disclosing Party that such Confidential Information has been destroyed. In addition, the Recipient shall also destroy all copies of any notes created by the Recipient or its Representatives and certify in writing to the Disclosing Party that such copies have been destroyed. Notwithstanding the foregoing, the Recipient may retain copies of Confidential Information that are stored on the Recipient's IT backup and disaster

recovery systems until the ordinary course deletion thereof. The Recipient shall continue to be bound by the terms and conditions of this Agreement with respect to such retained Confidential Information.

10. Term and Termination. The term of this Agreement shall commence on the Effective Date and shall expire <<NUMBER>> years from the Effective Date ("*Term*"), provided that any Party may terminate this Agreement at any time by providing written notice to the other Parties (such termination to be effective thirty (30) days from the date of notice). Notwithstanding anything to the contrary herein, each Party's rights and obligations under this Agreement shall survive any expiration or termination of this Agreement for a period of <<NUMBER>> years from the date of such expiration or termination, even after the return or destruction of Confidential Information by the Recipient.

11. No Representations or Warranties. Neither the Disclosing Party nor any of its Representatives make any representation or warranty, expressed or implied, as to the accuracy or completeness of the Confidential Information disclosed to the Recipient hereunder. Neither the Disclosing Party nor any of its Representatives shall be liable to the Recipient or any of its Representatives relating to or resulting from the Recipient's use of any of the Confidential Information or any errors therein or omissions therefrom.

12. No Transfer of Rights, Title, or Interest. Each Party hereby retains its entire right, title, and interest, including all intellectual property rights, in and to all of its Confidential Information. Any disclosure of such Confidential Information hereunder shall not be construed as an assignment, grant, option, license, or other transfer of any such right, title, or interest whatsoever to the Recipient or any of its Representatives.

13. No Other Obligation. The Parties agree that no Party shall be under any legal obligation of any kind whatsoever, or otherwise be obligated to enter into any business or contractual relationship, investment, or transaction, by virtue of this Agreement, except for the matters specifically agreed to herein. Any Party may at any time, at its sole discretion with or without cause, terminate discussions and negotiations with another Party.

14. Remedies. Each Party acknowledges and agrees that money damages might not be a sufficient remedy for any breach or threatened breach of this Agreement by such Party or its Representatives. Therefore, in addition to all other remedies available at law (which no Party waives by the exercise of any rights hereunder), the non-breaching Party shall be entitled to seek specific performance and injunctive and other equitable relief as a remedy for any such breach or threatened breach. Company recognizes the technical and research value of permitting USU to disclose Company's Confidential Information to permitted ASPIRE Partner Universities (*See* Section 5). Company further agrees that if a breach of the terms of this Agreement occurs, then the Company's exclusive remedy for any such breach shall be between the Company and the breaching party, whether that be USU or a permitted ASPIRE Partner University, and that USU shall not be included in any claim when the breach of duties or obligations resulted from the actions or inactions of a permitted ASPIRE Partner University.

15. Miscellaneous.

(a) Choice of Law and Venue. The Agreement will be governed by the laws of the State of Utah, without regard to conflicts of laws principles. Venue for any lawsuits, claims, or other proceedings between the Parties relating to or arising under the Agreement shall be exclusively in the State of Utah.

(b) Governmental Immunity. Company further acknowledges that USU is a governmental entity, and other Parties may be governmental entities, under various governmental immunity acts ("Acts") (e.g., Governmental Immunity Act of Utah, Utah Code Ann., Section 63G-7-101 et seq.) . Nothing in the Agreement shall be construed as a waiver by USU or any other Party of any protections, rights, or defenses applicable under the Acts, including without limitation, any the provisions

regarding limitation of judgments. It is not the intent of USU or any other Party to incur by contract any liability for the operations, acts, or omissions of Company or any third party and nothing in the Agreement shall be so interpreted or construed. Any limitation or exclusion of liability or remedies in the Agreement for any damages other than special, indirect or consequential damages, shall be void and unenforceable.

(c) Insurance. Nothing in the Agreement shall require the Parties to carry different or additional insurance.

(d) Notice. Any payment, notice, or other communication required or permitted to be given to any Party hereto shall be in writing and shall be deemed to have been properly given and effective: (a) on the date of delivery if delivered in person during recipient's normal business hours; or (b) on the date of attempted delivery if delivered by courier, express mail service or first-class mail, registered or certified. Such notice shall be sent or delivered to the respective addresses listed in the opening clause of this Agreement.

(e) Assignment. No Party may assign, transfer, or otherwise dispose of its rights, interests, or duties hereunder, in whole or in part, to any third party without prior written approval from another Party.

(f) Relationship of Parties. In assuming and performing the obligations of this Agreement, the Parties are each acting as independent parties and neither shall be considered or represent itself as a joint venture, partner, agent or employee of the other.

(g) Third-Party Beneficiaries. The Parties hereby designate ASPIRE Partner Universities, which are not signatories to this Agreement, but who receive Confidential Information as set forth herein pursuant to Section 5 of this Agreement, as third-party beneficiaries of this Agreement. The Parties do not confer any rights or remedies upon any other third-party other than the Parties to this Agreement and their respective successors and permitted assigns.

(h) Headings. No headings in this Agreement affect its interpretation.

(i) Amendment and Supplement. Any amendment and/or supplement of this Agreement shall come into force only after a written agreement is signed by both Parties. The amendment and supplement duly executed by both Parties shall be part of this Agreement and shall have the same legal effect as this Agreement.

(j) Severability. The provisions of this Agreement are severable, and in the event that any provision of this Agreement shall be determined to be invalid or unenforceable under any controlling body of the law, such invalidity or unenforceability shall not in any way affect the validity or enforceability of the remaining provisions herein.

(k) Waivers. No waiver by any Party of any of the provisions hereof shall be effective unless explicitly set out in writing and signed by the Party so waiving. No waiver by any Party shall operate or be construed as a waiver in respect of any failure, breach, or default not expressly identified by such written waiver, whether of a similar or different character, and whether occurring before or after that waiver. No failure to exercise, or delay in exercising, any right, remedy, power, or privilege arising from this Agreement shall operate or be construed as a waiver thereof; nor shall any single or partial exercise of any right, remedy, power, or privilege hereunder preclude any other or further exercise thereof or the exercise of any other right, remedy, power, or privilege.

(l) Signatures and Counterparts. This Agreement may be executed in counterparts, each of which shall be deemed an original, but all of which together shall be deemed to be one and the same agreement. A signed copy of this Agreement delivered by facsimile, email, or other means of electronic transmission shall be deemed to have the same legal effect as delivery of an original signed copy of this Agreement.

(m) Merger. This Agreement embodies the entire understanding of the Parties and

supersedes all previous communications, representations, or understandings, either oral or written, between the Parties relating to the subject matter thereof.

IN WITNESS THEREOF the Parties hereto have caused this Agreement to be duly executed on their behalf by a duly authorized representative as of the Effective Date set forth above.

UTAH STATE UNIVERSITY	<<COMPANY NAME>>
By:_____ Print Name: Title: Date: _____	By:_____ Print Name: Title: Date:_____
<<UNIVERSITY NAME>>	<<UNIVERSITY NAME>>
By:_____ Print Name: Title: Date: _____	By:_____ Print Name: Title: Date:_____
<<UNIVERSITY NAME>>	<<UNIVERSITY NAME>>
By:_____ Print Name: Title: Date: _____	By:_____ Print Name: Title: Date:_____

EXHIBIT E: Participation and Confidentiality Agreement Template

The National Science Foundation ("*NSF*") has established the Advancing Sustainability through Powered Infrastructure for Roadway Electrification Engineering Research Center ("*ASPIRE*") at Utah State University ("*USU*") (the lead university) in collaboration with core partners Purdue University, University of Texas at El Paso, University of Colorado Boulder, and University of Auckland and additional affiliated partner universities to pursue research, education, diversity and inclusion, and commercialization activities to advance transportation electrification.

This PARTICIPATION AND NON-DISCLOSURE AGREEMENT ("*Agreement*") establishes the terms and conditions for the following individual to participate in ASPIRE projects:

Participant Information:

Name:	("Participant")		
University:			
Address:			
Phone:		Email:	

I, in consideration of the opportunity to participate in ASPIRE projects and in consideration of any wages, financial support, training, and/or research experience associated with ASPIRE projects, hereby agree as follows:

1. Confidential Information. I understand that my University has entered into a "*Cooperative Agreement*" (a copy of which may be obtained from my University and which is incorporated herein by reference) that includes obligations and duties relating to the safeguarding and protection of "*Confidential Information*" (which term is defined in the Cooperative Agreement). I agree to comply with all applicable obligations and duties associated with safeguarding, protecting, and using Confidential Information as set forth in the Cooperative Agreement.

2. Data. I understand that the Cooperative Agreement includes obligations and duties relating to "*ASPIRE Data*" (which term is defined in the Cooperative Agreement). I agree to comply with all applicable obligations and duties associated with the use, management, and care of ASPIRE Data.

3. Intellectual Property. I understand that the Cooperative Agreement and associated ASPIRE Intellectual Property Policy includes obligations and duties relating to intellectual property. I agree to comply with all applicable obligations and duties associated with the ASPIRE Intellectual Property Policy. I understand that my access to or receipt of Confidential Information or ASPIRE Data shall not constitute any type of grant or license to the intellectual property associated therewith.

4. Ownership. I understand and agree that my participation in an ASPIRE project does not confer personal ownership rights to any intellectual property that I might develop as a result of

my participation. Ownership rights shall be subject to the ASPIRE Intellectual Property Policy and the policies of my employer (as applicable).

5. Personal Responsibility. I understand and agree that I may be held personally liable if I breach any of the terms or conditions as set forth herein.

6. Conclusion of Participation. I agree that immediately upon termination/completion of my participation in ASPIRE project(s), (a) I will destroy any records in my possession containing any ASPIRE Data or Confidential Information; and (b) I will protect and not disclose to third parties or make unauthorized use of ASPIRE Data or Confidential Information, unless otherwise authorized by the owner of the ASPIRE Data or Confidential Information.

7. Miscellaneous. I understand that USU, as ASPIRE's lead institution, reserves the right, at any time, to require me to execute a new participation agreement with modified terms as a condition of continued participation with ASPIRE. The Agreement will be governed by the laws of the State of Utah, without regard to conflicts of laws principles. Venue for any lawsuits, claims, or other proceedings between the Parties relating to or arising under the Agreement shall be exclusively in the State of Utah

IN WITNESS THEREOF, PARTICIPANT HEREBY EXECUTES THIS AGREEMENT AS OF THE DATE SET FORTH BELOW.

Signature:_____
Date:_____

EXHIBIT F: ASPIRE Intellectual Property Policy

The National Science Foundation ("*NSF*") has established the Advancing Sustainability through Powered Infrastructure for Roadway Electrification ("*ASPIRE*") Engineering Research Center at Utah State University ("*USU*") (the lead university) in collaboration with core partners Purdue University, University of Texas at El Paso, University of Colorado Boulder, and University of Auckland and additional affiliated partner universities to pursue research, education, diversity and inclusion, and commercialization activities to advance transportation electrification, including the areas of transportation infrastructure and charging systems, electric vehicles, and electric grid infrastructure. This document serves as the Intellectual Property Policy for ASPIRE.

The generation and transfer of valuable intellectual property is a primary objective of ASPIRE. In furtherance of this objective, ASPIRE will serve as a gathering place for researchers and innovators from universities, governmental agencies, and private industry, each of whom will contribute to the generation and eventual commercial transfer of intellectual property into the marketplace. All ASPIRE Participants will be subject to this Intellectual Property Policy.

1. Definitions

a. "Intellectual Property" means any Inventions, patents, Copyrights, Trademarks, service marks, Tangible Research Property, Trade Secrets, or know-how.

b. "Invention" means any new and useful process, machine, manufacture, or composition or matter, or any new and useful improvement thereof. See 35 U.S.C. §101.

c. "Copyright" means an original work of authorship fixed in any tangible medium of expression, now known or later developed, from which it can be perceived, reproduced, or otherwise communicated, either directly or with the aid of a machine or device. A work of authorship includes the following categories: literary works; musical works, including any accompanying words; dramatic works, including any accompanying music; pantomimes and choreographic works; pictorial, graphic, and sculpture works, motion pictures and other audiovisual works; sound recordings; and architectural works. See 17 U.S.C. §102.

d. "Trademark" means a word, phrase, symbol, or design, or a combination thereof that identifies and distinguishes the source of the goods or services of one party from those of others.

e. "Tangible Research Property" means tangible items produced in the course of research, such as compositions, chemical compounds, Biological Materials, materials, drawings, devices, integrated circuit chips, computer databases, computer software, prototypes, circuit designs, and equipment.

f. "Biological Materials" means, but is not limited to, products of synthetic biology, organisms, transgenic animals, plants and plant varieties, cells, cell lines, plasmids, vectors, viruses, cell products, cloned DNA and RNA, protein fragments, nucleic acid sequences, and protein sequences.

g. "Trade Secret" means information, including a formula, pattern, compilation, program, device, method, technique, or process, that: (i) derives independent economic value, actual or potential, from not being generally known to, and not being readily ascertainable by proper means by, other persons who can obtain economic value from its disclosure or use; and (ii) is the

subject of efforts that are reasonable under the circumstances to maintain its secrecy. See Utah State Code §13-24-2.

h. "ASPIRE Project" means any project that is funded by ASPIRE NSF funds, membership fees, or other ASPIRE funds.

i. "Project IP" means Intellectual Property arising from an ASPIRE Project.

j. "ASPIRE Participant" means a researcher, student, or volunteer who participates in an ASPIRE Project.

k. "Partner University" includes any core domestic partner university, core international partner university, or affiliated partner university as designated by the ASPIRE Leadership Team after having executed an approved cooperative agreement.

l. "Revenues" means any (i) royalties, (ii) fees (e.g. license fees, maintenance fees, and exit fees), and/or (iii) revenues derived as a result of equity (e.g. dividends and the sale of shares) that are actually received by an owner Project IP as a result of the Technology Transfer of the Project IP less any Cumulative Expenses, as defined herein.

m. "Cumulative Expenses" means any expenses incurred by the owner(s) for the protection and/or Technology Transfer of a particular work of Project IP. Cumulative Expenses includes, for example, expenses associated with the preparation and prosecution of a patent application and the maintenance of an issued patent.

n. "Technology Transfer" means the activities involved in taking Project IP from its conceptual, emerging, prototype, or early developmental state to a point where commercial financial gains can be realized. It also encompasses the activities involved in developing collaborations, partnerships, contracts, and similar agreements with commercial companies to achieve mutually beneficial commercial outcomes. These activities may include, but are not limited to, technology maturation, development of product prototypes, joint proposals to other funding entities, and performing technology demonstrations.

2. Ownership.

a. Background IP. All right, title, and interest in and to any Intellectual Property developed by an ASPIRE Participant independent of an ASPIRE Project shall remain with the developer.

b. Project IP. Project IP shall be initially owned by the employer(s) of the inventor(s). Inventorship or authorship shall be determined according to U.S. law. For example, if Project IP is invented by an inventor employed by institution A and an inventor employed by institution B, then both institutions A and B will be owners of the Project IP.

3. Disclosure. Each Partner University shall ensure that all ASPIRE Participants under its employ, care, or management, shall disclose in a timely manner all Project IP. To ensure that rights are legally secured, disclosure of Project IP **must** be made prior to any publication, presentation, or other form of public disclosure. Disclosure of Project IP shall be made by each inventor to both (a) his/her employer's/institution's existing technology transfer office according to the employer's invention disclosure policies; and (b) ASPIRE, via the ASPIRE intellectual property portal. The ASPIRE intellectual property portal shall be administered and maintained by USU, ASPIRE's lead institution.

4. IP Protection. Upon disclosure, the Project IP owner(s) will propose to the ASPIRE Leadership Team an intellectual property protection strategy. Strategies may include, for example, the filing of a patent application domestically or internationally, the registration of copyrightable material, etc. ASPIRE, as an Engineering Research Center, is not responsible for the protection of Project IP; rather, each Project IP owner retains ultimate responsibility for the protection of its Project IP.

5. Coordination for Multiple Owners. If multiple parties qualify as owners of Project IP, then the Project IP owners will promptly, after disclosure, enter into an appropriate and equitable interinstitutional agreement ("IIA"). An IIA must define responsibilities for IP protection and commercialization and include an explanation of how costs and revenues associated with the Project IP will be shared between the owners.

6. Commercialization. One of ASPIRE's objectives is the efficient and expeditious transfer of Project IP into the marketplace. Each Partner University shall support and enable the following described process.

a. Industry Research Collaborators. ASPIRE Industry Members may elect to participate in ASPIRE Projects as Industry Research Collaborators. When an Industry Member so elects, it is given first opportunity to negotiate commercial rights to Project IP that is developed and disclosed during the annual period set forth in the applicable Participation Agreement. The privileges and timelines for an Industry Research Collaborator or Industry Member generally for securing commercial rights to Project IP are as follows:

i. Notification. Upon ASPIRE's receipt of an invention disclosure containing Project IP, ASPIRE will, in turn and in a timely manner, provide participating Industry Research Collaborators with a copy of the invention disclosure under terms of confidentiality. ii. Evaluation. Each participating Industry Research Collaborator will have thirty (30) days from the date of receiving the invention disclosure ("Evaluation Period") to both evaluate the invention disclosure and notify ASPIRE in writing if it is interested in pursuing commercial rights to the Project IP. iii. Negotiation. Upon ASPIRE's receipt of an Industry Research Collaborator's notification of its interest, the Project IP owners(s) will be informed, and the Industry Research Collaborator and owner-institution(s) will engage in good faith negotiations for a period of up to ninety (90) days from the notification of interest date ("Negotiation Period"). iv. Extension of Opportunity to other Industry Members. If (i) no Industry Research Collaborator notifies ASPIRE of its interest during the Evaluation Period, (ii) the Project IP owner(s) and interested Industry Research Collaborators fail to come to terms during the Negotiation Period, or (iii) any commercial rights to Project IP remain available after the Negotiation Period, then ASPIRE will notify Industry Members generally of the availability of any such Project IP. If, after a period of sixty (60) days from the general notification date, interested Industry Members and the Project IP owner(s) have not come to terms for commercial Rights to the Project IP, then the Project IP may be offered to any interested party (including third parties that are not Industry Members).

b. Research License. ASPIRE has an objective to facilitate research and development among its various members and partners. To this end, the Partner Universities each grant to one another a fully paid up, non-exclusive, non-sublicensable right to any and all Project IP solely for non-commercial research purposes. Unless authorized by the ASPIRE Leadership Team, any grant of a commercial right to Project IP must specifically include terms retaining a research license for the IP owner(s) and the other Partner Universities.

c. Revenue Distributions. To aid in the ongoing support of ASPIRE, each Partner University will, subject to the distributions required by its governing policies, (i) distribute to USU, as the lead institution, ten percent (10%) of Revenues; and (ii) reserve at least fifteen percent (15%) of Revenues retained by the Partner University, after distributions to USU and any inventors, to be allocated to funding ASPIRE programs and projects internally within the Partner University. Any revenue distribution received by USU pursuant to this Section will be used solely to support the administrative, education, and research functions of ASPIRE. The above

percentages may be adjusted by the ASPIRE Leadership Team, as ratified by the Deans Council, from time-to-time.

7. Associated Intellectual Property. The Partner Universities acknowledge that each is engaged in research and activities that relate to the goals and objectives of ASPIRE and which are not necessarily funded by ASPIRE ("Associated Projects"). The management and commercialization of and access to Intellectual Property generated as a result of Associated Projects shall be determined by the IP owner in coordination with any applicable project sponsors or funders.

Human Subjects Approval Form

OFFICE OF RESEARCH
UtahStateUniversity.

Institutional Review Board

Exemption #2
Certificate of Exemption

From: Melanie Domenech Rodriguez, IRB Chair

Nicole Vouvalis, IRB Director

To: ***Regan Zane***

Date: ***October 20, 2021***

Protocol #: ***12113***

Title: ***Gig Driving and Electric Vehicles***

The Institutional Review Board has determined that the above-referenced study is exempt from review under federal guidelines 45 CFR Part 46.104(d) category #2:

> *Research that only includes interactions involving educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior (including visual or auditory recording) if at least one of the following criteria is met: (i) The information obtained is recorded in such a manner that the identity of the human subjects cannot readily be ascertained, directly or through identifiers linked to the subject; (ii) Any disclosure of the responses outside the research would not reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, educational advancement, or reputation, or (iii) the information obtained is recorded by the investigator in such a manner that the identity of the human subjects can readily be ascertained, directly or through identifiers linked to the subjects, and the IRB conducts a limited IRB review to make required determinations.*

This exemption is valid for five years from the date of this correspondence, after which the study will be closed. If the research will extend beyond five years, it is your responsibility as the Principal Investigator to notify the IRB before the study's expiration date and submit a new application to continue the research. Research activities that continue beyond the expiration date without new certification of exempt status will be in violation of those federal guidelines which permit the exempt status.

If this project involves Non-USU personnel, they may not begin work on it (regardless of the approval status at USU) until a Reliance Agreement, External Research Agreement, or separate protocol review has been completed with the appropriate external entity. Many schools will not engage in a Reliance Agreement for Exempt protocols, so the research team must determine what the appropriate approval mechanism is for their Non-USU colleagues. As part of the IRB's quality assurance procedures, this research may be randomly selected for audit during the five-year period of exemption. If so, you will receive a request for completion of an Audit Report form during the month of the anniversary date of this certification.

In all cases, it is your responsibility to notify the IRB prior to making any changes to the study by submitting an Amendment request. This will document whether or not the study still meets the requirements for exempt status under federal regulations.

Upon receipt of this memo, you may begin your research. If you have questions, please call the IRB office at (435) 797-1821 or email to irb@usu.edu.

The IRB wishes you success with your research.

435.797.1821 | 1450 Old Main Hill | Logan, UT 84322 | MAIN 155 | irb@usu.edu | FWA#00003308

Institutional Review Board

Exemption #2
Certificate of Exemption

From: Melanie Domenech Rodriguez, IRB Chair

Nicole Vouvalis, IRB Director

To: ***Regan Zane***

Date: ***February 28, 2022***

Protocol #: ***12462***

Title: ***Electric Vehicle Road Trip Study***

The Institutional Review Board has determined that the above-referenced study is exempt from review under federal guidelines 45 CFR Part 46.104(d) category #2:

> *Research that only includes interactions involving educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior (including visual or auditory recording) if at least one of the following criteria is met: (i) The information obtained is recorded in such a manner that the identity of the human subjects cannot readily be ascertained, directly or through identifiers linked to the subject; (ii) Any disclosure of the responses outside the research would not reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, educational advancement, or reputation, or (iii) the information obtained is recorded by the investigator in such a manner that the identity of the human subjects can readily be ascertained, directly or through identifiers linked to the subjects, and the IRB conducts a limited IRB review to make required determinations.*

This exemption is valid for five years from the date of this correspondence, after which the study will be closed. If the research will extend beyond five years, it is your responsibility as the Principal Investigator to notify the IRB **before** the study's expiration date and submit a new application to continue the research. Research activities that continue beyond the expiration date without new certification of exempt status will be in violation of those federal guidelines which permit the exempt status.

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In all cases, it is your responsibility to notify the IRB **prior** to making any changes to the study by submitting an Amendment request. This will document whether or not the study still meets the requirements for exempt status under federal regulations.

Upon receipt of this memo, you may begin your research. If you have questions, please call the IRB office at (435) 797-1821 or email to irb@usu.edu.

The IRB wishes you success with your research.

435.797.1821 | 1450 Old Main Hill | Logan, UT 84322 | MAIN 155 | irb@usu.edu | FWA#00003308

Protocol #12462
IRB Exemption Date: February 28, 2022
Consent Document Expires: January 31, 2023

v.2

Letter of Information

Electric Vehicle Road Trip Study

You are invited to participate in a research study by Regan Zane (a professor in the Electrical & Computer Engineering Department), Patrick Singleton (an assistant professor in the Civil & Environmental Engineering Department), and Antje Graul (an assistant professor in the Marketing & Strategy Department), all at Utah State University.

The purpose of this research is to understand experiences and perceptions of using electric vehicles (EVs) for recreational road trips. Specifically, we are interested in learning about the experiences, perceptions, barriers, and opportunities for using EVs to make road trips to recreational areas (such as national parks, state parks, national forests, etc.) and for recreational activities (such as camping, hiking, boating, fishing, skiing, etc.). You are being asked to participate in this research because you are an adult (age 18+) who has experience owning, driving, and/or using an EV for a recreational road trip.

Your participation in this study is voluntary and you may withdraw your participation at any time for any reason by closing out a browser, submitting an incomplete survey, or contacting one of the investigators.

If you take part in this study, you will be asked to complete an online survey about your EV information, experiences using an EV for a recreational road trip, perceptions of those experiences and other aspects of EVs, and sociodemographic characteristics. Your total participation in this study is expected to be 15 minutes.

The possible risks of participating in this study include loss of confidentiality. We cannot guarantee that you will directly benefit from this study, but it has been designed to learn more about barriers and opportunities for facilitating EV access to recreational destinations. Your input will be used to help plan future infrastructure investments in vehicle electrification.

We will make every effort to ensure that the information you provide remains confidential. We will not reveal your identity in any publications, presentations, or reports resulting from this research study. However, it may be possible for someone to recognize the specifics you share with us. You will be asked to provide your contact information in order to enter a gift card drawing. You will be also asked if USU can contact you about future research opportunities on these topics.

We will collect your information through Qualtrics.com, an online survey platform. Online activities always carry a risk of a data breach, but we will use systems and processes that minimize breach opportunities. This survey data will be securely stored in a restricted-access folder on Box.com, an encrypted, cloud-based storage system. After the data have been collected and checked for completeness, your contact information will be separated from your responses. After distributing gift

cards, your contact information will be destroyed; if you agreed to allow USU to contact you about future research opportunities, your contact information will be destroyed after 2 years.

For your participation in this research study you will be offered the opportunity to enter a drawing to win one of ten $100 Amazon e-gift cards. Contact information you provide in order to sign up for the gift card drawing will be deleted after the study has been completed and all gift cards have been distributed.

You can decline to participate in any part of this study for any reason and can end your participation at any time.

If you have any questions about this study, you can contact Regan Zane (regan.zane@usu.edu), Patrick Singleton (patrick.singleton@usu.edu), and/or Antje Graul (antje.graul@usu.edu). Thank you again for your time and consideration. If you have any concerns about this study, please contact Utah State University's Human Research Protection Office at (435) 797-0567 or irb@usu.edu.

Electrical & Computer Engineering | https://engineering.usu.edu/ece/ | 4120 Old Main Hill | Logan, UT 84322

Certification of the Industry/Practitioner Membership List

INDUSTRY/ PRACTITIONER MEMBERS

PRIVATE SECTOR
ABB E-Mobility
AECOM Technology Corporation
Asphalt Systems Inc
Concrete & Masonry & Hardscapes Association
CRH Group Services Limited
Cummins, Inc.
Denso Corporation
Eaton Corporation
Electreon Wireless
Electric Power Systems
ENRX
Esri
Ford Motor Company
Geotab
HNTB
Hyster-Yale Group, Inc.
InductEV
John Deere
Kenworth Trucks, Inc.
Laurel Group
PacifiCorp - Rocky Mountain Power
PC Krause and Associates, Inc.
Rekor
Schneider Electric
Southwire
Toyota Motor Engineering & Manufacturing North America, Inc.
WiTricity Corporation
WSP

NON-PRIVATE SECTOR
Central Florida Expressway
Indiana Department of Transportation
Pennsylvania Turnpike Authority
State of Utah
UDOT (Utah Department of Transportation)
Utah Inland Port Authority

AOR Certification: Drake Fresh Digitally signed by Drake Fresh Date: 2025.09.15 08:24:37 -06'00'

Certification of Cumulative and Current Cost Sharing

COST SHARING BY INSTITUTION

Institution	Award Year 1		Award Year 2	
	Committed	Amount transferred to ERC Account	Committed	Amount transferred to ERC Account
Utah State University (Lead)	$ 307,424.30	$ 483,752.41	$ 359,308.69	$ 659,181.21
Purdue University (Core)	$ 231,718.00	$ 72,432.55	$ 237,124.00	$ 291,992.76
The University of Texas at El Paso (Core)	$ 75,067.00	$ -	$ 97,997.00	$ -
University of Colorado Boulder (Core)	$ 163,127.00	$ 150,612.29	$ 169,702.00	$ 187,792.87
TOTAL	**$ 777,336.30**	**$ 706,797.25**	**$ 864,131.69**	**$ 1,138,966.84**

Institution	Award Year 3		Award Year 4	
	Committed	Amount transferred to ERC Account	Committed	Amount transferred to ERC Account
Utah State University (Lead)	$ 402,857.39	$ 615,311.28	$ 417,835.55	$ 574,153.11
Purdue University (Core)	$ 186,474.00	$ 212,163.90	$ 250,356.00	$ 258,998.60
The University of Texas at El Paso (Core)	$ 131,757.00	$ -	$ 132,073.00	$ 636,026.77
University of Colorado Boulder (Core)	$ 152,511.00	$ -	$ 157,909.00	$ 322,729.06
TOTAL	**$ 873,599.39**	**$ 827,475.18**	**$ 958,173.55**	**$ 1,791,907.54**

Institution	Current Award Year		Award Year 6	
	Committed	Amount transferred to ERC Account (to date)*	Committed	Amount transferred to ERC Account
Utah State University (Lead)	$ 414,968.07	$ 438,180.85	$ 546,356.46	$ -
Purdue University (Core)	$ 190,682.00	$ 216,658.69	$ 251,276.00	$ -
The University of Texas at El Paso (Core)	$ 133,366.00	$ 59,881.51	$ 138,150.00	$ -
University of Colorado Boulder (Core)	$ 163,538.00	$ 84,053.59	$ 137,101.00	$ -
TOTAL	**$ 902,554.07**	**$ 798,774.64**	**$ 1,072,883.46**	**$ -**

Institution	Award Year 7		Award Year 8	
	Committed	Amount transferred to ERC Account	Committed	Amount transferred to ERC Account
Utah State University (Lead)	$ 560,772.73	$ -	$ 571,741.31	$ -
Purdue University (Core)	$ 260,307.00	$ -	$ 265,462.00	$ -
The University of Texas at El Paso (Core)	$ 141,629.00	$ -	$ 145,215.00	$ -
University of Colorado Boulder (Core)	$ 141,778.00	$ -	$ 146,628.00	$ -
TOTAL	**$ 1,104,486.73**	**$ -**	**$ 1,129,046.31**	**$ -**

Institution	Award Year 9		Award Year 10	
	Committed	Amount transferred to ERC Account	Committed	Amount transferred to ERC Account
Utah State University (Lead)	$ 435,361.32	$ -	$ 336,587.18	$ -
Purdue University (Core)	$ 162,981.00	$ -	$ 112,037.00	$ -
The University of Texas at El Paso (Core)	$ 148,898.00	$ -	$ 149,869.00	$ -
University of Colorado Boulder (Core)	$ 151,650.00	$ -	$ 116,200.00	$ -
TOTAL	**$ 898,890.32**	**$ -**	**$ 714,693.18**	**$ -**

Institution	Cumulative Amount Transferred to ERC Account
Utah State University (Lead)	$ 2,770,578.86
Purdue University (Core)	$ 1,052,246.50
The University of Texas at El Paso (Core)	$ 695,908.28
University of Colorado Boulder (Core)	$ 745,187.81
TOTAL	**$ 5,263,921.45**

***This information is as of 06/30/2025**

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AOR Certification: _____

Listing of all Conflict of Interests for Center Faculty and Students

1. There is currently no COIs at the Center.

Certification of Unexpended Residual Funds Table

UNEXPENDED RESIDUAL IN THE CURRENT AWARD AND PROPOSED AWARD YEAF

	Previous Award Year to Current Award Year	Current Award Year to Proposed Award Year
Total Unexpended Residual Funds	$ 9,108,079.00	$ 6,155,443.00
Committed, Encumbered, Obligated Funds	$ -	$ 2,865,162.99
Residual Funds Without Specified Use	$ -	$ 3,290,280.01

***This information is according to the estimated support and estimated residual funds reported in the ERC system through 08/31/2025**

AOR Certification: Drake Fresh Digitally signed by Drake Fresh Date: 2025.09.15 15:31:21 -06'00'

Appendix III: ERC Web Personnel Summary

Table: ERC Personnel

Personnel Type	Total[1]	Sex			Citizenship Status										Ethnicity: Hispanic			Disability
					Race-U.S. citizens and permanent residents only								Citizenship Foreign/Temp Visa	Citizenship Not Reported	U.S. Citizen/Perm Resident	Citizenship Foreign/Temp Visa	Citizenship Not Reported	
		Male	Female	Sex Not Reported	AI/AN	NH/PI	B/AA	W	A	More than one race reported, minority	More than one race reported, non-minority	Race Not Reported						
Total All Institutions																		
Total [2]	456	211	95	150	3	1	5	191	23	1	2	18	87	125	26	14	1	10
Leadership/Administration																		
Directors	8	4	4	0	0	0	0	4	1	0	0	1	1	1	1	0	0	0
Research Thrust Leader	12	9	3	0	0	0	0	8	2	0	0	0	2	0	1	0	0	0
Innovation Ecosystem Program Leader	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Engineering Workforce Development Program Leader	3	2	1	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0
Administrative Director	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Staff	10	1	8	1	0	0	1	8	0	0	0	0	0	1	0	0	0	0
Student Leader	2	1	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
Subtotal	**37**	**18**	**18**	**1**	**0**	**0**	**2**	**24**	**3**	**0**	**0**	**1**	**4**	**3**	**2**	**0**	**0**	**1**

Programmatic Personnel																		
Senior Faculty	51	35	12	4	0	0	0	28	8	0	0	2	4	9	2	0	0	2
Junior Faculty	34	17	14	3	0	0	1	12	5	1	1	1	7	6	3	1	0	0
Staff	54	26	19	9	0	0	1	37	0	0	0	2	6	8	1	1	0	3
Visiting Faculty	2	2	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	1
Total Postdocs	10	5	2	3	0	0	0	4	0	0	0	0	4	2	2	0	0	0
Total Doctoral Students	105	48	16	41	0	0	2	16	2	0	0	3	44	38	3	5	1	0
Total Master's Students	41	19	8	14	0	0	1	14	1	0	0	2	14	9	1	2	0	0
Total Undergraduate Students	152	58	24	70	3	1	0	79	6	0	1	8	8	46	14	5	0	4
Subtotal	**449**	**210**	**95**	**144**	**3**	**1**	**5**	**190**	**23**	**1**	**2**	**18**	**87**	**119**	**26**	**14**	**1**	**10**
ERC REU Students																		
Center Funding Students	6	0	0	6	0	0	0	0	0	0	0	0	0	6	0	0	0	0
Subtotal	**6**	**0**	**0**	**6**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**6**	**0**	**0**	**0**	**0**
Precollege (K-12)																		
Teachers (non-RET)	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Subtotal	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Utah State University - Lead Institution																		
Total [2]	202	95	44	63	0	1	2	125	6	1	0	8	28	31	3	2	0	7
Leadership/Administration																		
Directors	2	1	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0
Research Thrust Leader	5	4	1	0	0	0	0	4	0	0	0	0	1	0	0	0	0	0
Innovation Ecosystem	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1

Program Leader																		
Engineering Workforce Development Program Leader	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Administrative Director	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Staff	9	1	7	1	0	0	1	7	0	0	0	0	0	1	0	0	0	0
Student Leader	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Subtotal	**20**	**7**	**12**	**1**	**0**	**0**	**1**	**15**	**0**	**0**	**0**	**0**	**3**	**1**	**0**	**0**	**0**	**1**
Programmatic Personnel																		
Senior Faculty	9	7	2	0	0	0	0	7	1	0	0	1	0	0	0	0	0	1
Junior Faculty	17	8	7	2	0	0	0	8	3	1	0	0	4	1	0	0	0	0
Staff	35	15	14	6	0	0	1	27	0	0	0	2	3	2	0	0	0	3
Total Doctoral Students	30	15	6	9	0	0	1	5	1	0	0	0	16	7	0	0	0	0
Total Master's Students	19	9	2	8	0	0	0	11	0	0	0	1	3	4	0	0	0	0
Total Undergraduate Students	92	41	13	38	0	1	0	67	1	0	0	4	2	17	3	2	0	3
Subtotal	**202**	**95**	**44**	**63**	**0**	**1**	**2**	**125**	**6**	**1**	**0**	**8**	**28**	**31**	**3**	**2**	**0**	**7**
Purdue University - Core Partner																		
Total [2]	55	26	8	21	0	0	2	16	3	0	1	0	19	14	2	3	0	1
Leadership/Administration																		
Directors	2	1	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
Research Thrust Leader	2	1	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0
Engineering Workforce Development Program Leader	2	2	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0

Subtotal	**6**	**4**	**2**	**0**	**0**	**0**	**1**	**4**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**
Programmatic Personnel																		
Senior Faculty	11	7	2	2	0	0	0	9	0	0	0	0	0	2	0	0	0	1
Junior Faculty	5	4	1	0	0	0	1	1	2	0	0	0	1	0	0	0	0	0
Staff	2	2	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0
Total Postdocs	5	1	1	3	0	0	0	2	0	0	0	0	2	1	1	0	0	0
Total Doctoral Students	20	8	2	10	0	0	0	2	0	0	0	0	12	6	0	2	0	0
Total Master's Students	2	0	2	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0
Total Undergraduate Students	10	4	0	6	0	0	0	1	1	0	1	0	2	5	1	1	0	0
Subtotal	**55**	**26**	**8**	**21**	**0**	**0**	**2**	**16**	**3**	**0**	**1**	**0**	**19**	**14**	**2**	**3**	**0**	**1**
University of Colorado Boulder - Core Partner																		
Total [2]	52	22	16	14	1	0	0	21	4	0	1	0	12	13	1	2	0	0
Leadership/Administration																		
Directors	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Research Thrust Leader	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Subtotal	**2**	**1**	**1**	**0**	**0**	**0**	**0**	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Programmatic Personnel																		
Senior Faculty	6	4	1	1	0	0	0	4	1	0	0	0	0	1	0	0	0	0
Junior Faculty	3	0	3	0	0	0	0	2	0	0	1	0	0	0	1	0	0	0
Staff	6	2	3	1	0	0	0	4	0	0	0	0	1	1	0	0	0	0
Total Postdocs	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Total Doctoral Students	13	8	2	3	0	0	0	7	0	0	0	0	4	2	0	1	0	0

Total Master's Students	7	3	2	2	0	0	0	1	0	0	0	0	4	2	0	0	0	0
Total Undergraduate Students	16	4	5	7	1	0	0	3	3	0	0	0	2	7	0	1	0	0
Subtotal	**52**	**22**	**16**	**14**	**1**	**0**	**0**	**21**	**4**	**0**	**1**	**0**	**12**	**13**	**1**	**2**	**0**	**0**
University of Texas at El Paso - Core Partner																		
Total [2]	55	27	11	17	2	0	0	12	5	0	0	8	10	18	19	6	0	1
Leadership/Administration																		
Directors	2	1	1	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0
Research Thrust Leader	2	1	1	0	0	0	0	1	1	0	0	0	0	0	1	0	0	0
Student Leader	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Subtotal	**5**	**3**	**2**	**0**	**0**	**0**	**0**	**2**	**1**	**0**	**0**	**1**	**0**	**1**	**2**	**0**	**0**	**0**
Programmatic Personnel																		
Senior Faculty	8	5	3	0	0	0	0	3	4	0	0	1	0	0	2	0	0	0
Junior Faculty	5	2	2	1	0	0	0	1	0	0	0	1	1	2	2	1	0	0
Staff	3	2	0	1	0	0	0	1	0	0	0	0	1	1	1	1	0	0
Visiting Faculty	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Total Postdocs	1	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0
Total Doctoral Students	8	6	1	1	0	0	0	1	0	0	0	2	3	2	3	1	0	0
Total Master's Students	5	3	1	1	0	0	0	0	0	0	0	1	4	0	1	2	0	0
Total Undergraduate Students	24	8	3	13	2	0	0	5	0	0	0	3	1	13	9	1	0	0
Subtotal	**55**	**27**	**11**	**17**	**2**	**0**	**0**	**12**	**5**	**0**	**0**	**8**	**10**	**18**	**19**	**6**	**0**	**1**
Aerokats and Rover Education Network (NASA-funded) - Collaborating Institution																		

Amazon - Collaborating Institution																		
Auckland University of Technology - Collaborating Institution																		
Beth Myers Consulting - Collaborating Institution																		
Total [2]	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Leadership/Administration																		
Staff	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Subtotal	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Programmatic Personnel																		
Staff	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Subtotal	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Colorado Department of Transportation - Collaborating Institution																		
Colorado State University - Collaborating Institution																		
Total [2]	3	2	0	1	0	0	0	2	0	0	0	0	0	1	0	0	0	0
Programmatic Personnel																		
Senior Faculty	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Staff	2	1	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0
Subtotal	**3**	**2**	**0**	**1**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**
Colorado Technology Students Association - Collaborating Institution																		
Cornell University - Collaborating Institution																		
Total [2]	19	6	4	9	0	0	1	1	3	0	0	0	6	8	0	1	0	0
Leadership/Administration																		
Research Thrust Leader	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Subtotal	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Programmatic Personnel																		

Senior Faculty	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Total Postdocs	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Total Doctoral Students	10	4	2	4	0	0	1	0	1	0	0	0	5	3	0	1	0	0
Total Master's Students	2	0	0	2	0	0	0	0	0	0	0	0	0	2	0	0	0	0
Total Undergraduate Students	5	0	2	3	0	0	0	0	1	0	0	0	1	3	0	0	0	0
Subtotal	**19**	**6**	**4**	**9**	**0**	**0**	**1**	**1**	**3**	**0**	**0**	**0**	**6**	**8**	**0**	**1**	**0**	**0**

CUB ODECE Rural Summer Program - Collaborating Institution

CUB Society of Hispanic Professional Engineers Student Society - Collaborating Institution

CUB Upward Bound Summer Academic Summer Institute - Collaborating Institution

Denver Museum of Nature and Science - Collaborating Institution

Drive Electric Utah - Collaborating Institution

Eco El Paso - Collaborating Institution

El Paso Electric - Collaborating Institution

El Paso Fab Lab - Collaborating Institution

El Paso Insights Science Center - Collaborating Institution

Fairpark Community Council - Collaborating Institution

Familias Triunfadoras - Collaborating Institution

Glendale Community Council - Collaborating Institution
GNS Science - Collaborating Institution
Green Hope Project - Collaborating Institution
Growth Sector - Collaborating Institution
I Have a Dream Foundation of Boulder County - Collaborating Institution
IBEW Local 659, Crater Lake JATC - Collaborating Institution
Institute for Factory Automation and Production Systems (FAPS) - Collaborating Institution
Jordan Meadows Community Council - Collaborating Institution
Lewis County Transit - Collaborating Institution
Mahi Maioro Professionals - Collaborating Institution
Michigan Department of Transportation - Collaborating Institution
Murdock Chevrolet GMC - Collaborating Institution
National Association of State Energy Officials - Collaborating Institution
NSF INCLUDES CAHSI - Collaborating Institution
NSF LSAMP NICE - Collaborating Institution
NW Energy Coalition - Collaborating Institution

Poplar Grove Community Council - Collaborating Institution																		
Rose Park Community Council - Collaborating Institution																		
Rose Park Community Learning Center - Collaborating Institution																		
Sorenson Multi-Cultural Center - Collaborating Institution																		
Stadler Rail - Collaborating Institution																		
Stellantis - Collaborating Institution																		
Sun Metro - Collaborating Institution																		
The Bennett Consulting Group - Collaborating Institution																		
The City Library, Glendale Branch - Collaborating Institution																		
TransAlta - First Mode Proving Grounds - Collaborating Institution																		
University Neighborhood Partners - Collaborating Institution																		
University of Colorado Colorado Springs - Collaborating Institution																		
Total [2]	11	7	1	3	0	0	0	5	1	0	0	2	1	2	1	0	0	0
Leadership/Administration																		
Research Thrust Leader	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Subtotal	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Programmatic Personnel																		
Senior Faculty	2	2	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0

Total Doctoral Students	3	1	0	2	0	0	0	0	0	0	0	1	1	1	0	0	0	0
Total Master's Students	3	3	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0
Total Undergraduate Students	3	1	1	1	0	0	0	1	0	0	0	1	0	1	1	0	0	0
Subtotal	**11**	**7**	**1**	**3**	**0**	**0**	**0**	**5**	**1**	**0**	**0**	**2**	**1**	**2**	**1**	**0**	**0**	**0**
University of Michigan Battery Lab - Collaborating Institution																		
University of Utah - Collaborating Institution																		
Total [2]	10	5	1	4	0	0	0	5	0	0	0	0	3	2	0	0	0	1
Programmatic Personnel																		
Senior Faculty	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Junior Faculty	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Staff	2	2	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
Total Postdocs	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Total Doctoral Students	3	1	1	1	0	0	0	1	0	0	0	0	2	0	0	0	0	0
Total Undergraduate Students	2	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	0	1
Subtotal	**10**	**5**	**1**	**4**	**0**	**0**	**0**	**5**	**0**	**0**	**0**	**0**	**3**	**2**	**0**	**0**	**0**	**1**
Utah AFL-CIO - Collaborating Institution																		
Utah Asphalt Pavement Association - Collaborating Institution																		
Utah System of Higher Education - Collaborating Institution																		
Utah Transit Authority - Collaborating Institution																		

UTEP Upward Bound - Collaborating Institution																		
Victoria University of Wellington - Collaborating Institution																		
Virginia Polytechnic Institute and State University - Collaborating Institution																		
Total [2]	10	1	4	5	0	0	0	2	1	0	0	0	2	5	0	0	0	0
Programmatic Personnel																		
Senior Faculty	3	0	3	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0
Total Doctoral Students	4	0	0	4	0	0	0	0	0	0	0	0	0	4	0	0	0	0
Total Master's Students	3	1	1	1	0	0	0	0	0	0	0	0	2	1	0	0	0	0
Subtotal	**10**	**1**	**4**	**5**	**0**	**0**	**0**	**2**	**1**	**0**	**0**	**0**	**2**	**5**	**0**	**0**	**0**	**0**
Washington State Ferries - Collaborating Institution																		
Westpointe Community Council - Collaborating Institution																		
Westside Coalition - Collaborating Institution																		
Wilson Motors - Collaborating Institution																		
Yes-She-Can - Collaborating Institution																		
Young Automotive Group - Collaborating Institution																		
University of Auckland - Foreign Partner																		
Total [2]	31	19	5	7	0	0	0	0	0	0	0	0	6	25	0	0	1	0
Leadership/Administration																		
Directors	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Subtotal	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**

Programmatic Personnel																		
Senior Faculty	9	8	1	0	0	0	0	0	0	0	0	0	4	5	0	0	0	0
Junior Faculty	3	2	1	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0
Staff	3	2	1	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0
Visiting Faculty	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Total Postdocs	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Total Doctoral Students	14	5	2	7	0	0	0	0	0	0	0	0	1	13	0	0	1	0
Subtotal	**31**	**19**	**5**	**7**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**6**	**25**	**0**	**0**	**1**	**0**
Cabrillo College - Non-ERC Institution Providing REU Students																		
Total [2]	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0
ERC REU Students																		
Center Funding Students	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Subtotal	**1**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**
George Mason University - Non-ERC Institution Providing REU Students																		
Total [2]	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0
ERC REU Students																		
Center Funding Students	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Subtotal	**1**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**
Grambling State University - Non-ERC Institution Providing REU Students																		
Total [2]	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0
ERC REU Students																		
Center Funding Students	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Subtotal	**1**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**

Stevens Institute of Technology - Non-ERC Institution Providing REU Students																		
Total [2]	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0
ERC REU Students																		
Center Funding Students	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Subtotal	**1**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**
University of California Riverside - Non-ERC Institution Providing REU Students																		
Total [2]	2	0	0	2	0	0	0	0	0	0	0	0	0	2	0	0	0	0
ERC REU Students																		
Center Funding Students	2	0	0	2	0	0	0	0	0	0	0	0	0	2	0	0	0	0
Subtotal	**2**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**
Centralia College - Community College																		
El Paso Community College - Community College																		
Front Range Community College - Community College																		
Salt Lake Community College - Community College																		
Weber State University - Community College																		
Western Tech El Paso - Community College																		
Arrupe Jesuit High School - Pre-college Partner																		
DSST Public Schools (HS Creative Engineering Design course) - Pre-college Partner																		
El Paso Leadership Academy (HS Creative Engineering Design Course) - Pre-college Partner																		

GEAR Up Junior High School - Pre-college Partner																		
InTech Collegiate Academy (HS Engineering Design Course) - Pre-college Partner																		
Neighborhood House - Pre-college Partner																		
Northridge Elementary School - Pre-college Partner																		
Purdue Polytechnic High School - Pre-college Partner																		
Total [2]	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Precollege (K-12)																		
Teachers (non-RET)	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Subtotal	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Salt Lake City School District/West High School - Pre-college Partner																		
Spring Creek Middle School - Pre-college Partner																		
Thornton Middle School - Pre-college Partner																		
UCB ODECE STEM Summer Program - Pre-college Partner																		
Utah Division of Multicultural Affairs - Pre-college Partner																		

[1] The Total column will not equal the sum of the values in each row. This is because an individual will be reported more than once across Sex, Citizenship Status, Ethnicity: Hispanic, and Disability.

[2] If ERC Personnel were entered at the individual level the Total row may not equal the sum of the line items. This is because an individual may be reported in more than one personnel category but is only counted once for the purposes of the Total.

Legend

AI/AN: American Indian or Alaska Native

NH/PI: Native Hawaiian or Other Pacific Islander

B/AA: Black/African American

W: White

A: Asian, e.g., Asian Indian, Chinese, Filipino, Japanese, Korean, Vietnamese, Other Asian

More than one race reported, minority - Personnel reporting a) two or more race categories and b) one or more of the reported categories includes American Indian or Alaska Native, Black or African American, or Native Hawaiian or Other Pacific Islander

More than one race reported, non-minority - Personnel reporting a) both White and Asian and b) no other categories in addition to White and Asian

US/Perm: U.S. citizens and legal permanent residents

Non-US: Non-U.S. citizens/Non-legal permanent residents

Appendix IV: Board, Council, Committee Charters

Student Leadership Council Charter

CHARTER AND BYLAWS OF THE STUDENT LEADERSHIP COUNCIL AND ASPIRE STUDENT ASSOCIATION

As Adopted on December 10, 2020

PREAMBLE:

The National Science Foundation ("*NSF*") has established the Advancing Sustainability through Powered Infrastructure for Roadway Electrification Engineering Research Center ("*ASPIRE*") at Utah State University ("*USU*") (the lead university) in collaboration with core partners Purdue University, University of Texas at El Paso, University of Colorado Boulder, and University of Auckland and additional affiliated partner universities to pursue research, education, diversity and inclusion, and commercialization activities to advance transportation electrification.

This Charter and Bylaws establish and outline the purposes and roles of the ASPIRE Student Leadership Council ("SLC") and the ASPIRE Student Association ("ASA").

MISSION STATEMENT:

The mission of the SLC and ASA is to provide a collaborative forum for a diverse number of students enrolled at core and affiliated universities to benefit from and support the mission of ASPIRE. The SLC and ASA will specifically assist ASPIRE in its mission to advance opportunities for skills development and workforce preparation related to widespread transportation electrification and improve health and quality of life for everyone by being a catalyst to sustainable and equitable electrification across the transportation industry.

1. ASA Membership and Chapters.

1.1. Student Members. Membership in the ASA is available to all students who are registered as full-time students and in good standing with a current ASPIRE core partner university or affiliated partner university ("Partner Universities"), whether as a graduate or undergraduate student. The eligibility of students for membership (full-time and good standing) shall be determined by each Partner University in keeping with its respective policies and procedures and will be identified by each chapter in its constitution, or its equivalent.

1.2. Chapters. ASA Membership is organized by chapters associated with each Partner University. A chapter will be established for each Partner University that has entered into a cooperative agreement joining ASPIRE. If a Partner University fails to maintain a current cooperative agreement, then its associated ASA chapter will be dissolved. Chapters will be organized in keeping with the established student organizational procedures of each participating Partner University, in coordination with the SLC.

2. Governance.

2.1. Director. The overall organization of the SLC shall be the responsibility of the Director of ASPIRE ("Director") in close coordination and cooperation with ASPIRE's

Leadership Team ("Leadership Team"), which comprises representatives from each of the core partner universities. The Director will be responsible for the finances of the SLC and may coordinate with SLC leaders and committees regarding finances as needed. The overall organization of the ASA shall be the responsibility of the ASPIRE Campus Directors ("Campus Directors") in close coordination and cooperation with the Director, Leadership Team, and SLC. The Campus Directors will be responsible for the finances of the ASA and may coordinate with the Director and SLC regarding finances as needed.

2.2. Chapter Leadership. Each ASA chapter will (i) be led by a council comprising of the chapter president and additional members as decided among ASA members of the chapter and (ii) have an assigned faculty advisor who is affiliated with ASPIRE. Chapters may choose to establish additional leadership positions (e.g. secretary, treasurer, etc.). The election rules will be submitted to the SLC and to the Director to be included in the annual plan ("Annual Plan"). Chapter leaders will serve for approximately a year, and their service can be renewed as agreed by the ASA members. If a vacancy occurs mid-term (either by loss of eligibility or resignation), then the ASA chapter members will select a person from among the chapter membership to serve until the next chapter election.

2.3. Student Leadership Council.

A. Purpose and Responsibilities. The SLC will serve as a student advisory board to the Director. SLC Responsibilities include:

i. organizing student activities to achieve ASPIRE's goals, including student professional development;

ii. serving as a hub for coordinating efforts in each of the Partner University ASA chapters;

iii. carrying out an annual strengths, weakness, opportunities, and threats ("SWOT") analysis of ASPIRE and communicating the results to the Director, the ASPIRE Leadership Team, and the NSF Site Visit Team; and

iv. developing and implementing the Annual Plan, comprising of the SLC organizational chart, meeting schedule, details of committees, budget, activities, reporting process and the election procedure of each ASA chapter.

Additional responsibilities may be assigned to the SLC by the Director as needed. The members of the SLC are not fiduciaries of ASPIRE or its Partner Universities but, rather, serve in an advisory capacity.

B. Composition. The SLC will be comprised of (i) two representatives from the ASA chapter of each core partner university and (Leadii) one representative from each affiliated partner university. Students will be required to submit induction applications along with a letter of support from an ASPIRE- faculty member to be considered to serve on the SLC. The SLC members will be proposed by the Leadership Team and approved by the Director. The SLC will serve for approximately one year. Membership of individuals can be renewed by the Director. SLC members serve at the pleasure of the Director, meaning that the Director reserves the right to remove an individual as an SLC member if such an individual

fails to perform his/her duties and responsibilities as may be assigned by the Director or the Chair. Upon removal, a new individual will be appointed by the Director to serve on the SLC for the remainder of the annual term.

C. Leadership. The SLC shall be chaired by a Chair and Co-Chair. The Chair will serve as a member of the Leadership Team. In January of each year, the SLC will make a recommendation (by a majority vote) to the Director of who should serve as the Chair and Co-Chair for the upcoming year. The Director will ratify or reject the recommendation at his discretion and in coordination with the ASPIRE Leadership team. If a recommendation for a Chair or Co-Chair is rejected, then the SLC will reconvene and recommend new person(s). The SLC should recommend individuals who have demonstrated excellence in academics, research, and leadership. If a vacancy of the Chair or Co-Chair occurs mid-term (either by loss of eligibility or resignation), then the Director will select a person from among the SLC to serve for the remainder of the annual term.

D. Committees. The SLC may, under the direction of its Chair and Co-Chair, organize student committees to accomplish the purposes of the SLC. Committees will be chaired by SLC members appointed by the Chair and may be staffed with SLC members and general members selected from the various ASA chapters. Exemplary committees could include a committee on diversity and inclusion, a committee on chapter elections, a committee directed to a specific research thrust of ASPIRE, a committee on professional development, etc.

E. Meetings. The SLC will meet together monthly. The Chair will be responsible for organizing the time and place of each meeting and for setting a meeting agenda. Meetings may take place virtually or in-person depending on the month and circumstances.

3. **Amendment and Ratification.** This Charter and Bylaws may be amended from time-to-time by the SLC as needed. Any amendments must be approved by a two-thirds vote of the SLC, be in writing, and be ratified by the Director. Ratified amendments shall be effective upon the Director's signature.

Council of Deans Charter

CHARTER AND BYLAWS OF THE ASPIRE COUNCIL OF DEANS

As Adopted on December 10, 2020

The National Science Foundation ("*NSF*") has established the Advancing Sustainability through Powered Infrastructure for Roadway Electrification Engineering Research Center ("*ASPIRE*") at Utah State University ("*USU*") (the lead university) in collaboration with core partners Purdue University ("Purdue"), University of Texas at El Paso ("UTEP"), University of Colorado Boulder ("UCB"), and University of Auckland ("UA") and additional affiliated partner universities to pursue research, education, diversity and inclusion, and commercialization activities to advance transportation electrification.

This Charter and Bylaws establish and outline the purposes and roles of the ASPIRE Council of Deans ("Council").

1. **Purpose.** The purpose of the Council is to provide the guidance and coordination across the universities to enable ASPIRE's success. Example items that the Council may discuss are: streamlining the ability to conduct joint research across the Center, enabling student and faculty pathways to achieve STEM and DCI goals, assisting in technology transfer efforts, and sharing of data across the Center. In its advisory role, the Council will help identify risks to the Center and ways to mitigate the risk as part of the Center's Risk Management Plan.
2. **Composition.** The Council comprises the current deans of engineering from USU, Purdue, UTEP, UCB, and UA. If a dean of engineering is serving as an ASPIRE campus director for his/her respective university, then he/she must designate an alternative representative to serve on the Council during the period of time where the dean is a campus director. The Council may invite department heads or deans from the ASPIRE-affiliated partner universities to participate in Council meetings and discussions.
3. **Governance.**

    3.1. Chair. The Dean of USU's College of Engineering shall serve as the Chair of the Council.

    3.2. Director. The Council will regularly coordinate with the Director of ASPIRE ("Director") to ensure that the Council is supporting ASPIRE in keeping with the Council's mission.

    3.3. Committees. The Chair may organize committees and appoint associated committee chairs to accomplish the purposes of the Council.

    3.4. Meetings. The Council will meet together at least quarterly. The Chair will be responsible for organizing the time and place of Council meetings and for setting meeting agendas. Meetings may take place virtually or in-person.
4. **Amendment and Ratification.** This Charter and Bylaws may be amended from time-to-time by the Council as needed. Any amendments must be approved by a two-thirds vote of the Council, be in writing, and be ratified by the Director. Ratified amendments shall be effective upon the Director's signature.

Executive Advisory Board

CHARTER AND BYLAWS OF THE EXECUTIVE ADVISORY BOARD

As Adopted on December __, 2020

The National Science Foundation ("*NSF*") has established the Advancing Sustainability through Powered Infrastructure for Roadway Electrification Engineering Research Center ("*ASPIRE*") at Utah State University ("*USU*") (the lead university) in collaboration with core partners Purdue University, University of Texas at El Paso, University of Colorado Boulder, and University of Auckland and additional affiliated partner universities to pursue research, education, diversity and inclusion, and commercialization activities to advance transportation electrification.

This Charter and Bylaws establish and outline the purposes and roles of the ASPIRE Executive Advisory Board ("EAB").

1. **Purpose.** The EAB serves as an advisory board to ASPIRE with the overall success of the Center in mind, providing a broad and diverse perspective to ASPIRE leadership and a valuable resource to ASPIRE participants. The EAB's primary purposes are as follows: (i) review current and planned strategic research, engineering workforce development, diversity and culture of inclusion, and innovation ecosystem direction and activities, or other activities and projects in furtherance of ASPIRE's mission; (ii) through personal and professional networks, facilitate the establishment of new relationships between ASPIRE and companies, governmental agencies, professional societies and other non-profit organizations, and universities; (iii) serve as ambassadors for ASPIRE at state, national, and international levels in industry and government circles; and (iv) provide support to the Student Leadership Council, particularly in their annual development of a Center level SWOT analysis. Additional EAB activities may include: serving on committees, financial overview, planning for the annual meeting, assisting with fundraising, and engaging with the ASPIRE community.

Composition. The EAB comprises twelve (12) to eighteen (18) members with state, national, and/or international scope/experience and at an advanced organization leadership level from across the electrified transportation ecosystem. New members will be nominated by the ASPIRE leadership team, reviewed by the existing EAB members, and approved by the Director. Each EAB member will be appointed by the Director for a term of at least one year. Members may resign at any time and may be removed by the Director based on performance and the needs of ASPIRE. The composition of the EAB is anticipated to be diverse in its industry and government sectors representation, technical and leadership experience, and gender and racial makeup. Its membership is anticipated to be fluid and may change over the course of time. EAB members serve as advisors only and do not assume fiduciary duties or administrative roles regarding ASPIRE or its associated universities. Participation on the EAB is a service opportunity, and members will be responsible for their own travel and lodging expenses.

2. **Governance.**

2.1. Director. The Director shall retain general responsibility for ensuring that the EAB has twelve (12) to eighteen (18) members consistent with the described desired makeup.

2.2. EAB Executive Committee. The day-to-day business of the EAB will be administered by an EAB Executive Committee ("Executive Committee") in coordination with the Innovation Director, Managing Director and Director. The Executive Committee comprises a Chair, Chair Elect and Past Chair. The Chair Elect shall (i) be selected by being nominated followed by a majority vote of the existing EAB members; and (ii) serve for a three (3) year period following election (each of which begins on January 1st), the first year as the Chair Elect, the second year as the Chair, and the third years as the Past Chair. The Director will ensure that any person serving on the Executive Committee has an EAB appointment that is at least as long as the anticipated term of Executive Committee service. For the first year of the EAB, (i) the Director will appoint an individual to serve as the "Chair" and "Past Chair" for purposes of having a fully staffed Executive Committee; and (ii) the Chair Elect shall be elected during or following the first EAB meeting by a majority vote of the EAB.

2.3. Committees. The Chair may organize committees (e.g., research/technical areas, communication, events, membership, finance) and appoint associated committee chairs to accomplish the purposes of the EAB.

2.4. Meetings. The EAB will meet at least quarterly. The Chair will be responsible for organizing the time and place of EAB meetings and for setting meeting agendas. Meetings may take place virtually or in-person.

3. **Amendment.** This Charter and Bylaws may be amended from time-to-time by the Director as needed.

EAB & IIB Committee Structure Changes from Year 5 to Year 6

Our Executive Advisory and Industry & Innovation Committees continue to evolve to ensure sustainability, responsiveness, and impact as ASPIRE advances toward its Year 10 vision.

In Year 5, ASPIRE streamlined its committee structure to strengthen alignment with the Center's core research and workforce development activities. The Societal Impact Committee was dissolved, with its efforts now fully embedded within the four core research projects—Charging Stations of the Future, Electrified Roadways, Intelligent Systems, and Pathways (K-22 workforce development). Similarly, the Research Direction Committee was retired, with its functions incorporated into ASPIRE's annual feedback cycle, where industry and advisory input directly inform the progress, milestones, and new proposals emerging from the research projects. These changes reduce redundancy while ensuring that cross-cutting societal and research priorities remain integral to ASPIRE's work.

Looking ahead to Year 6, ASPIRE will strategically reconstitute the Policy & Governmental Outreach Committee to respond to federal agency restructuring and upcoming infrastructure legislation, including anticipated reauthorization debates with implications for Section 111 commercialization of federal rights-of-way. The Student Engagement Committee is also being redefined to align with ASPIRE's new Student Leadership Model, which centers on a Presidents' Council of ASPIRE Student Associations across ten campuses in the U.S. and New Zealand. These adjustments preserve strong student-industry-policy linkages while creating a more agile and integrated committee structure, ensuring that advisory input remains actionable and well-connected to both ASPIRE's research mission and its societal impact goals.

Appendix V: Highlights and Significant Achievements

Stationary 1 Megawatt Inductive Wireless Charger for Class-8 Trucks

ASPIRE developed novel single-pad MW stationary inductive wireless charger for Class 8 trucks is in the deployment stage and will be deployed in Utah with UPS and Kenworth as part of Utah Inland Port pilot.

- 1,800+ miles of validation testing completed in Seattle
- Utah's cold/hot climates and mountain passes
  - Utah Inland Port, SLC – Logan, 193 miles
  - Utah Inland Port, SLC – Orem, 187 miles
- Inland Port site construction – civil scope is complete, grid interconnect is scheduled for March
- EVR site construction – civil scope completed, grid interconnect completed, hardware installation scheduled

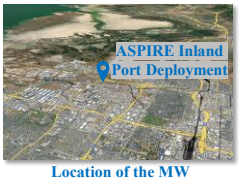
ASPIRE's ready-to-deploy technologies also achieve wired and wireless charging for EVs from light- to heavy-duty with power up to above 1 MW, and include both 480 V and medium voltage grid connection.



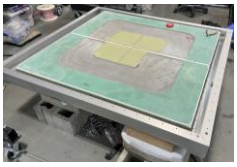
Class-8 Truck developed by Kenworth docked at the EVR 1MW charging site



Secondary (receiver) pad design



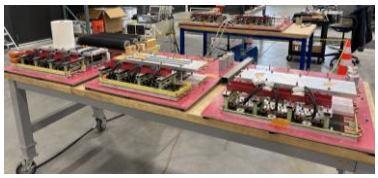
Location of the MW wireless charging pilot



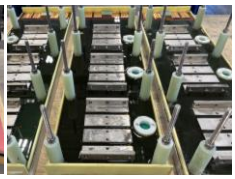
Primary pad potting



Special equipment cabinet design



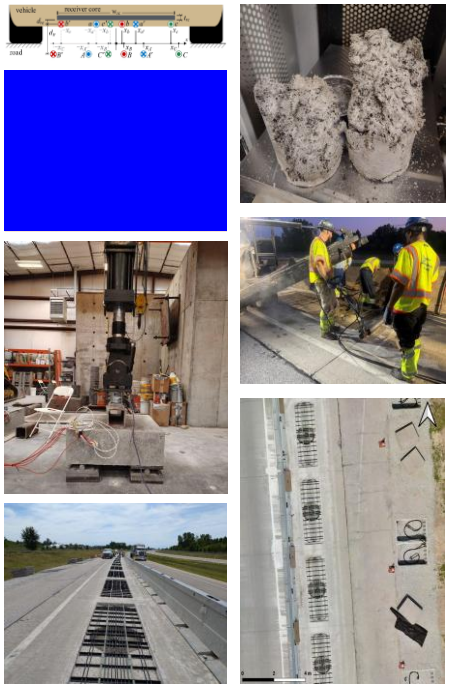
T-type tuning networks testing



T-type tuning networks in assembly

High-Power Electrified Roadways

- Three-phase dynamic inductive wireless charging technology developed for high-power electrified roads
- Custom numerical tools refined and utilized to design electrified pavements with dynamic wireless charging
- Power scaling approaches developed for MHz-frequency dynamic capacitive wireless charging to reduce costs
- Several engineered cementitious composite formulations developed to increase durability and cost-effectiveness
- Evaluated durability and safety of embedded systems
- ¼-mile US-52/US-231 INDOT pilot with 85-transmitter-coil 230-kW dynamic wireless charging system constructed
- Highway speed (60 mph) tests performed using a trailer-mounted receiver coil and load bank towed by a truck
- Developed and integrated receiver assembly and 200-kW dc-dc converter into a heavy-duty electric truck



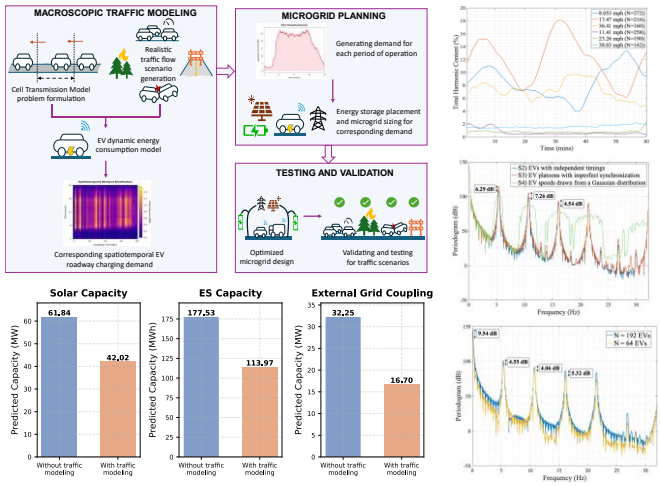
Advancing the simulation of electric roads and the optimization of transportation–power systems

Informed by ASPIRE's DWTP pilots

- Integration of connected vehicle data streams.
- Improved forecasting of electricity demand under varying EV adoption scenarios.
- Cross-validation with real-world pilot projects.
- Established scaling laws to describe how harmonics are affected by traffic conditions.
- Coupled with slow time-scale traffic dynamics on electric roadways and grid models for grid demand estimation, planning, operation, and system efficiency.

Informing plans and deployments

- Closely coupled with associated project: DOE-FOA-0002611, "MD-HD ZEV Infrastructure Planning with Focus on I-80 Midwest (IN-IL-OH) Corridor."



Appendix VI: List of ERC Projects

Thrust	Task #	Project	Faculty Members	Institutions	Departments	REDI Element	First Funding Sources
Charging Stations of the Future	1.1	Modeling, State Estimation, and Life-Aware Model-Predictive Controls of On-Vehicle Battery Systems	Michael Trimboli; Gregory Plett	University of Colorado Colorado Spring	Electrical and Computer Engineering	Convergent Research	Core
Charging Stations of the Future	1.2	Advancing Charging Technologies	Tzu-Liang Tseng; Dragan Maksimovic; Hongjie Wong; Honglun Xu; Janette Goodridge; Luca Corradini; Paras Mandal; Regan Zane; Wade Goodridge	University of Texas at El Paso; University of Colorado Boulder; Utah State University	Industrial, Manufacturing and Systems Engineering; Electrical, Computer, and Energy Engineering; Electrical and Computer Engineering; Economics and Finance; Engineering Education	Convergent Research; Engineering Workforce Development	Core
Charging Stations of the Future	1.3	Thermal Modeling, Management, and Storage to Enable Sustainable and Advanced High-Powered EV Charging Infrastructure	Hailei Wang; Nicholas Roberts; Hongjie Wong; Khurram Afridi	Utah State University; Cornell University	Mechanical and Aerospace Engineering; Electrical and Computer Engineering	Convergent Research	Core
Charging Stations of the Future	1.4	Design, Planning, and Implementation of EV Charging Infrastructure	Adeeba Raheem; Ivonne Santiago; Ole Sleipness; Patrick Singleton	University of Texas at El Paso; Utah State University	Civil Engineering; Landscape Architecture & Environmental Planning; Civil and Environmental Engineering	Convergent Research; Engineering Workforce Development; Innovation Ecosystem	Core

Thrust	Task #	Project	Faculty Members	Institutions	Departments	REDI Element	First Funding Sources
Charging Stations of the Future	1.5	Charging Station Virtual Reality Visualization and Smart Management	Tzu-Liang Tseng; Hongjie Wong; Rose Hu; Honglun Xu	University of Texas at El Paso; Utah State University; Virginia Polytechnic Institute and State University	Industrial, Manufacturing, and Systems Engineering; Electrical and Computer Engineering	Convergent Research; Engineering Workforce Development	Core
Charging Stations of the Future	1.6	Connected Vehicle Data Analytics for Charging Stations of the Future	Darcy Bullock	Purdue University	Civil Engineering	Convergent Research; Engineering Workforce Development	Core
Electrified Roadways	2.1	Design Considerations towards High Performing Embedded Dynamic Wireless Power Transfer Systems	Aaron Brovont; Cesar Tirado; Dionysios Aliprantis; John Haddock; Marv Halling; Miguel Montoya; Rajib Mallick; Soheil Nazarian; Srishti Banerji; Steve Pekarek	Purdue University; University of Texas at El Paso; Utah State University	School of Electrical and Computer Engineering; Civil Engineering; Center for Transportation Infrastructure Systems; Electrical and Computer Engineering; Lyles School of Civil Engineering; Civil and Environmental Engineering	Convergent Research; Engineering Workforce Development	Core

Thrust	Task #	Project	Faculty Members	Institutions	Departments	REDI Element	First Funding Sources
Electrified Roadways	2.2	Coupled Thermal/Mechanical Modeling and Evaluation of Electrified Pavement Systems	John Haddock; Khurram Afrid; Konstantina Gritzka; Nick Roberts; Jinha Jung; Simon Bickerton	Purdue University; Cornell University; Utah State University; University of Auckland	Lyles School of Civil Engineering; Electrical and Computer Engineering; Mechanical and Aerospace Engineering; Civil Engineering; Mechanical and Mechatronics Engineering	Convergent Research	Core
Electrified Roadways	2.3	Interoperability of Wireless Power Transfer Systems	Aaron Brovont; Dionysios Aliprantis; Regan Zane; Steve Pekarek; Seho Kim	Purdue University; Utah State University; University of Auckland	School of Electrical and Computer Engineering; Electrical and Computer Engineering; Electrical, Computer and Software Engineering	Convergent Research; Engineering Workforce Development	Core
Electrified Roadways	2.4	Evaluation of Potential Electrical Threats to Electrified Pavement Components	Juhyeong Lee; Marv Halling; Srishti Banerji; Tom Allen; Simon Bickerton	Utah State University; University of Auckland	Mechanical and Aerospace Engineering; Civil and Environmental Engineering; Mechanical and Mechatronics Engineering	Convergent Research; Engineering Workforce Development	Core
Electrified Roadways	2.5	Modeling, Communications, Networking Infrastructure, and Protection for Secure and Smart Electrified Roadway Charging	Rose Hu; Tianyi He; Ryan Gerdes; Hongjie Wang	Virginia Polytechnic Institute and State University; Utah State University	Electrical and Computer Engineering; Mechanical and Aerospace Engineering	Convergent Research	Core

Thrust	Task #	Project	Faculty Members	Institutions	Departments	REDI Element	First Funding Sources
Electrified Roadways	2.6	Evaluate Performance and Resilience of Transportation Asset Management for Electrified Road Systems	Adeeba Raheem; Amanda Katz; Cristina Torres-Machi; Janette Goodridge; Soheil Nazarian	University of Texas at El Paso; Utah State University; University of Colorado Boulder	Civil Engineering; History; Civil, Environmental, and Architectural Engineering; Economics and Finance	Convergent Research; Engineering Workforce Development	Core
Systems of Systems	3.1	Power and Transportation Simulator	Dionysios Aliyantis; Ruey Cheu; Konstantina Gritzka; Patrick Singleton; Vassilis Kekatos; Amir Sajadi; Mario Harper; Qin LV; Vijay Gupta; Bri-Mathias Hodge	Purdue University; University of Texas at El Paso; Utah State University; University of Colorado Boulder	Electrical and Computer Engineering; Civil Engineering; Lyles School of Civil Engineering; Civil and Environmental Engineering; Electrical, Computer and Energy Engineering; Computer Science	Convergent Research; Engineering Workforce Development	Core
Systems of Systems	3.2	Examining the air quality and health implications of vehicle electrification	Colleen Reid; Michael Hannigan; Daniel Mendoza	University of Colorado Boulder; University of Utah	Geography; Mechanical Engineering; Atmospheric Sciences	Convergent Research; Engineering Workforce Development ; Innovation Ecosystem	Core

Thrust	Task #	Project	Faculty Members	Institutions	Departments	REDI Element	First Funding Sources
Systems of Systems	3.3	Adoption of Electric Vehicles and Transportation Systems	Janette Goodridge; Konstantina Gritzka; Ole Sleipness; Patrick Singleton; Rosalee Clawson; Antje Graul; Prakash Ranjitkar; Selena Sheng; Sarah Grajdura	Utah State University; Purdue University; University of Auckland	Economics and Finance; Lyles School of Civil Engineering; Landscape Architecture & Environmental Planning; Civil and Environmental Engineering; Political Science; Jon M. Huntsman School of Business; Energy Centre, Department of Economics	Convergent Research	Core
Systems of Systems	3.4	Optimization of Transportation Electrification Solutions Through Integrated Techno-economic and Life-Cycle Assessment	Jason Quinn	Colorado State University	Mechanical Engineering	Convergent Research; Engineering Workforce Development	Core
Systems of Systems	3.5	Combined Simulation Framework for Mass Charger Utilization through Massive Simulation and Distributed Market Approaches	Greg Droge; Steve Petruzza; Mario Harper	Utah State University	Electrical and Computer Engineering; Computer Science	Convergent Research; Engineering Workforce Development	Core
Systems of Systems	3.6	Environmentally Aware EV Charging Integration in Energy Systems	Junjie Qin; Ivonne Santiago; Sivaranjani Seetharaman	Purdue University; University of Texas at El Paso	Electrical and Computer Engineering; Civil Engineering; Industrial Engineering	Convergent Research; Engineering Workforce Development	Core

Thrust	Task #	Project	Faculty Members	Institutions	Departments	REDI Element	First Funding Sources
Systems of Systems	3.7	Empowering Urban Electrification: Leveraging Socio-Economic and Social Network Insights with CARLA-Charge in the ASPIRE Framework for Optimal EV Charging Solutions	Masood Parvania; Steve Petruzza; Mario Harper	University of Utah; Utah State University	Electrical and Computer Engineering; Computer Science	Convergent Research; Engineering Workforce Development ; Innovation Ecosystem	Core
Pathways	4.1	Pre-College Curricula, Engagement & PD Year 5	Brandon Allen; Jennifer Taylor; Hillary Swanson; LuEtta Lawrence	Purdue University; University of Colorado Boulder; Utah State University	Political Science; Integrated Teaching and Learning Program; Instructional Technology and Learning Sciences	Engineering Workforce Development	Core
Pathways	4.2	REU, Higher Education Curricula & Engagement	Brandon Allen; Rosalee Clawson; Amanda Katz	Purdue University; Utah State University	Political Science; History	Convergent Research; Engineering Workforce Development ; Innovation Ecosystem	Core
Pathways	4.3	Student Engagement and Center-Wide Mentorship	Brandon Allen; Penelope Espinoza; Ivonne Santiago	Purdue University; University of Texas at El Paso	Political Science; Educational Leadership; Civil Engineering	Engineering Workforce Development	Core

Thrust	Task #	Project	Faculty Members	Institutions	Departments	REDI Element	First Funding Sources
Pathways	4.4	CC and Post-secondary Electrified Transportation Systems (ETS) Pathway Credentialing	Matt Ohland; Angie Minichiello; Ivonne Santiago	Purdue University; Utah State University; University of Texas at El Paso	Engineering Education; Civil Engineering	Engineering Workforce Development	Core
Pathways	4.5	Community Engagement & Governance	Emma Mecham; Konstantina Gritzka; Nick Roberts	Utah State University; Purdue University	School of Teacher Education and Leadership; Lyles School of Civil Engineering; Mechanical and Aerospace Engineering	Engineering Workforce Development	Core
Pathways	4.6	Social Systems and Impact Research	Brandon Allen; Emma Mecham; Penelope Espinoza; Hillary Swanson	Purdue University; Utah State University; University of Texas at El Paso	Political Science; School of Teacher Education and Leadership; Educational Leadership; Instructional Technology and Learning Sciences	Convergent Research; Engineering Workforce Development	Core

Appendix VII – Project Updates

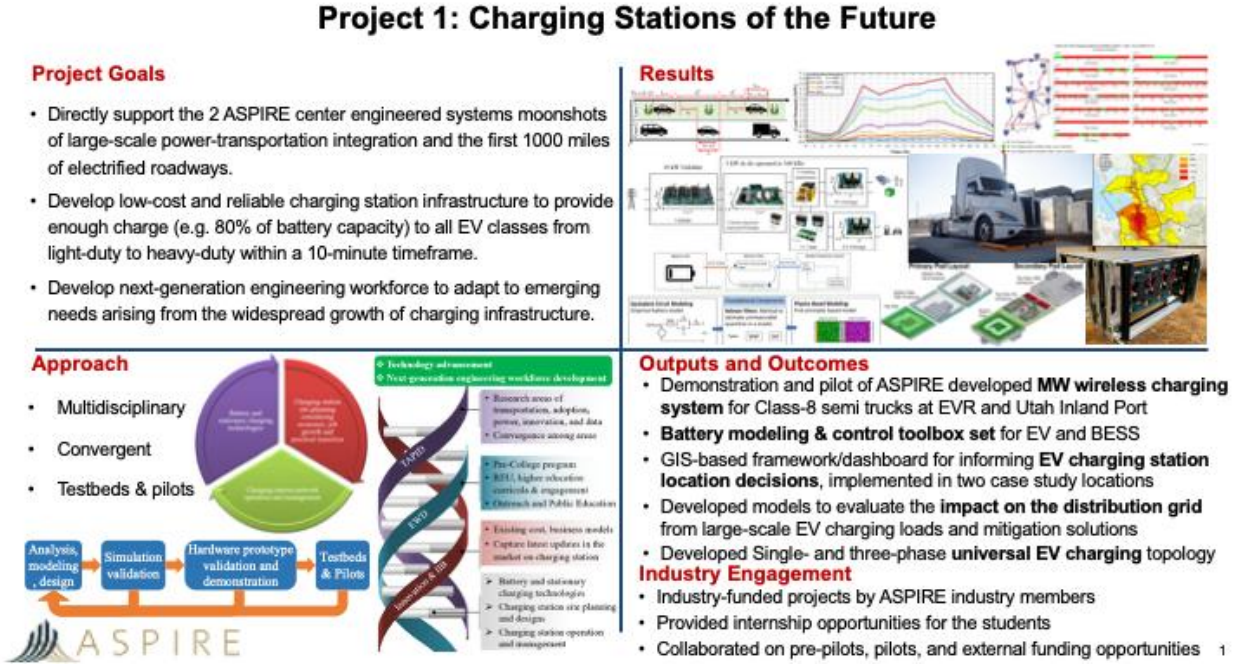
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Project 1 Charging Stations of the Future

1.1 Project 1 Quad Chart



1.2 Project 1 Gantt Chart Year 5 and 6

Gantt Chart Year 5

Center Goals		Tasks	Year 5 Q1	Q2	Q3	Q4
		Task 0 Charging stations vision and project management				
		Task 0.1 Project management				
		Task 1 Modeling, State Estimation, and Life-Aware Model-Predictive Controls of On-Vehicle Battery Systems				
	2	Task 1.1 Implement model predictive controls on ESC				
	2	Task 1.2 Implement model predictive controls on SPMe				
1	2	Task 1.3 Investigate battery SOF/SOH effects of discharge-pulse during charge				
		Task 2 Advancing charging technologies				
1	2	Task 2.1 Power converter development for charging stations				
2	5	Task 2.2 Charging equipment health monitoring and reliability				
2	4	Task 2.3 Evaluating impacts of large-scale charging infrastructure on distribution grid				
		Task 3 Thermal Modeling, Management, and Storage to Enable Sustainable and Advanced High-Powered EV Charging Infrastructure				
1	2	Task 3.1 Thermal modeling of rrimary 1 MW pad and capacitive WPT systems including validation and sensitivity analysis				
1	2	Task 3.2 Novel thermal management				
5	6	Task 3.3 Run IRES (if funded) + expand educational materials (collaborative with P2T2)				
1	2	Task 3.4 Feasibility of waste heat harvesting				
1	2	Task 3.5 Thermal energy storage				
		Task 4 Site Design, Planning, and Implementation of EV Charging Infrastructure				
2	4	Task 4.1 Planning: Identify and define planning criteria. Develop site design typologies and examples				

2	4	Task 4.2 Data collection: Assemble data from various sources to measure identified planning criteria				
2	4	Task 4.3 Optimization: Optimize the identified planning criteria. Align metrics to be comparable across criteria, so that metrics with different input data can be compared on the same numerical scale. Accommodate multi-objective weighting, to allow users to input custom weights for different criteria				
2	4	Task 4.4 Development: Develop the cost-equity+ CSoF location decision tool, that evaluates criteria and offers suggestions				
2	4	Task 4.5 Enhancement: Enhance the measurement of charging accessibility, considering multiple factors.				
2	4	Task 4.6 Implementation: Develop a web dashboard for site selection of charging stations in El Paso, TX.				
		Task 5 Charging Station Virtual Reality Visualization and Smart Management				
5	2	Task 5.1 Literature review on VR implementation in EV charger maintenance and parking lot				
5	2	Task 5.2 Create VR 3D model to improve EV charger maintenance and streamline charging station operations				
5	2	Task 5.3 Open-loop formulation of the dynamic stochastic programming problem for the expected cost functional associated with the SCMS				
5	2	Task 5.4 Develop a digital twin and strategic decision-making method to optimize electric vehicle charging infrastructure via commercially customized AnyLogic software				
	2	Task 5.5 Study V2X needs and implementation for networking charging stations				
	2	Task 5.6 EV charging station network operation and management algorithms				
		Task 6 Connected Vehicle Data Analytics for Charging Stations of the Future				
	2	Task 6.1 Monthly longitudinal analysis of CV data (VMT, O-D pairs, Trip Lengths)				
	2	Task 6.2 Monthly longitudinal analysis of a combination of CV data, EV-ChART data and Alternative Fuel Stations Data in the context of existing charging infrastructure (utilization, gaps)				
2	4	Task 6.3 Develop scalable performance measures to track return on investment on charging infrastructure				

Gantt Chart Year 6

Center Goals		Tasks	Year 6 Q1	Q2	Q3	Q4
		Task 0 Charging stations vision and project management				
		Task 0.1 Project management				
		Task 1 Modeling, State Estimation, and Life-Aware Model-Predictive Controls of On-Vehicle Battery Systems				
	2	Task 1.1 Implement model predictive controls on xRA PBM models				
	2	Task 1.2 Implement model predictive controls on SPMe PBM models				
1	2	Task 1.3 Develop a prototype toolbox to inform the design of charging components using battery simulation				
		Task 2 Technology Advancement for Stationary Charging				
1	2	Task 2.1 Development of universal charging station with integrated energy storage				
1	2	Task 2.2 Development and integration of high-density magnetics for fast chargers				
1	2	Task 2.3 Development of high power-density DAB without dc blocking capacitor				
1	2	Task 2.4 Development of a multi-port power converter based on unfolding technology to integrate grid, battery storage, and renewables for EV Charging				
1	2	Task 2.5 Development of MV grid-tied multi-port ac-dc converter for high-power charging stations				
1	2	Task 2.6 WPT system EMI standard study and simulation (conducted, radiated, and crosstalk)				
1	2	Task 2.7 WPT system EMI measurement, filter design, and evaluation				
		Task 3 Impact Analysis of Large-Scale EV Charging Systems and Reliability				
1	2	Task 3.1 Power converter development for charging stations				
1	2	Task 3.2 Charging Infrastructure Load Demand Modeling and Reliability Analysis of Distribution Grid				
		Task 4 Thermal Modeling, Management, and Storage				
1	2	Task 4.1 Investigate pool boiling characteristics of dielectric fluids such as NOVEC-7000 on native and enhanced ferrite surfaces				

1	2	Task 4.2 Characterize heat transfer performance of single and hybrid PCMs as a potential thermal management solution on vehicle-side				
1	2	Task 4.3 Advance the mobile thermal storage concept through design, modeling and simulations				
1	2	Task 4.4 Modeling of high-power capacitive and inductive WPT systems for fast stationary charging				
1	2	Task 4.5 Thermal management integrated packaging of dc-dc power converter module				
		Task 5 The Economic and Community Benefits of EV Charging Stations				
2	4	Task 5.1 Literature review on the economic benefits of charging stations				
2	4	Task 5.2 Select case study communities				
2	4	Task 5.3 Assemble information and existing data on selected communities				
2	4	Task 5.4 Contact (and potentially interview) key people or organizations in communities. Produce design prototypes for EV charging stations with associated improvements to the built environment				
2	4	Task 5.5 Conduct econometric analysis on case study communities				
2	4	Task 5.6 Prepare macroeconomic analysis report				
2	4	Task 5.7 Prepare overall report on case studies				
		Task 6 Geospatial Artificial Intelligence for Electric Vehicle (EV) Charging Station Site Location and Optimal Roadway Segments for Dynamic Wireless Power Transfer (DWPT)				
2	4	Task 6.1 Data collection & processing				
2	4	Task 6.2 Geospatial analysis of existing infrastructures				
2	4	Task 6.3 GeoAI model development and validation				
2	4	Task 6.4 Decision-support dashboard prototype				
5	4	Task 6.5 Stakeholder evaluation and feedback				
		Task 7 Reliable and Resilient Charging Station Design				
5	4	Task 7.1 Develop interviews with electric grid operators, industry station designers, DOTs, Federal Highway personnel, and others; Analyze findings				
5	4	Task 7.2 Hold community focus groups and analyze data				
1	4	Task 7.3 Design charging elements incorporating feedback				

		Task 8 MW Charging System Maintenance, Repair, and Multi-megawatt Charging Station Design and Smart Management				
6	2	Task 8.1 VR Training Modules for EV Charging Stations				
2	4	Task 8.2 AI-Based Multi-Megawatt Charging Station Design & Smart Management				

1.3 Project 1 Task Summaries

Project 1 Task 1: Modeling, State Estimation, and Life-Aware Model-Predictive Controls of On-Vehicle Battery Systems
Team: Scott Trimboli, Faculty, UCCS; Gregory L. Plett, Faculty, UCCS; Kaylie Maddux, Student, UCCS; Craig Chambers, Student, UCCS s; Wesley Hileman, Student, UCCS; Suchita Undare, Student, UCCS; Juan-Jie Sun, Student, UCCS
Task Summary:
Task 1 focuses on advancing modeling, state estimation, and life-aware model-predictive controls for on-vehicle battery systems, with an emphasis on enabling extreme fast charging and in-road wireless charging. Key challenges include limited understanding of how intermittent charging affects battery aging and failure, the slow adoption of physics-based models for optimal charging algorithms, and a lack of experimental validation for these approaches. To address these gaps, the team has developed both empirical and physics-based lithium-ion battery models and incorporated them into a user-friendly software toolbox. This toolbox allows researchers and industry partners to investigate performance, lifetime impacts, and advanced control strategies that can extend battery life while supporting rapid charging.

Significant progress has been made this quarter. The implementation of model predictive control on the equivalent circuit model is 90% complete, with the software component in final testing and a draft user manual already written. This milestone provides a new platform for exploring innovative charging strategies that leverage the high-powered charge capabilities under development in Task 2. By combining predictive control with physics-based extensions, these strategies are expected to demonstrate faster, safer, and more reliable charging while mitigating battery degradation.

The team's work directly contributes to ASPIRE's broader goals by offering tools that will accelerate the transition to electrified transportation. Outcomes of Task 1.0 are designed to lower barriers to EV adoption by enhancing charging convenience, reducing wait times, and improving overall battery health, ultimately delivering a more satisfying long-range driving experience for consumers.

Innovation efforts this quarter included advancing the Battery Modeling & Control Toolbox**,** which provides applications for generating a variety of battery models from experimental data. Currently in the validation phase at Technology Readiness Level 6, this software holds strong commercialization potential for both academic and industry users. Planned enhancements include predictive aging capabilities and advanced fast-charge control strategies, though additional funding, personnel, and laboratory resources for long-term cell testing will be needed to complete this work.

Through these developments, Task 1 is laying the foundation for future charging stations that seamlessly combine advanced modeling and controls with high-power charging hardware, ensuring reliable, efficient, and user-friendly EV charging experiences.

Project 1 Task 2: Advancing Charging Technologies
Team: Hongjie Wang, Faculty, USU; Paras Mandal, Faculty, UTEP; Bill Tseng, Faculty, UTEP; Honglun Xu, Faculty, UTEP; Janette Goodridge, Faculty, USU; Wade Goodridge, Faculty, USU; Regan Zane, Faculty, USU; Dragan Maksimovic, Faculty, Colorado Boulder; Luca Corradini, Faculty, Colorado Boulder; Sayan Paul, Postdoc, Colorado Boulder
Task Summary:
Task 1.2 is focused on advancing the technologies that support sustainable, efficient, and high-powered electric vehicle (EV) charging infrastructure. This effort addresses gaps in current charging capabilities, including system efficiency, scalability, and the integration of advanced controls that ensure reliability while meeting growing demand. The team has emphasized the importance of bridging the disconnect between existing charging designs and the future requirements of widespread electrification, targeting innovations that improve both performance and societal accessibility.

In year 5, the project has investigated technical limitations such as heat management, energy transfer efficiency, and cost-effective deployment. Research progress has included both modeling and experimental validation of new charging approaches, as well as the development of prototype systems that demonstrate improved safety and performance metrics. These efforts contribute directly to ASPIRE's mission of enabling rapid adoption of electrified transportation while addressing real-world engineering and community challenges.

Key milestones completed this year include: 1) Developed control strategies to eliminate sector distortion, detailed loss modeling, zero-voltage switching analysis, and small-signal modeling of T-type LCL resonant converter for unfolder-based high-power wired and wireless; 2) Developed topologies, modeling, control strategies, DCX, and MV-isolated planar transformer for MV grid-tied ac-dc power converter for charging stations; 3) Design, modeling, and initial prototyping of universal ac-dc charging topology to enable single-phase and three-phase versatility; 4) Developed volume-optimized design of ac/dc interface, and innovative versatile control solutions for universal ac/dc charging interface; 5) Studied the topology, design, modeling, and control of unfolder-based multiport ac-dc system for grid, energy storage, renewable, and charging station integration; 6) Continuous development of mega-watt inductive wireless power transfer technology; 7) Development of an Unfolder-based ac-dc power converter hardware with regulated output current for large-scale EV charging infrastructure; 8) Developed a silicon carbide MOSFETs aging testing platform that can test 6 devices simultaneously for EV chargers using power cycling and collected the aging data by using the testing platform; 9) Development of methodologies to analyze sustainability and potential impacts of large-scale charging system on electric power distribution grid; 10) Developed an algorithm for DER-integrated grid operations under extreme weather events, incorporating DWPT, and a priority load control approach to mitigate impacts from large-scale charging loads.

From an innovation perspective, Task 1.2 has conducted technology readiness assessments to benchmark progress and prioritize future developments. Emerging initiatives include system-level integration of next-generation charging hardware, improved modeling for predicting real-time system behavior, and exploration of new materials that enhance energy transfer. Planned next steps will leverage collaborations with industry and interdisciplinary research partners to accelerate deployment, address identified resource needs, and prepare for commercialization opportunities.

In sum, Task 1.2 is building the foundation for advanced charging technologies that are not only technically sound but also responsive to the social, economic, and environmental imperatives of large-scale EV adoption.

Project 1 Task 3: Thermal Modeling, Management, and Storage to Enable Sustainable and Advanced High-Powered EV Charging Infrastructure

Team: Nick Roberts, Faculty, USU; Jorge Hernandez Ramiro, Student, USU; Hailei Wang, Faculty, USU; Mahdi Ghorbani, Student, USU; Hongjie Wang, Faculty, USU; Khurram Afridi, Faculty, Cornell; Dheeraj Etta, Student, Cornell

Task Summary:

In Year 5, Task 1.3 advanced the understanding and application of thermal management strategies to enable sustainable, high-powered electric vehicle (EV) charging infrastructure. Recognizing that thermal constraints remain a critical barrier to scaling up power transfer, the team concentrated on both modeling and experimental approaches to address heat dissipation, material performance, and system-level energy storage integration.

Key progress included the development of thermal models that predict system behavior under various load and heat flux conditions, as well as experimental studies using immersion cooling techniques to characterize ferrite materials. By leveraging advanced statistical methods such as bootstrap resampling, the team refined estimates of interface thermal resistance and improved confidence in design predictions. These findings not only provide a more reliable basis for component and system design but also directly support ASPIRE's goal of enabling fast, safe, and efficient charging systems.

Milestone achievements in Year 5 included demonstration of prototype thermal management solutions and the validation of models against experimental data. These efforts helped clarify trade-offs between cost, performance, and manufacturability, providing insights into the practical deployment of high-power charging technologies. Importantly, the results also informed broader system-level strategies, ensuring that thermal solutions integrate effectively with storage and control systems.

On the innovation front, Task 1.3 conducted technology readiness assessments to benchmark thermal solutions and highlight pathways for near-term impact. Planned initiatives include expanding immersion cooling research, refining system-level storage integration models, and exploring novel materials that can push the limits of heat tolerance. The task also identified areas where industry collaboration will be critical to scaling laboratory advances into commercial systems.

Overall, Task 1.3 in Year 5 strengthened ASPIRE's technical foundation for thermal management, providing the tools and validated approaches necessary to overcome one of the key barriers to widespread deployment of high-powered EV charging infrastructure.

Project 1 Task 4: Design, Planning, and Implementation of EV Charging Infrastructure
Team: Patrick Singleton, Faculty, USU; Adeeba Raheem, Faculty, UTEP; Ziqi Song, Faculty, UB; Ole Sleipness, Faculty, USU; Ivonne Santiago, Faculty, UTEP; Fariba Soltani Mandolakani, Student, USU; Juan Zenil Araiza, Student, UTEP; Nestor Acosta, Student, UTEP; Yiming Zhang, Student, UB; Rishika Srinivasa Tumula, Student, Purdue
Task Summary:
In Year 5, Task 1.4 advanced strategies for designing, planning, and implementing electric vehicle (EV) charging infrastructure (EVCI) that is both technically feasible and socially responsive. The task aimed to close persistent gaps between infrastructure deployment goals and the realities of cost, accessibility, and regulatory frameworks. Recognizing that infrastructure design must integrate both engineering considerations and human-centered outcomes, the team focused on creating tools and approaches that enable effective decision-making at scale.

Work in Year 5 focused on developing and operationalizing an integrated framework for public EVCI location planning, incorporating demand, cost, and opportunity considerations, and addressing the critical need to balance multiple, often competing, factors. These three major categories reflect the need for investment to be cost-effective, responsive to current and future charging demands, and provide opportunities to benefit communities and economic development. To illustrate the EVCI planning framework's utility, the research teams applied it to two distinct case studies—Salt Lake County, Utah, and El Paso County, Texas—utilizing geospatial data including population density, points-of-interest (POIs), existing EV charging stations, transmission lines, and designated Opportunity Zones. Importantly, the team secured a significant external partnership through the City of El Paso, El Paso Electric, and the U.S. Department of Transportation, participating in a $15 million Charging and Fueling Infrastructure (CFI) grant. Although the grant was ultimately paused, it enabled meaningful collaboration and laid the groundwork for future efforts. Importantly, we delivered to the City of El Paso a decision-making dashboard designed to facilitate the siting of EV charging stations.
Milestone achievements included collaboration with Task 3.4 to develop a costing tool that models the installation and operation of different charging station types. This work helps municipalities and private partners assess trade-offs between investment, accessibility, and long-term sustainability. Additionally, Task 1.4 converged with Task 3.3 to incorporate behavioral and adoption factors into planning models, ensuring that infrastructure placement reflects patterns of EV use and public accessibility. Building previous work on EV charging station site design vignettes completed by students in the Recreation Design and Environmental Planning (LAEP) department's Recreation Design and Open Space Planning studio, a graduate student analyzed several suitable sites for locating EV charging stations on the I-15 corridor through Utah and Idaho, as well as several sites in Colorado. Of these selected sites, several were selected for in-depth site design modifications that integrate EV charging infrastructure at the local community scales.

Overall, Year 5 positioned Task 1.4 as a vital link between technical innovation and community deployment, ensuring that EV charging infrastructure planning advances in ways that are economically viable, socially responsive, and technically robust. Looking ahead to Year 6, the research team identified opportunities to refine planning methodologies, expand partnerships, and continue integrating costing and adoption insights into scalable infrastructure frameworks. Planned innovations include expanding the decision-support tools, aligning them with real-world pilot projects, and ensuring that design frameworks can adapt to diverse regional needs. Additionally,

work will identify how EVCI location and site design considerations can be leveraged to improve other local community conditions that support local economic development activities.

Project 1 Task 5: Charging Station Virtual Reality Visualization and Smart Management
Team: Bill Tseng, Faculty, University of Texas at El Paso (UTEP); Honglun Xu, Faculty, University of Texas at El Paso (UTEP); Hongjie Wang, Faculty, Utah State University (USU); Rose Hu, Faculty, Virginia Tech University (VT); Urenda Castaneda, Denisse, Student, University of Texas at El Paso (UTEP); Bustamante-Murguia, Pablo, Student, University of Texas at El Paso (UTEP); Jackson Morgan, Student, Utah State University (USU); Lhaden, Tenzin, Student, University of Texas at El Paso (UTEP)
Task Summary:
In Year 5, Task 1.5 advanced the integration of virtual reality (VR) technologies, digital twin simulations, and smart management strategies to optimize the design and operation of EV charging stations. The task addressed critical needs in visualization, forecasting, user training, and infrastructure optimization, positioning itself as a bridge between research innovation and real-world deployment.

A major thrust was the development of VR-based visualization and training platforms. Building on the SmartCharge VR framework, immersive modules were created for two primary use cases: (1) EV User Training, where drivers practiced charging operations with safety awareness and troubleshooting guidance; and (2) EV Production Worker Training, simulating assembly and maintenance processes to enhance precision and reduce error. These VR environments—developed in Unity for Oculus Quest Pro/2—provided interactive 3D models of charging stations, improving user confidence, workforce readiness, and design evaluation before deployment. On the modeling and forecasting side, three complementary research works shaped the task's findings:

SmartCharge VR (Augmented Reality for Training and Troubleshooting): This work demonstrated that immersive VR/AR platforms can serve as interactive guidance and troubleshooting tools. Users benefited from safety awareness modules, hazard simulations, and real-time troubleshooting wizards that reduced operational errors and improved charging reliability.

Composite NARXNN Forecasting: A hybrid Nonlinear Autoregressive Neural Network (NARXNN) framework was developed to integrate weather forecasts into PV power prediction. By interpolating between NARX and exogenous-only models, the approach improved responsiveness to weather variability and offered probabilistic forecasts with quantified uncertainty, outperforming baseline methods on RMSE, MAE, and Interval Score.

Hybrid DES–ABM Simulation Framework: Developed in AnyLogic, this framework combined discrete-event simulation (DES) of energy flows with agent-based modeling (ABM) of stochastic EV arrivals. Optimization experiments revealed that Genetic Algorithm (GA) consistently outperformed OptQuest in terms of convergence speed, robustness, and computational cost. Sensitivity analysis highlighted grid ramp limits, ESS capacity, and PV sizing as critical system design drivers.

Together, these works contributed to Task 1.5's dual objectives: (1) improving human-centered visualization and training through VR/AR platforms and (2) enhancing system-level smart management through forecasting, optimization, and digital twins. Innovation assessments in Year 5 confirmed that VR-enhanced training and intelligent management algorithms are approaching readiness for scaled pilot applications. Looking forward, Task 1.5 will expand VR tools to integrate

behavioral adoption models, extend the forecasting and optimization frameworks to multi-station networks, and refine digital twins for operational decision support. Overall, Year 5 demonstrated how combining immersive visualization, intelligent forecasting, and hybrid simulation can transform the planning, training, and performance of EV charging infrastructure—delivering solutions that are more efficient, adaptive, and user-centered**.**

Project 1 Task 6: Connected Vehicle Data Analytics for Charging Stations of the Future
Team: Darcy Bullock, Faculty, Purdue University; Jairaj Desai, Staff, Purdue University
Task Summary:
In Year 5, Task 1.6 has expanded ASPIRE's ability to leverage connected vehicle (CV) data to inform electric vehicle (EV) charging infrastructure planning, siting, and evaluation. The task directly addresses key gaps in the field: the limited availability of EV-specific CV data across diverse OEMs, the low market penetration of EVs relative to internal combustion engine vehicles (ICEVs), and the lack of consistent charging session data from providers. By combining CV data with other public data sources, Task 1.6 is building the evidence base needed to assess infrastructure utilization, measure return on investment, and identify gaps in charging availability.

Over the course of Year 5, the team established partnerships with major CV data providers including StreetLight, CompassIoT, and INRIX, securing near real-time data streams for Indiana and its borders. They also obtained six months of nationwide sample data covering all 50 states, as well as datasets from the UK, New Zealand, and Australia. These efforts diversified the data pool to include EV, hybrid, and ICEV powertrains, enabling cross-regional analyses of vehicle miles traveled (VMT), trip lengths, origin-destination patterns, and charging station usage. The task also integrated Tesla data, providing unique visibility into state-of-charge patterns and charging behavior across a wide EV mix.

Milestones in Year 5 showed strong progress. Technical publications advanced to 75% completion, with one accepted paper in November 2024 and additional manuscripts in preparation. Quarterly reporting reached 75% completion, with Q1 uploads finalized and subsequent reports in production for multiple states where ASPIRE is active, including Colorado, New York, Texas, Utah, and Virginia. Analysis milestones reached 75% progress, with exploratory studies of nationwide Tesla datasets underway, international collaborations established, and findings presented at the Purdue Road School and to UK partners. End-of-year projections place all milestones at 100% completion.

Deliverables this year included monthly longitudinal analyses of CV data, integration of CV data with EV-ChART and Alternative Fuel Stations datasets, and the development of scalable performance measures for evaluating infrastructure investment. These outputs are currently at **TRL 1**, representing foundational research, but they are designed for scalability and repeatability across different geographic contexts. The results are laying the groundwork for advanced performance measurement frameworks that can help both public and private stakeholders make evidence-based decisions on infrastructure deployment and return on investment.

Task 1.6's contributions directly support ASPIRE's Center goals 2, 4, and 5, enabling widespread electrification, reducing greenhouse gas emissions, and ensuring equitable access to charging infrastructure. By providing data-driven insights into vehicle behavior and infrastructure utilization, this task not only fills critical research gaps but also demonstrates clear societal impact through quantifiable measures of EV adoption, accessibility, and environmental benefits.

Looking ahead, Task 1.6 will continue to expand its data ingestion and analysis pipelines, enhance longitudinal monitoring methods, and pursue pathways for commercialization of CV data analytics tools. These initiatives will move the work toward higher readiness levels and ensure its integration into real-world infrastructure planning and operational decision-making.

1.4 Associated Project Summaries

CSoF Associated Project: Western Smart Regional EV Adoption and Infrastructure at Scale – WestSmartEV@Scale

Team

Faculty: Regan Zane

Graduate students: Abdullah Al Mehadi, Jackson Morgan

Industry Collaborators: PacifiCorp, University of Utah, National Renewable Energy Laboratory, GivGroup, Forth Mobility, FlexCharging, Breathe Utah, Doglatin, Rocky Mountain Institute, Utah Inland Port, Utah CCC, Yellowstone-Teton CCC, Treasure Valley CCC, Valley of the Sun CCC

Summary

The objective of the WestSmart EV@Scale project is to identify pathways to accelerate use of EVs. The pathways will be evaluated by researchers through the analysis of EV infrastructure gaps, EV workforce development training, EV infrastructure deployment and data gathering, freight and port load, and grid evaluations. WestSmart EV@Scale leverages lessons learned and best practices from the tremendous success of the WestSmartEV project in Utah. It facilitates successful expansion into a regional program covering portions of Washington, Oregon, Idaho, Wyoming, Nevada, and Arizona—covering all major corridors in and out of California. It encompasses five critical EV application focus areas of: Destination Highways (National Park and Recreation), Underserved Regions (EV Training, Rural Transit Hub, Electric Car Share at Affordable Housing), Urban Mobility (Transportation Network Company, Intermodal Hub), Freight (Airport, Inland Port), and Community/Workplace (Mobility Hub, Workplace Charging).

Key progress

The power systems analysis for WestSmartEV @ Scale include an analysis of how electrified public transit impacts a local distribution network in Salt Lake City and the average wholesale energy costs of supporting it. Results included a time-series simulation of the distribution network model feeding the Salt Lake Central station's light rail and bus charging loads. The integration of electrified transportation on the distribution network was measured in terms of its contribution to the network's peak demand and energy consumption. The results of the simulation showed that the daytime light rail and bus charging loads increased peak power demand more than they increased average power demand. This worsens the load factor of the system, pushing up fixed costs for the utility without a proportional amount of energy supplied to cover those costs. Recommendations were provided by USU to alter bus charging schedules to increase charging in the low-demand morning hours and allow buses to deplete their batteries further during the typical peak demand hours of the day.

Similar analysis was performed based on the wholesale price to generate electrical energy, provided by the Western Energy Imbalance Market. These results showed that the average cost of generating electricity for the UTA's transit loads were a few percent lower than the average cost of serving the non-transportation loads on the network. This indicated a tradeoff between energy costs and peak demand. While daytime transportation loads may push up infrastructure costs, these same loads appear to make good use of cheap power during the day when solar energy is most available.

CSoF Associated Project: Increasing Affordability, Energy Efficiency, and Ridership of Transit Bus Systems through Large-Scale Electrification

Team

Faculty: Ziqi Song, Regan Zane

Graduate students: Jackson Morgan, Yiming Zhou

Industry Collaborators: Purdue University, NREL, Argonne National Laboratory, Utah Transit Authority (UTA), Rocky Mountain Power (RMP), Tri-County Metropolitan Transportation District of Oregon (TriMet)

Summary

The primary goal of the proposed project is to promote the large-scale adoption of electric buses and improve the efficiency and effectiveness of transit bus systems, which aligns with EEMS's overall goal of improving mobility energy productivity. The objectives are to research, develop, apply, and validate technology and/or data solutions to reduce energy costs per mile for battery electric bus systems by ≥ 20% (compared to the non-optimized electrification case), lower up-front battery and charging infrastructure costs by ≥ 10%, and bring down bus charging costs by ≥ 20%.

Key progress

The goals of the Battery Electric Bus project are to demonstrate cost and emissions reductions using electric bus deployment. The cost reductions can be broadly separated into two categories: planning costs and operational costs. For estimating planning costs of new bus charging infrastructure, grid models of real networks in Utah featuring battery electric buses are being used to identify underutilized infrastructure that could support BEB charging. Work is ongoing to the locations where the distribution network and bus routes overlap and identifying which of those intersections have underutilized grid capacity that can be used for on-route bus charging.

As part of this project, a reservation-based optimization framework to reduce the costs of electric bus charging has been proposed. It considers both the ability of the buses to charge on-route during the day and at the depot during night. By co-optimizing both types of charging, the optimizer can find a least-cost solution that ensures the buses get the required energy. The proposed method estimates the total energy use of the buses' daily schedules based on historical energy consumption on the day's routes. It then creates a charging schedule that ensures this energy is delivered to the buses over the course of the day, with special consideration in the optimizer's constraints that consider the buses' states of charge and charger availability.

Beyond this operational optimization, the team has proposed a method for planning deployments of electric bus charging equipment. The choice of charger power level significantly affects the upfront costs of providing electric bus charging. The proposed method includes the operational charging

costs and the upfront charger installation costs, and treats the charger power as a decision variable. As a result the optimizer strikes a balance between the costs of high-power chargers and the costs of utility bills composed of peak demand and time-of-use energy components.

CSoF Associated Project: Connected Community

Team

Faculty: Regan Zane

Graduate students: Jackson Morgan, Abdullah Al Mehadi, Emily Pitts

Industry Collaborators: Rocky Mountain Power (RMP), Giv Group, Utah Transit Authority, University of Utah

Summary

This is a demonstration project in DOE's Connected Communities that aims to seamlessly integrate 700 discrete building spaces into PacifiCorp's daily grid operations, by linking hundreds of various systems, equipment, and plug loads found across the Salt Lake City region, including new and existing single-family homes and multifamily apartments to college research laboratories, downtown office spaces, industrial manufacturing facility, and a mass transit hub in the urban center of Salt Lake City. By connecting this diverse group of electricity end uses at the grid level, PacifiCorp plans to create a new and holistic approach that allow utilities to coalesce, manage, and coordinate disparate but flexible power resources located at each building space – such as batteries, solar panels, electric vehicles, and water heaters, collectively called distributed energy resources (DER) – and help meet its customers' energy demand in a novel way, which do without expensive grid upgrades that keep the heaters on during cold snaps while preserving energy affordability.

Key progress

This stage of the UDERMS Connected Communities project has focused on developing communication pathways between a utility and building loads capable of providing demand response, taking inventory of existing DERs on the network, and developing grid-informed control of those building loads.

USU has been working closely with RMP to deploy its OpenADR communication software named aspiredr. The software enables rapid deployment of OpenADR servers and clients (called VTNs and VENs) that can provide telemetry reporting and generate demand response events. Both USU and RMP have made changes to their firewall configurations to allow communication between their networks, and have succesfully tested communication between their devices. Significant work has been performed to integrate USU's devices with RMP's energy management system using OpenADR-based communication. To this end, USU has developed an API endpoint for its energy management system which receives events from RMP over OpenADR and then dispatches the devices to provide grid services.

USU has also developed a hardware-in-the-loop (HIL) system that allows for real-time simulation, communication, and control between a simulated power distribution network and generator and existing hardware devices at USU's microgrid facility. It uses OpenADR for inter-device communication, and uses OpenDSS and Simulink to perform a simulation of a power system of a

small size with small inertia. This HIL system is being used to validate USU's control methods and demonstrate scalability with larger fleets of DERs being used to improve stability of the grid and reduce ancillary service costs.

CSoF Associated Project: Electrification MOSAIC Platform for Grid-informed Smart Charging Management

Team

Faculty: Regan Zane, Jake Gunther, Greg Droge, Mario Harper

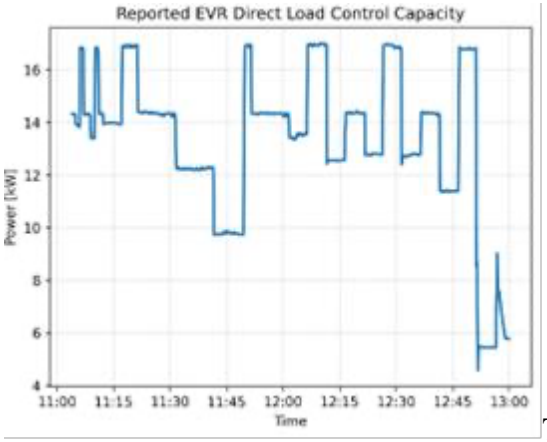
Graduate students: Jackson Morgan, Justin Whitaker, Derek Redmond

Industry Collaborators: ABB, Utah Transit Authority (UTA), Rocky Mountain Power (RMP)

Summary

The focus of this project is to develop a system for EV charger communication between EV users, the chargers themselves, a charging control aggregator, and the electric utility feeding these chargers. The purpose of communication is to reduce costs for the end user, better utilize the EV chargers, and allow the charging control aggregator to provide grid services to reduce electricity system's cost and emissions. This project was successfully completed in June 2025.

Key progress



The ABB eMosaic project relies on OpenADR communication that has been developed in the last year. The key features of the eMosaic OpenADR framework are a Virtual Top Node (VTN) which communicates with several Virtual End Nodes (VENs) at or near EV charging sites. USU developed the VTN, which registers VENs, sends them demand response events, and stores their reports. The duties of each VEN are to opt in or out of the events and to report on the current demand response capacity of the site.

Tests have been conducted around the four key eMosaic use cases:

- Use case 1: Dynamic pricing.
- Use case 2: Smart bus charging.
- Use case 3: Direct load control.
- Use case 4: Dynamic load limits.

A novel method resulting from this project has been developed to use energy packets to optimize charging at a charging station in response to both a dynamic price (use case 1) and direct load control or dynamic load limits (use case 4). The team also developed a reservation-based optimization of

electric vehicle charging considering dynamic pricing and operating envelopes. A conference paper [1] based on this work has been accepted for publication at the 57th North American Power Symposium (NAPS) 2025 in October 2025.

Testing has focused on USU's OpenADR system and validated its effectiveness at performing direct load control, and has demonstrated the VTN's ability to send load curtailment events based on the high-frequency reporting of the VEN(s). These events have successfully been implemented on USU's EV chargers at the Electric Vehicle Roadway. The figure above shows total charging power being temporarily curtailed to varying power levels in five-minute increments.

[1] J. Morgan, A. A. Mehadi, A. Sultana, H. Wang, and R. Zane, "Reservation-Based Optimization of Electric Vehicle Charging Considering Dynamic Pricing and Operating Envelopes," in *The 57th North American Power Symposium (NAPS) 2025*, Oct. 2025, in press.

CsoF Associated Project: Long-Range Battery Electric Vehicle with Megawatt Wireless Charging

Team

Faculty: Mahmoud Mansour, Reebal Nimri, Hongjie Wang, and Regan Zane, all at USU
Graduate students: Aditya Zade, USU, Shubhangi Gurudiwan, USU
Industry partner: Kenworth, WAVE, UPS, UIPA, Seattle City Light, Portland General Electric

Summary

This project aims to enable Class-8 truck electrification with seamless operation compared to internal combustion-powered vehicles. A wireless charger, designed by USU/ASPIRE, is suited for fast high-power operation at the expense of minimal operator knowledge and interaction. The wireless charger is designed to deliver a peak power of 1 megawatt (MW) during the vehicle operator shift rotation window (lunchtime/30 min). The charger enables power delivery at large air gaps using inductive coupling while maintaining safety requirements.

Key Accomplishments

- Demonstrated 850 kW operation of the designed system
- Accommodated site change and challenging route requirements (site routes and locations changed from Seattle/Portland to Logan/SLC, UT)
- Fabrication of vehicle side chill plate with split manufacturing
- Electrical performance and control validation of individual subsystems at the system voltage: shunt filter stage, unfolder stage, T-type converter, and resonant inductor
- Developed a tool that facilitates the evaluation of numerous UL standards to accelerate the electrical designs process and completed a second design review with UL compliance on subsystems and components
- Developed a high-bandwidth control for the T-type converter modules in the system using the extra element theorem and current emulation technique
- Developed modulation and control strategies to mitigate the input current distortion at sector transitions in Unfolding-based grid-tied ac-dc converters
- Finished testing of each T-type converter module with system assembly and integrated testing in progress

Key Challenges

Vehicle operation in northern climates impacts vehicle and charger designs
Existing UL standards lack design requirements for ultra-high power wireless charger
Material for compact and integrated design of thermal and electrical systems
Thermal limitation of chill plate heat capacity, long lead time, significant cost, thermal efficiency requirements of vehicle side chill plate

CSoF Associated Project: NSF CAREER: Novel Direct Current Power Distribution for Large-scale Electrified Transportation Charging

Team

Faculty: Hongjie Wang

Graduate students: Shubhangi Gurudiwan, Paul Bradford, Mckay Waite

Summary

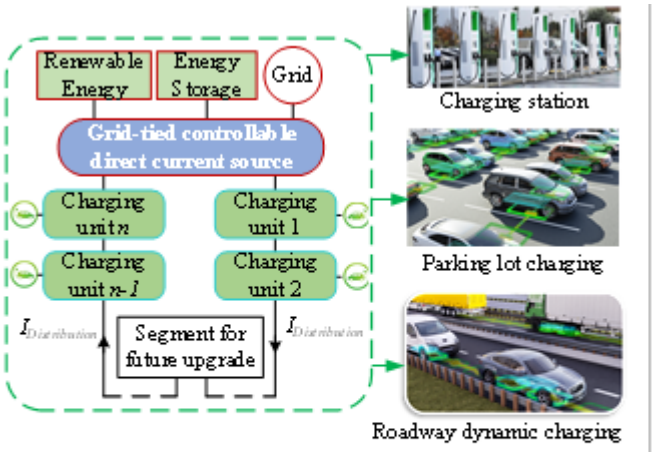


Figure 1. System diagram of the proposed direct current power distribution architecture with charging units connected in series to address the significant fundamental problem of how to distribute power to chargers for large-scale electrified transportation (electric vehicle) charging.

The CAREER plan goal is to make fundamental advances and create new scientific knowledge in direct current power distribution (DCPD) architectures (Fig. 1), power converter design techniques, power converter and system modeling, and novel electro-thermal analysis, collectively enabling transformative impact on efficient, reliable, and low-cost charging to support widespread adoption of electric vehicles. As shown in Fig. 1, the PI proposes a novel DCPD with charging units connected in series through a trunk cable powered by a grid-tied ac-dc current source to address the significant fundamental problem of how to distribute power to the chargers for large-scale electrified transportation charging.

Key progress

The project has made great progress towards the objectives in the past year. The key progress includes:

New design and control approach of the current injection circuit with zero voltage switching (ZVS) assisting leg to achieve soft switching for the unfolder-based ac-dc power converters.

New models and analysis approaches for the ZVS analysis of T-type resonant converters used in the ac-dc power converter.

Data and knowledge on sensitivity to component tolerances in both the series and parallel branches, misalignment, mistuning, no-load operation, and open and short circuit faults, for the novel inductive wireless charging transmitter design with current-fed H-bridge plus CLCL compensation.

A design procedure for the optimal design of the proposed new transmitter with CLCL compensation, considering efficiency and mistuning performance.

A Furious-based analysis approach considering higher-order harmonics for modeling the CLCL compensation network (resonant converter in general) to achieve improved accuracy, a novel thermal modeling and analysis approach using ML algorithms for high-power converter systems, and collected SiC MOSFET aging data from the testing of thousands of hours.

CSoF Associated Project:

SPR 4942: EV Charging Needs & Demand for Multifamily Dwellings in Indiana

Project Leads: Konstantina Gkritza
Post-Doctoral Researchers: Lavan Teja Burra
Students: Sarangi Jayaram, Kenny Chandra Wijaya
Partners: Indiana Department of Transportation (INDOT); Greater Indiana Clean Cities, Inc.; HNTB

Abstract/ Summary

In collaboration with the Indiana Department of Transportation (INDOT), a project is being designed to investigate the current and future charging requirements of EV users living in multi-family dwellings (MFD) across Indiana. This project utilizes a survey to capture the current charging usage and requirements of MFD residents in the state. Using these survey results, combined with public charging utilization data, the future demand for public chargers will be estimated. This will then be used to identify priority locations for deploying NEVI-funded DC fast chargers, with the broader goal of addressing various charging patterns, and ensuring that Indiana residents- particularly those in MFDs- have access to reliable charging options.

Alignment with Center Goals:

This project aligns with the following short-term center goals:

Goal 4 (Equitable Transition)

Through considerations of electrification scenarios in the future and development of future charging infrastructure that can support greater adoption of electrified vehicles.

Through the incorporation of multiple stakeholders in the planning, design and analysis of the project to create a viable siting plan.

Goal 5 (Informed Public)

Informs communities and industry partners and incorporates their feedback through the survey in transportation decision-making.

Milestones

Survey development

Preparation of supporting charging station usage datasets

Progress

The initial survey has been designed and is under review for approval by the Institutional Review Board (IRB). Meanwhile charging station usage data, starting from September 2024, for the state has been prepared for integration with results of the survey. Preliminary results of the data show clear weekday daytime peaks in session counts and durations. *Note that the project was paused for two months in response to the Executive Orders issued on January 20, 2025.*

1.5 Project 1 Year 6 Proposal

Project 1 Year 6 Proposal

Project: Charging Stations of the Future
Project Lead: Hongjie Wang (USU)
Project Co-Lead: Scott Trimboli (UCCS)

Project Overview:

According to a recent study regarding the electric vehicle (EV) market conducted by EV Volumes, global light-duty EV market share dominance is expected to occur by 2031. Furthermore, as many as two-thirds of vehicles sold in the year 2035 could be electric. The popularity of EVs continues to increase despite economic concerns about EV cost and range capabilities. The charging infrastructure, including wired and wireless solutions, is a critical component of the charging infrastructure and a key enabler for the widespread adoption of electric vehicles (EVs) from light- to heavy-duty.

To address the emerging societal and economic needs for charging station infrastructure, the Charging Stations of the Future (CSoF) project at ASPIRE emphasizes addressing the grand challenges associated with heavy-duty truck electrification, the charging station infrastructure of which can support light- and medium-duty vehicles easily. The project defines ‘moonshots’ for the nation in terms of the charging stations of the future development as:

(2) having charging station infrastructure to support 5 million trucks and achieving 200 billion truck-miles by 2050;
(2) having charging station infrastructure to go along with the first 1,000 miles of electrified roadways to enable reduced battery packs for trucks by 2050.

With the progress and advancements made by the project during the first 5 years, the project team will now focus more on enabling the real-world, large-scale, multi-megawatt and beyond charging station development and deployment to generate great impacts on the growth of the economy, job market, energy efficiency, and energy security for the nation.

The CSoF project aims to address the fundamental research gaps and technical challenges to enable the ‘moonshots’ for the nation from battery modeling and control, advanced charging technologies, impact of large-scale charging station infrastructure on the distribution grid, smart

charging management to reduce cost and optimize the grid impact, charging station location decision informed by data analytics, economic analysis, and traffic and power network analysis, the reliability and resilience of charging station infrastructure, and future engineering workforce development through new technologies. These research focuses are critical for the development and deployment of large-scale multi-megawatt charging stations in a cost-effective way.

The goal of the Year 6 CSoF project is to build toward ASPIRE Center goals 1, 2, 4, 5, and 6, and perform the convergent fundamental research required for developing and deploying the CSoF under various scenarios to enable the low-cost, safe, reliable, and resilient charging infrastructure necessary for the widespread adoption of all EV classes, especially the large-scale truck electrification.

The Year 6 CSoF project aligns with the Center's strategic planning themes of @Scale, leveraging, stakeholder and community engagement, and convergence. To be more specific, each task's full proposal will be required to show:

1)A clear and direct tie or contribution to 'moonshots' of charging stations of the future (@Scale),

2)A team interacting across disciplines generating outcomes/results that a single discipline could not achieve (Convergence),

3)A contribution to stakeholder and industry engagement with SMART milestone(s) (Stakeholder and industry engagement),

4)AND/OR, a clear path or idea on how research and accomplishments in Year 6 will position the project to pursue external funding opportunities and/or lead to proposal submission for external funding (Leveraging).

The Year 6 CSoF project **objectives** continue and further advancements in:

4) High-performance hardware and charging strategies design, modeling, and development to achieve high-power, reliable, fast, and low-cost EV charging, and approaches to evaluate and improve distribution grid reliability and resiliency with large charging loads;
4) Technologies and algorithms for smart charging management of charging stations that demonstrate the reduced charging cost for EV end users and operating cost for charging station owners/operators for a clearly defined and practical charging station scenario that includes different power levels of chargers, different vehicle classes, on-site PV, and battery energy storage;
4) Models, data analytics supported, toolboxes, and planning frameworks for charging station planning to achieve cross-disciplinary optimized charging station location decisions and optimized site planning/landscaping designs within one charging station;
4) Economic analysis and educational materials/products related to residential and public charging stations that directly contribute to the growth of the economy, job market, energy efficiency, energy security, and future workforce needs for the nation, to support the stakeholders and industry in decision-making and obtaining knowledge for widespread adoption of EV charging infrastructure.

To achieve these objectives, each task is encouraged to collaborate with other projects and tasks within the Center, utilizing a detailed collaboration or communication plan to generate broader

impacts and better contribute to the center goals. While each task needs to articulate how task objectives contribute to one or more of the project objectives, milestones will measure progress toward those objectives. Task milestones should directly support the project milestones listed below and/or directly contribute to the accomplishment of the stated project objectives.

Project Milestones:

Please work with task leads to complete proper alignment between task milestones> project milestones>center goals>societal impact targets. These connections can be made in the order that best suits the project's collaboration, but **there must be a clear link** between each element. This is how we report progress to NSF. The project milestones are now 1-year duration milestones

Project Milestone Name	***Description***	***Center Goal(s) Alignment***	***Please describe how it contributes to the Center Goal***	***Societal Impact Target***
CSoF1: Development of battery modeling enabled charging strategy and battery lifetime and performance impact modeling	Develop EV charging profile(s) that achieve fast charging of EVs to support the goal of providing enough charge (80% of battery capacity) within a 10-minute timeframe. Experimental validation on hardware prototypes, and models will evaluate the impact of fast charging on batteries and deployed to the ASPIRE software testbed library.	#2 - System Models/Tools	This milestone develops models and tools for the CSoF system.	1, 3, 5
CSoF2: Development of advanced high-power EV charging technologies	Develop MW-level capable wired and wireless charging technologies with hardware-validated modeling and control advancements demonstrating improved charging performance and reduced cost. Integrate into the ASPIRE EVR testbed and demonstrate to key stakeholders in preparation for pilots.	#1 - Charging Hardware	This milestone develops charging hardware	1, 2, 3, 5
CSoF3: Development of approaches for	Solutions are developed and evaluated at the ASPIRE hardware testbed that improve the reliability and resiliency of high-power	#1 - Charging Hardware #2 - System Models/Tools	This milestone advances charging hardware	1, 2, 3, 5

enhanced charging station resilience, distribution grid stability and reliability, and charging system reliability	charging systems through advanced thermal management and health monitoring, evaluate and improve distribution grid reliability and resiliency in the presence of large charging loads, and the resilience of charging station deployment.		performance and develops models and tools for the CSoF system.	
CSoF4: Smart charging management solutions for charging stations developed.	Solutions and algorithms for smart charging management of charging station(s) that demonstrate the reduced charging cost for EV end users and operating cost for charging station owners/operators are developed and uploaded to the ASPIRE toolbox library.	#2 - System Models/Tools #4 - Equitable Transition	This milestone will generate algorithms, models, and tools for cost-efficient charging station design and operation.	1, 2, 3,5
CSoF5: Analysis of economics, community benefits, and siting recommendations of multi-MW charging stations developed.	Toolbox, models, and approaches are developed and shared within ASPIRE for understanding the economics, community benefits, and siting recommendations of charging stations and ERs.	#2 - System Models/Tools #4 - Equitable Transition #5 – Informed Public	This milestone will develop models, analysis results, and tools for the societal impact of charging stations.	2, 3, 4, 5
CSoF6: EV workforce development	Virtual Reality (VR) technology-based and other training materials for MW charging system developed.	#5 - Informed Public #6 - Diverse Workforce	This milestone will develop training material for the operation, maintenance, and repair technicians and professionals related to MW charging systems.	1, 2, 5
CSoF7: Publication of research findings.	At least fifteen journal and conference papers are published for disseminating the research findings from the project and proposals are submitted for external funding.	#5 – Informed Public	Professional publications build the overall credibility of the ASPIRE team and draw national attention to the effort.	2, 5

Societal Impacts

1 – Improve charging performance

2 – Widespread deployment of charging stations

3 – Air quality improvement

4 – Economic and job growth

5 – EV workforce development

Project Budget: total NSF Funding request: 937,943.47

References:

EWD Competencies: Please review the four EWD competencies below, and if your task involves an EWD element please list which competency (1,2,3,4) your activity is designed to meet in the task table below.

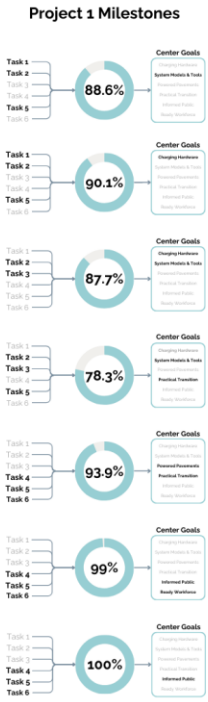
1. **System of systems thinking.** SoS can be defined as a collection of systems wherein resources and capabilities are combined, synthesizing a more complex system that offers greater functionality and performance than the sum total of resources and capabilities in the individual constituent systems. For example, our transportation system and our electric power grid system easily qualify as systems of systems by this definition. Electrified transportation has to consider these two extremely complex systems of systems together. Thus, we strive to see ETS engineering workers take responsibility for problem formulation in flexible and adaptive ways. Sustainability and ecosystems thinking are essential for the transformations ASPIRE seeks for electrified transportation.
2. **Transdisciplinarity.** SoS thinking frames data in the broader context of professional competencies necessary to effectively navigate organizational, societal, and global contexts. Because *transdisciplinarity* is fundamental to addressing convergent sociotechnical challenges, a future ETS-Engineering workforce needs exposure not only to a broader range of engineering specialties, but also to integrated and complementary social science knowledge**.** For example, a key component in forming transdisciplinary engineers is instilling epistemic humilit**y** – the recognition that others may have different ways of knowing that are valid and valuable. This disposition must be supported early on, through formal and informal precollege learning, and sustained in undergraduate curricula and beyond.
3. **Professional competencies.** New professional competencies are also foundational for the engineering workforce of the 21st century. Those professional skills include:
    - Participatory leadership and mentoring
    - Ethics and empathy
    - Communication
    - Intercultural competencies
4. **Entrepreneurship and Innovation:** Entrepreneurship is the process of creating, developing, and managing a new business or for-profit project for the purpose of turning innovative ideas into reality. Entrepreneurship also includes the desire and ability to drive innovative change within existing organizations to propel growth and progress. Entrepreneurship requires adaptability, independence, responsibility, and willingness to take risks and manage uncertainty to seize potential opportunities in real-time. The entrepreneurial spirit plays a crucial role in fostering market competition and economic dynamism.

1.6 Project 1 Year 5 Milestones

Project Milestone Name	*Description*	*Center Goal(s) Alignment*	*Please describe how it contributes to the Center Goal*	*How should this milestone be measured?*
CSoF 1	Develop EV charging profile(s) that achieve fast charging of EVs to support the goal of providing enough charge (80% of battery capacity) to all EV classes from light-duty to heavy-duty within a 10-minute timeframe. Experimental validation on hardware prototypes, and models will evaluate the impact of fast charging on batteries of various chemistries and deployed to the ASPIRE software testbed library, by Q4 2025.	#2 - System Models/Tools	Fast-charging profiles created using software tools developed in this milestone will be used to validate ASPIRE testbed designs.	Measure fast-charge time to 80% capacity; characterize effect on energy storage element and charging hardware components after repeated charging cycles.
CSoF 2	Develop 300 kW to 1 MW plug-in and wireless charging systems with hardware-validated modeling and control advancements demonstrating improved charging performance and reduced cost. Integrate into the ASPIRE EVR testbed and demonstrate to key stakeholders in preparation for pilots. Adapt into accessible materials and activities for hosting K-12 visits, community and public tours, and student training by Q4 2025.	#1 - Charging Hardware	Hardware prototypes designed and developed in this milestone will be integrated into ASPIRE testbed and pilot designs.	Furnish detailed design documents showing hardware-tested integration.
CSoF 3	Solutions are developed and evaluated at the ASPIRE hardware testbed that improve the reliability and resiliency of high-power charging systems through advanced thermal analysis, thermal management, and health monitoring, and that evaluate and improve distribution grid reliability and resiliency in the presence of large charging loads by Q4 2025.	#1 - Charging Hardware #2 - System Models/Tools	It improves the performance of the charging hardware that will be integrated into ASPIRE testbeds or pilots. It provides models and tools that evaluate the impacts of large charging loads on the distribution grid.	Furnish detailed design documents showing hardware-tested advancements and models/tools uploaded to the ASPIRE material library.
CSoF 4	Solutions and algorithms for smart charging management of charging station(s) that demonstrate the reduced charging cost for EV end users and operating cost for charging station owners/operators are developed and evaluated at the ASPIRE hardware	#2 - System Models/Tools #4 - Equitable Transition	This milestone will generate algorithms, models, and tools for cost-efficient charging station design and operation.	Models, algorithms, and tools are uploaded to the ASPIRE material library.

	testbed, and are integrated into the ASPIRE software testbed, by Q4 2025.			
CSoF 5	Toolbox, models, and approaches are developed and integrated into the ASPIRE software testbed for understanding the economics, equity, zoning, and landscaping of building and operating charging stations, utilization of charging infrastructure and for equitable and accessible planning and siting recommendations of charging stations based on identified gaps in charging availability by Q4 2025.	#4 - Equitable Transition #2 - System Models/Tools	Battery modeling and advanced controls toolbox is deployed to ASPIRE and used to create battery models of various chemistries. Models incorporated into HIL simulations for validating testbed/pilot designs.	Models and tools are uploaded to the ASPIRE material library.
CSoF 6	A short video (less than 15 minutes each) series and a Virtual Reality (VR) technology-based tool are developed and used for educating and informing stakeholders, K-12 students, public, and community on the topics related to Charging Stations of the Future including basic knowledges, economics, landscaping, state-of-art technologies, latest policies, emerging datasets and related analytics, and others, and are uploaded to the ASPIRE material library, by Q4 2025. Each project team member will need to create at least one short video that contributes to the short video series.	#5 - Informed Public #6 - Diverse Workforce	Video series conveys a compelling and easily understandable message to a wide audience on the benefits and utility of new charging station infrastructure.	All videos are uploaded to the ASPIRE material library. Capture the number of video presentations made and audience sizes.
CSoF 7	At least ten journal and conference papers are published for disseminating the research findings from the project and proposals are submitted for external funding, by Q4 2025.	#5 - Informed Public	Professional publications build the overall credibility of the ASPIRE team and draw national attention to the effort.	Capture the number of publications, presentations, impact factors and audience sizes.

Year 5 Milestone progress and Center goal alignment


Project 1 Milestones
Task 1
Task 2
Task 3
Task 4
Task 5
Task 6
88.6%
90.1%
87.7%
78.3%
93.9%
99%
100%
Center Goals
Charging Hardware
System Models & Tools
Powered Pavements
Practical Transition
Informed Public
Ready Workforce

Project 2: Electrified Roadways

2.1 Project 2 Quad Chart

Project 2: Electrified Roadways

Project Goals

- Push performance frontier of electrified roadways with embedded dynamic and semi-dynamic wireless charging systems in terms of wireless power delivery, constructability, durability, maintainability, packaging, interoperability, standards, safety, EMI/EMC, supporting infrastructure and accessibility
- Train diverse engineering workforce capable of developing and deploying electrified roadways
- Reduce inequities in electric vehicle charging infrastructure access through appropriate ways of deploying electrified roadways

Results



Approach

- Convergent research across multiple fields to cover structural, electrical, electromagnetic, thermal, economic and human aspects of electrified roadways with integrated wireless charging
- Active recruitment and mentorship of diverse group of students, staff, and faculty members
- Partnering with Project 4 (Learning and Engagement) to understand inequities in electric vehicle charging infrastructure access and potential for reduction through electrified roadways

Outputs and Outcomes

- Developed and tested pavement material formulations, including with crumb rubber and fly ash to improve durability and cost-effectiveness
- Fabricated, deployed and tested 85 transmitters in INDOT pilot with a ¼-mile 215-kW dynamic wireless charging system on US 52/231
- Multiple conference and journal publications, including at WPTCE

Industry Engagement

- Collaboration with wireless charging and construction companies, highway authorities, and state transportation departments, including AECOM, CFX, Cummins, Electreon, Kenworth, and INDOT
- Partnership with SAE J2954 standards committee

1

2.2 Project 2 Year 5 and 6 Gantt Chart

Tasks		Year 5				Year 6			
		Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Task 1 - Durability and Performance Enhancement of Wireless Charging Pavements									
	Formulation of optimized concrete mixtures for embedded electrified panels	X							
	Material property characterization of the developed concrete mixtures	X	X	X					
	Structural level performance evaluation of DWPT embedded concrete panels		X	X	X				
	Calibration of thermo-structural numerical model	X	X	X	X				
	Develop guidelines for design and construction of DWPT embedded concrete panels			X	X				
	Failure mechanisms of pavement-DWPT transmitter materials interface	X	X	X	X				
	Evaluation of bond strength between asphalt pavement layers and embedded DWPT	X	X	X	X				
	Calibrate interface contact model to assess adhesiveness of DWPT binding materials	X	X	X	X				
	Assessing pavement structural performance in deeply embedded DWPT					X	X	X	X
	Corridor-level traffic-pavement modeling for DWPT performance assessment					X	X	X	
	Curling on concrete pavements with embedded DWPT concrete panels					X	X	X	X
	Understanding impact of electromagnetic fields on pavement material deterioration					X	X	X	X
	Investigating influence of DWPT module on asphalt compaction quality					X	X	X	X
	Improving performance of concrete pavements for DWPT systems					X	X	X	X
	Thousand-mile electrified roadway electrical component design and integration					X	X	X	X
Task 2 - Thermal Modeling & Cost Reduction of Pavement Embedded Wireless Charging									
	Sensitivity analysis of in-pavement thermal model	X	X						
	Develop and update English/Spanish public education materials			X					
	Develop and submit NSF IRES proposal	X	X						
	Couple in-pavement model with mechanical and diffusion and validate	X	X	X	X				
	Evaluate performance of pavement embedded multi-MHz capacitive WPT systems	X	X	X	X				
	Evaluate thermal performance of DWPT under different traffic conditions	X	X	X	X				
	Identify areas of the DWPT that may be prone to overheating	X	X	X					
Compare thermal behavior of DWPT system to that of regular pavement			X	X	X				
	Detect potential areas of pavement distress		X	X	X				
	Assess impact of temperature on performance and durability of DWPT system				X				
	Assess impact of DWPT waste heat on performance and safety of DWPT system			X	X				
	Thermal modeling of capacitive WPT with validation and sensitivity analysis					X	X	X	X
	Development of high power capacitive WPT systems					X	X	X	X
	Collection of thermal data of the DWPT highway section					X	X	X	X
Task 3 - Interoperability of Wireless Power Transfer Systems									
	Optimization of transmitter/receiver systems that incorporate passive shielding	X							
	Modeling and design of transmitter/receiver systems for interoperability	X	X	X	X				
	Minimize cost of DWPT systems	X	X	X	X				

Tasks		Year 5				Year 6			
		Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Task 4 - Advanced Protection Materials for Electrified Pavement Systems									
	Develop coupled electro-thermo-structural model for predicting structural damage	X	X						
	Perform Hipot and surge testing on potted Litz wire and concrete specimens	X	X						
	Conductive mechanical testing on potted Litz wire bundles and concrete specimens		X	X					
	Identify Litz wire and concrete material specifications to mitigate electrical threats				X				
	Fabrication of layered protection materials					X	X	X	
Optimization of electrical and thermal performance							X	X	
	Evaluation of material-structure interactions							X	
	Performance validation and safety assurance							X	X
Task 5 - Control, Communications and Power Distribution for Electrified Roadways									
	Explore security aspects of EV communication with dynamic charging infrastructure	X	X	X	X				
	Investigate impact of communication latency on dynamic charging process	X	X	X	X				
	Develop plan to integrate wireless communication into EVR powered pavement	X	X	X	X				
	Establish and solve multi-objective optimization problem for autonomous control					X	X	X	X
Identify vehicle/infrastructure data and design communication protocol						X	X	X	
	Co-simulate control-communication in multi-objective optimization							X	X
	Comprehensive analysis and feasibility of HVDC power distribution architecture					X	X	X	
	Design of power converter topology for driving transmitter pad from HVDC input						X	X	X
Task 6 - Asset Management Framework for Electrified Roadways									
	Identify case studies for application of E-TAM framework	X							
	Identify and quantify climate characteristics and economic factors	X	X						
	Evaluate performance and resilience			X	X				
	Sensitivity analysis				X				
	Develop survey to understand challenges and opportunities for electrified roads					X	X		

2.3 Project 2 Task Summaries

Project 2 Task 1: Design Considerations toward High Performing Embedded Dynamic Power Transfer Systems
Team: Cesar Tirado, Faculty, UTEP; Srishti Banerji, Faculty, USU; Marv Halling, Faculty, USU; John Haddock, Faculty, Purdue; Soheil Nazarian, Faculty, UTEP; Rajib Mallick, Faculty, UTEP; Miguel Montoya, Faculty, UTEP; Dionysios Aliprantis, Faculty, Purdue; Aaron Brovont, Faculty, Purdue; Steve Pekarek, Faculty, Purdue
Task Summary:
Design of pavement-embedded DWPT systems requires navigating significant tradeoffs in thermal, structural, and electromagnetic performance. There are challenges regarding the long-term safety, reliability, and maintainability of both the pavement structure and embedded electrical components. ASPIRE researchers, including groups from UTEP and Purdue have developed custom numerical tools for the analysis and design of pavements (UTEP) and low-frequency electromagnetics (Purdue). In this Task, these numerical tools are being further refined, validated, and their developers are working together to explore and evaluate DWPT thermal/structural/electromagnetic design tradeoffs. The objective of this collaboration is to find and test the means to maximize reliability and maintainability of powered pavements while maintaining sufficient electromagnetic performance to serve heavy-duty electric vehicles.

In Years 1-4, a 3-phase Tx-Rx DWPT system was considered to reduce the power oscillations observed at the input and output of traditional single-phase designs. In the proposed tx/rx topology, the magnetic poles travel transversely to the road. An advantage of this configuration is that it can be readily scaled lengthwise to meet a range of power ratings. ,A known shortcoming of planar three-phase topologies is magnetic imbalance, leading to power oscillation and poor current/voltage sharing among phases. Prior efforts to balance the phases have focused on reducing interphase mutual couplings or adding compensation components. These demonstrated solutions tend to increase system cost/complexity or yield unsatisfactory performance. However, the team developed a method to address the imbalance through judicious placement of coil conductors. The conductor placement is determined using a design process that leverages a Fortescue transformation to evaluate Tx and receiver (Rx) behavior using positive and negative sequence quantities. The impacts of unequal phase coupling can be overcome by minimizing negative to positive sequence coupling.

In Year 5 we oversaw the fabrication and testing of 85 of ASPIRE's 3-phase transmitter coils within the INDOT DWPT pilot system. Data from the transmitter coils was collected at four stages of system construction: pre-concrete, post-concrete, post-winter, and post-cut.
Analysis of the data showed that expected Tx performance was maintained through a lengthy construction process that includes off-site coil fabrication, installation in a milled channel, routing of long leads through under-road conduits, and pouring of a concrete overlay. The results demonstrate that the instantiation of the three-phase coils, which required meticulous placement and

alignment of conductors, successfully achieved the intended electromagnetic characteristics and validated the ASPIRE design approach.

A major thrust of the work centered on Engineered Cementitious Composites (ECC), a non-metallic fiber-reinforced concrete exhibiting superior ductility, tensile strength, and microcrack resistance compared to conventional concrete. Several ECC formulations were developed and evaluated, including mixes enhanced with crumb rubber and fly ash to improve sustainability and cost-effectiveness. Large-scale slabs were fabricated and subjected to thermal and structural loading, with instrumentation including fiber optic sensors and strain gauges enabling high-fidelity data collection on thermo-structural response under simulated operational conditions.

To replicate realistic pavement heating from power electronics, the team fabricated a dummy inductive power transfer coil, integrating high-gauge wire and a nichrome heating element to emulate embedded charging units. This apparatus allowed controlled application of thermal stresses during structural tests, enabling better understanding of combined loading scenarios. Parallel to physical experiments, advanced numerical models were developed to capture pavement–coil interactions. These models included representations of bonding interfaces between coils and pavement, dynamic vehicle loading, and cyclic thermal effects. Validation against experimental data confirmed their utility as predictive tools for scaling DWPT pavement design.

Year 5 also focused on moving ASPIRE technologies forward toward vehicle and roadway application. Validation of a misalignment detection scheme for three-phase wireless power transfer moved us to a TRL-3, with a provisional patent submitted. A rail-rung installation system for embedding three-phase transmitters in pavements reached TRL-8 with a nonprovisional patent submitted. Additionally, leveraging the INDOT pilot, the 3-phase transmitter and receiver coil designs advanced to TRL-7, with a nonprovisional patent already filed.

By the end of Year 5, Task 2.1 delivered a comprehensive portfolio of experiments that validated modeling and design frameworks, construction techniques, and innovations. Collectively, this work establishes a technically- and economically -viable pathway toward high-power DWPT electrified roadways. These advances significantly strengthen ASPIRE's mission to create nationwide electrified transportation infrastructure, supporting the transition to heavy-duty electric mobility and sustainable freight systems.

Project 2 Task 2: Coupled Thermal/Mechanical Modeling and Evaluation of Electrified Pavement Systems
Team: Nick Roberts, Faculty, USU; Karmen Teuscher, Student (UG), USU; Jorge Hernandez Ramiro, Student (Grad), USU; Khurram Afridi, Faculty, Cornell; Dheeraj Etta, Student (Grad), Cornell; Nadia Gkritza, Faculty, Purdue; John Haddock, Faculty, Purdue; Jinha Jung, Faculty, Purdue; Oscar Moncada, Student (Grad), Purdue; Gaia Cervini, Student (Grad), Purdue; Simon Bickerton, Faculty, UoA; Willsen Wijaya, Postdoc, UoA
Task Summary:
This task advanced understanding of the coupled thermal and mechanical effects of embedded wireless power transfer (WPT) systems and pushed forward the scalability of capacitive wireless power transfer (CWPT). The central technical challenge is ensuring long-term durability and safe operation of roadway pavements containing WPT units, while scaling to higher power levels demanded by electrified heavy-duty vehicles. Another gap addressed in this task is the power scaling issues of multi-MHz inverters/rectifiers due to limited current ratings of commercially available MHz-frequency semiconductor devices (such as Gallium Nitride (GaN) transistors).

In Year 5, the team pursued two major thrusts: (1) coupled thermal-mechanical modeling and validation, and (2) CWPT scaling demonstrations. Thermal models of capacitive and inductive systems, both in free air and embedded conditions, were validated through experiments. These results were disseminated at the IMECE 2024 conference, highlighting the scientific and engineering rigor of the approach. UAV-based thermal imaging of the INDOT pilot site was launched, generating high-resolution datasets to capture...

In parallel, researchers achieved a major milestone by demonstrating a >10 kW CWPT prototype with a power transfer density of 136 kW/m². This was enabled by innovative PCB layouts and power combining architectures that paralleled multiple MHz-frequency inverters and rectifiers. The achievement demonstrated the feasibility of scaling CWPT to levels previously considered impractical, moving the technology closer to deployment readiness.

Quarterly progress also included early results from sensitivity analysis of coupled models, which will be expanded in subsequent phases, and UAV-based RGB and 3D reconstruction of pavement surfaces for condition monitoring. Additionally, the task contributed to outreach by preparing public-facing educational materials explaining embedded WPT system performance and limitations, further supporting ASPIRE's educational mission.

By integrating validated thermal models, pavement-scale evaluations, and high-power CWPT prototypes, Task 2.2 provided critical insights into system durability and performance. These outcomes directly support ASPIRE's technical milestones in Wireless Power Delivery and Constructability, Durability, Maintainability, and Packaging. Year 5 work has positioned CWPT as a scalable complement to inductive systems, enhancing flexibility in the electrification ecosystem and de-risking pilot demonstrations.

Project 2 Task 3: Interoperability of Wireless Power Transfer Systems
Team: Regan Zane, Faculty, USU; Seho Kim, Faculty, UoA; Haris Ahmed, Graduate Student, USU, Abhilash Kamineni, Faculty, USU; Dionysios Aliprantis, Faculty, Purdue; Aaron Brovont, Faculty, Purdue; Steve Pekarek, Faculty, Purdue
Task Summary:

Task 2.3 is dedicated to achieving interoperability across dynamic wireless power transfer (DWPT) systems, ensuring that roadway-embedded transmitters can serve a diverse range of receivers designed by different vehicle manufacturers. This capability is essential for large-scale electrified roadway deployment, as it allows OEMs to design receivers optimized for their platforms while guaranteeing compatibility with standardized roadway infrastructure.
In Year 5, modeling/design tools have been created to facilitate the design of transmitter coils that can be used across a range of receivers. The tools include custom finite element and boundary element solvers that enable rigorous multi-objective optimization where performance metrics include system efficiency and transmitter/receiver winding voltages/currents with low positive/negative sequence coupling. The tools have been validated through design and laboratory experiment of a receiver intended for installation of a Cummins heavy-duty vehicle that is being used to support the ASPIRE/INDOT pilot. Specifically, a 1st generation receiver was constructed and its performance characterized within Purdue's Vehicle Systems Laboratory. An initial receiver performance assessment was then used to further refine the design codes to enable minimization of the ferrite required and reduce the stray fields under relatively significant transmitter/receiver misalignment. A 2nd generation receiver was then fabricated for installation on the Cummins vehicle.

A fundamental aspect of the tool development and optimization was to consider whether a 3-phase receiver designed subsequent to (not coupled with) the design of a 3-phase transmitter can have strong performance. The fact that strong performance was observed is significant as it highlights an interoperable nature of the ASPIRE 3-phase system. This will be further validated through the testing with the Cummins vehicle in Year 6. The team has also been focused on ensuring that ASPIRE technologies are being considered within industry standards. To support the inclusion of the 3-phase topology within the SAE Standards around DWPT, the team has developed new models to evaluate the performance of 3-phase transmitters serving single-phase receivers.

Finally, in addition to the receiver design, a focus was placed on developing the controls for power electronics within a vehicle that operate with the vehicle's power management system to handle real-world scenarios such as misalignment and pad-to-pad transitions. Within the associated INDOT pilot project, a 200-kW interleaved DC-DC buck-boost converter topology has been developed for installation on the Cummins truck. Within this task, a focus has been on designing a controller that ensures that the converter tracks vehicle power demands by adapting to rapid changes in receiver voltage. Simulation studies and hardware experiments at power levels up to 200-kW have been used to validate the stability and responsiveness of the converter to a wide range of input voltage and power references.

In summary, In Year 5, Task 2.3 has delivered design methodologies and hardware experiments demonstrating interoperability of ASPIRE-based DWPT systems. This outcome directly contributes to ASPIRE's mission of scalable, interoperable, and industry-aligned electrified roadway infrastructure, strengthening the foundation for broad adoption across passenger and heavy-duty vehicle fleets.

Project 2 Task 4: Evaluation of Potential Electrical Threats to Electrified Pavement Components
Team: Juhyeong Lee, Faculty, USU; Srishti Banerji, Faculty, USU; Marv Halling, Faculty, USU;

Tom Allen, Faculty, UoA; Simon Bickerton, Faculty, UoA; Bryce Hesterman, Staff, USU; Graduate Student for Lee, Student, USU; Graduate Student for Banerji, Student, USU

Task Summary:

Task 2.4 evaluates the vulnerability of electrified pavements and embedded power electronics to electrical threats, including surges, alternating and direct current stress, and long-term underground exposure. Traditional studies have often focused on individual properties of polymer encapsulants under idealized laboratory conditions, leaving significant technology gaps in understanding long-term field performance. This task addresses that gap by conducting comprehensive testing, material characterization, and Multiphysics modeling to assess the durability and failure mechanisms of encapsulated systems.

During Year 5, the team advanced three main areas: (1) comparative evaluation of candidate encapsulation materials, (2) experimental testing of mechanical and dielectric properties, and (3) coupled thermal-electrical-mechanical modeling for predictive analysis. Two epoxy materials (832 TC and FX) were identified as promising candidates based on cost-performance analysis, thermal stability, and dielectric reliability. Specimens underwent tensile, flexural, compressive, and hipot testing to establish baseline performance. These results directly informed the development of material property databases used in simulations.

Progress was also made in model validation, with hipot test results confirming predictive accuracy. Models were extended to simulate damage in potted Litz wire bundles and reinforced concrete, providing insights into electrical-thermal-mechanical failure modes under surge or continuous current stress. By mid-year, baseline models were complete, with refinements in progress through Q2 and Q3 to enhance predictive fidelity and incorporate environmental aging factors (moisture ingress, temperature cycling).

The task also emphasized dissemination and professional engagement. Students and faculty presented posters at ASPIRE's annual meeting and at the ASC 2024 conference, broadening visibility and building momentum for continued research. Looking forward, this task is positioned to support material selection guidelines for pilot deployments, ensuring long-term durability and safety of embedded systems.

By combining empirical testing, finite element modeling, and professional engagement with the broader engineering community, Task 2.4 produced actionable insights into cost-effective material strategies for electrified pavements. These outcomes improve the resilience of DWPT infrastructure, reduce the risk of premature component failure, and directly contribute to ASPIRE's societal goal of safe and reliable electrified roadway systems.

Project 2 Task 5: Modeling, Communications, Networking Infrastructure, and Protection for Secure and Smart Electrified Roadway Charging
Team: Rose Hu, Faculty, VT; Ryan Gerdes, Faculty, VT; Hongjie Wang, Faculty, USU; Tianyi He, Faculty, USU; Graduate Student, Student, USU; Graduate Student, Student, USU
Task Summary:
Task 2.5 addresses the communications, control, and cybersecurity dimensions of electrified roadway charging infrastructure. The ability of vehicles to seamlessly and securely communicate with roadway charging units, align coils during dynamic operation, and maintain reliable operation under cyber-physical threats is critical to scaling nationwide deployment. The challenge lies in coordinating multiple EVs with roadside infrastructure under stringent latency, security, and efficiency requirements.

In Year 5, the team made major strides toward a communication–control co-design framework. This approach integrates vehicle communication with control strategies to achieve precise coil alignment, improved charging efficiency, and enhanced misalignment tolerance. To enable this, DSRC and C-V2X testbeds were procured and commissioned, allowing low-latency data transmission experiments between EVs and roadside units. Complementary work on high-precision localization leveraged dual-antenna RFID techniques to d...

Control-oriented modeling also advanced, with nonlinear and linear parameter-varying (LPV-MPC) models developed to capture coil–vehicle misalignment dynamics. Early simulations demonstrated that data-driven LPV-MPC approaches can significantly improve alignment correction under dynamic conditions. Additionally, simulation models for electrified roadway operation and protection strategies were created, incorporating grid interactions, vehicle charging coordination, and system protection elements. Initial res...

Innovations emerging from this task include a Vehicle Fingerprinting Platform (TRL-5) capable of distinguishing vehicles by make, model, and year even under adversarial conditions, and a Nonlinear Reachability Suite optimized for analyzing EVSE–grid interactions at scale. Together, these advances highlight both near-term and long-term pathways for securing and optimizing electrified roadway operations.

By Year 5's end, Task 2.5 had delivered integrated models, experimental testbeds, and innovations that directly address the challenges of communication, control, and cybersecurity. These outcomes strengthen ASPIRE's broader vision of a secure, interoperable, and intelligent electrified roadway ecosystem, enabling reliable scaling of DWPT systems nationwide.

Project 2 Task 6: Evaluate Performance and Resilience of Transportation Asset Management for Electrified Road Systems
Team: Adeeba Raheem, Faculty, UTEP; Cristina Torres-Machi, Faculty, University of Colorado Boulder; Janette Goodridge, Faculty, USU; Soheil Nazarian, Faculty, UTEP; Francisco Contreras, Student, University of Colorado Boulder; Oscar Villegas, Student, UTEP; Catherine Fosburgh, Student, USU; Amanda Katz, Faculty, USU
Task Summary:
The transition to electrified roadways requires new approaches to transportation asset management (TAM). Traditional TAM frameworks are not designed to capture the unique characteristics of electrified roadway systems, including the costs of embedded charging technology, their long-term performance, and vulnerabilities to climate-related risks. Task 2.6 is developing the Electrified Transportation Asset Management (E-TAM) framework to evaluate the economic viability, resilience, and performance of electrified road systems. By integrating engineering, economic, and environmental considerations, the framework supports decision-making for planning, operation, and maintenance, ensuring that investments in electrified infrastructure are both cost-effective and self-sufficient.

Building on work from prior years, the team refined the E-TAM platform — originally adapted from FHWA's HERS-ST model — to incorporate risk, reliability, and performance benefits alongside agency and user costs. In Year 5, efforts focused on refining the framework to enable a comparative analysis of the economic costs, environmental benefits, and risks of electrified roadways, compared to traditional roadways. This evaluation accounts for differences among states, enabling a comparative analysis across the country. This analysis provides agencies with data-driven insights into the long-term availability and reliability of electrified roadways.

Education and workforce development are also integral to this task. In Year 5, the team designed an interactive session for UTEP's TRIP summer camp, introducing high school students to construction technology and asset management for electrified transportation systems. The task also established connections with state DOTs and turnpike authorities to share findings and strengthen industry engagement.

Year 5 highlights include: developing and IRB-approving a survey instrument to assess vulnerabilities of electrified roadways to extreme weather, partnering with ASPIRE industry members to refine ERS cost and benefit analysis, and advancing integration of economic, environmental, and risk dimensions into the E-TAM tool. The team also explored datasets and models relevant to electrified roadways, laying groundwork for more robust resilience evaluations.

Through these efforts, Task 2.6 is providing critical insights into how electrified roadways can be designed, managed, and sustained for long-term performance, resilience, and availability.

2.4 Electrified Roadway Associated Project Summaries

ASPIRE ER Associated Project: Receiver, Vehicle, and Roadway System for a Dynamic Wireless Power Transfer Roadway Testbed

Team: Dionysios Aliprantis, Aaron Brovont, Konstantina Gkritza, John Haddock, Steve Pekarek, Rob Swanson (research engineer), Vatan Mehar (grad student), Nicholas Frooninckx (grad student), Isaac Abram (grad student), Oscar Moncada (grad student).

Abstract:
Over the past several years, the Indiana Department of Transportation (INDOT) has partnered with ASPIRE researchers to evaluate the potential of Dynamic Wireless Power Transfer (DWPT) systems. Early investigations focused on financial feasibility, showing that such systems could be viable on roadways with significant heavy-duty truck traffic. Subsequent technical studies demonstrated the electromagnetic and pavement feasibility of a three-phase rectangular coil system and validated pavement performance using INDOT's accelerated pavement test (APT) facility. Laboratory and APT evaluations confirmed that the architecture could function at highway speeds while maintaining roadway integrity.
Building upon these results, ASPIRE has been working with INDOT, AECOM, PCKA and Cummins to deploy a ¼-mile DWPT Testbed (DWPTT) along northbound US-52/US-231 in West Lafayette, IN. In Year 5, the DWPTT was constructed, and initial testing was performed.

Alignment with center goals:
ASPIRE's mission is to accelerate electric vehicle (EV) adoption by addressing cost and range anxiety, advancing workforce training, developing new design methodologies, and promoting public-private partnerships. The DWPTT directly contributes to all of these objectives:

Partnerships: The project unites INDOT, AECOM, Cummins, and academic researchers, enabling rapid transition of designs from early readiness levels to pilot-scale demonstrations (TRL 7–8).

Policy engagement: Policymakers at the state and national levels have been briefed on the technology and its infrastructure implications, informing broader DWPT efforts in Utah, Michigan, Florida, and Nebraska.

Public outreach: Media coverage has reached audiences in the billions, increasing awareness and reducing misconceptions about EV charging technologies.

Workforce training: Students, engineers, and construction crews have received hands-on experience with DWPT system design, construction, and testing.

Barriers Addressed:
Two primary barriers to EV adoption are **cost** and **range anxiety**. By enabling in-motion charging, DWPT systems reduce the required onboard battery size, lowering overall vehicle cost. At the same time, the ability to charge while driving eliminates concerns about limited range and sparse charging infrastructure.

2025 Milestones:

Established the DWPTT with INDOT and contractors.

Developed and validated testing procedures for coils, compensation circuits, power electronics, and generation systems.

Designed a DWPT receiver and power electronics for retrofit on a Cummins battery-electric truck.
Implemented new construction techniques for embedding transmitter coils into concrete pavement.

2.5 Project 2 Year 6 Proposal

Project 2 Year 6 Proposal

Project: Electrified Roadways
Project Lead: Khurram Afridi (ECE, Cornell)
Project Co-Lead: Marvin Halling (CEE, USU)

Project Overview:

In 2024, about 1.301 million electric vehicles (EVs) were sold in the US – corresponding to about 8.1% of new vehicle sales. This represents a 7.3% increase in EV sales in the US compared with 1.212 million EVs sold in 2023 (representing roughly 7.8% of new vehicle sales) [1], [2]. The number of EVs sold in the US is expected to continue along this upward trajectory. Large penetration of EVs will require widespread deployment of publicly accessible charging infrastructure. This charging infrastructure can be similar to gas stations, but there is an opportunity to provide additional benefits by taking advantage of the flexibility inherent in electric power delivery. Innovative charging strategies could overcome some of the major shortcomings of EVs and accelerate their adoption. The charging infrastructure should also accommodate and leverage the other major trends transforming road transportation: connectivity, autonomy and ridesharing which could reduce the number of vehicles required to meet our transportation needs and dramatically improve the sustainability of road transportation [3].

NSF ASPIRE ERC aims to accelerate the adoption of EVs by exploring and developing technologies that eliminate charging related barriers for all classes of EVs. In support of these aims, the goal of the electrified roadways project is to push the performance frontier of roadway embedded dynamic and semi-dynamic wireless charging systems in terms of wireless power delivery, constructability, durability, maintainability, packaging, interoperability, standards, safety, EMI/EMC, supporting infrastructure and accessibility (see roadmap of Fig. 1). This requires convergent research across multiple fields to cover the structural, electrical, electromagnetic, thermal, economic and human aspects of pavement integrated wireless charging.

A major goal of ASPIRE for years 6-10 is to enable deployment of its developed technologies at scale. This includes the moonshot vision of deploying a 1000-mile electrified roadway in the US, for example, from Los Angeles to Salt Lake City, Salt Lake City to Chicago, or Chicago to New York, in time enabling coast-to-coast transportation on an electrified roadway.

This proposal comprises multiple convergent tasks to be conducted by multi-disciplinary multi-university teams that collectively address the key research needed to help move the electrified roadway technology along the roadmap shown in Fig. 1, meet the project objectives for year 6 as given in Table 1, and advance at scale deployment towards the moonshot vision. Each task also aims to leverage all available resources, engage stakeholders, including relevant

communities, and advance engineering workforce development (EWD) goals synergistic with electrified roadways.

The primary objectives of this project for Year 6 are listed in Table 1. These objectives are organized along each of the major threads of the project, as identified in Fig. 1. Table 1 also lists the Center goals towards which each of the project objectives contribute, the tasks that support that objective, and the main deliverables related to that objective. The task proposals are attached on the following pages of this project.

- "Electric Vehicle Sales Jump Higher in Q4, Pushing U.S. Sales to a Record 1.3 Million," Cox Automotive, January 13, 2025, https://www.coxautoinc.com/market-insights/q4-2024-ev-sales/#:~:text=Overall%2C%20EV%20sales%20in%20the,from%207.8%25%20share%20in%202023.
- "A Record 1.2 Million EVs Were Sold in the U.S. in 2023, According to Estimates from Kelley Blue Book," Cox Automotive, January 9, 2024, https://www.coxautoinc.com/market-insights/q4-2023-ev-sales/
- K. Afridi, "The Future of Electric Vehicle Charging Infrastructure," Nature Electronics, February, vol. 5, no. 2, 2022.

Project Milestones:

Please work with task leads to complete proper alignment between task milestones> project milestones>center goals>societal impact targets. These connections can be made in the order that best suits the project's collaboration, but **there must be a clear link** between each element. This is how we report progress to NSF. The project milestones are now 1-year duration milestones

Project Milestone Name	***Description***	***Center Goal(s) Alignment***	***Please describe how it contributes to the Center Goal***	***Societal Impact Target***
PM1 - Deploy and test 200-kW dynamic wireless charging system	Deploy and test 200 kW dynamic systems at testbed or pilot with stakeholder engagement at power transfer density exceeding 75 kW/m2.	1 - Charging Hardware	This milestone is developing charging hardware	1, 3
PM2 - Proof-of-concept in-pavement charging	Proof-of-concept robust in-pavement charging with power electronics in roadside cabinets and examples of asphalt and concrete construction with	3 - Powered Pavements	This milestone is developing powered pavements	3, 4

	fault-tolerant electronics.			
PM3 - Interoperable system	Multiple vehicle classes operable across varying ground clearance of 15-20 cm.	1 - Charging Hardware	This milestone is developing charging hardware	1, 2, 3
PM4 - System meets field safety standards	Deep-seated systems designed and demonstrated to meet existing safety and interference standards.	3 - Powered Pavements	This milestone is developing powered pavements	1, 3
PM5 - Effective grid interface and secure communication	Effective grid interface and secure communication demonstrated in testbeds	3 - Powered Pavements	This milestone is developing powered pavements	1, 3
PM6 - Accessibility	Approaches addressing system costs and large-scale deployment	4 -	This milestone is making the system more accessible	1, 2, 3, 4, 5

Societal Impacts

1 – widespread use

2 – reduced emissions

3 – cost

4 – job growth

5 – X

Project Budget: Compile proposed budgets from task proposals and enter the total project budget (See form No.010): 1,352,659.55

2.6 Project 2 Year 5 Milestones

Project Milestone Name	*Description*	*Center Goal(s) Alignment*	*Please describe how it contributes to the Center Goal*	*How should this milestone be measured?*
Deploy 200-kW dynamic wireless charging system	Deploy 200 kW dynamic systems at testbed or pilot with stakeholder engagement at power transfer density exceeding 75 kW/m2.	1 - Charging Hardware	This milestone is developing charging hardware	Deployment complete
Proof-of-concept in-pavement charging	Proof-of-concept robust in-pavement charging with power electronics in roadside cabinets and examples of asphalt and concrete construction with fault-tolerant electronics.	3 - Powered Pavements	This milestone is developing powered pavements	System energized
Interoperable system	Multiple vehicle classes operable across varying ground clearance of 15-20 cm.	1 - Charging Hardware	This milestone is developing charging hardware	Deployment complete
System meets field safety standards	Systems designed and demonstrated to meet existing safety and interference standards.	3 - Powered Pavements	This milestone is developing powered pavements	System energized
Effective communication	Effective communication demonstrated in testbeds	3 - Powered Pavements	This milestone is developing powered pavements	System communicates
Accessibility	Approaches addressing system costs and large-scale deployment	4 - Equitable Transition	This milestone is making the system more accessible	Cost reduction

Year 5 Project milestone progress and Center goal alignment



Project 3: Integrated Systems

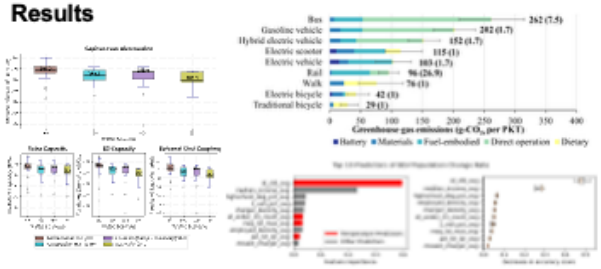
3.1 Project 3 Quad Chart

Project 3: Integrated Systems

Project Goals

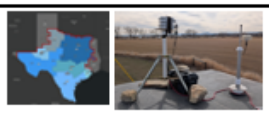
- Study the integration of EVs and EV charging technologies into transportation systems, transportation systems, electric power systems, the environment, and society.
- Model integrated transportation–power systems for decision-making around electric roads.
- Advance solutions for optimizing the operation of EV fleets (trucks, buses, and more.)
- Provide enhanced techno-economic and lifecycle evaluation capabilities of electrification technologies, including those being developed in ASPIRE's Projects 1 and 2.

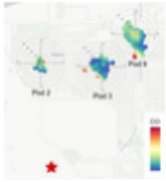
Results



Approach

- Convergent, systems-level
- Simulations, models, and data collection
- Integrated planning & optimization algorithms
- Air quality & human health models
- Coupled infrastructure models
- Innovative surveys & policy-informed models





Outputs and Outcomes

- Cost and emissions tools, grid capacity expansion models, multi-scale transportation planning models, charging control algorithms, for dynamic wireless power transfer (DWPT).
- High-resolution models of the air pollution and human health impacts of transportation electrification.
- Enhanced techno-economic analysis (TEA) and life cycle assessment (LCA) tools for electrified transportation systems.

Industry Engagement

- Partnerships with companies, DoTs, transit agencies, freight fleets, port authorities, cities, utilities, clean cities coalitions, and others.

1

3.2 Project 3 Year 5 and 6 Gantt Chart

Gantt Chart Year 5

Tasks, Subtasks (3.X.X), & Milestones (M3.X-X)	*Year 5* Q1	Q2	Q3	Q4
Task 3.1 – Transportation and Power Simulator				
3.1.1 – Power system stability and power quality with EV loads	■	■	■	■
3.1.2 – Data infrastructure development	■	■	■	■
3.1.3 – Optimal charging station placement	■	■	■	■
3.1.4 – Framework for planning-level electric transportation system models			■	■
3.1.5 – Transportation model development			■	■
M3.1-1 Small-signal stability analysis has been conducted across different scenarios to evaluate grid stability with introduction of DWPT loads and identify potential transmission network upgrades needed		★		
M3.1-2 Development and validation of non-linear EV load models for stability analysis and power quality assessment to identify the generators' capability to support DWPT loads during- and post-fault conditions.			★	
M3.1-3 Stochastic models for aggregate EV load demand and methods for reducing spurious frequencies at DWPT substation level developed and evaluated.			★	
M3.1-4 Stochastic models for feeder-based EV load demand and voltage regulation methods for distribution system have been developed and evaluated.				★
M3.1-5 Build a working diagram of inputs/outputs of data tools and models.	★			
M3.1-6 Expand existing catalog of center-wide datasets and tools; make them easily searchable and shareable with connections established among datasets and tools to create an SoS overview of their linkage.		★		
M3.1-7 Expand live data collection, monitoring, and computing capabilities; make the server/cloud platform generally accessible within the center and with specific partners.			★	
M3.1-8 Develop multi-model data fusion techniques to improve effectiveness and efficiency of data-driven electrified transportation for planning and operation scenarios.				★
M3.1-9 Incorporate external and user-based considerations to the framework.				★
M3.1-10 Multi-objective optimization problems for optimal charging station placement.				★
M3.1-11 Memo documenting what elements, which tools, and what data are needed to advance transportation system integrated modeling.				★
M3.1-12 Transportation network simulation model and co-simulation case study.				★
Task 3.2 – Examining the Air Quality, Health, and Environmental Implications of Vehicle Electrification				
3.2.1 – Air quality modeling	■	■		
3.2.2 – Health modeling (initiated)	■	■	■	■
3.2.3 – Yearlong source apportionment of particulate matter in Salt Lake County	■	■	■	
3.2.4 – Spatial measurements of roadway emissions	■	■	■	
3.2.5 – Develop a network of coarse PM monitors to assess dust sources in SLCo	■	■	■	■
M3.2-1 Air quality modeling with general charging assumptions		★		
M3.2-2 Initiate health impact analysis of air quality modeling				★
M3.2-3 Finish analyzing sources of particulate matter in SLCo using source apportionment techniques			★	

M3.2-4 Submit journal manuscript assessing roadway pollution using air quality monitors coupled with small unmanned aircraft systems	★			
M3.2-5 Create community engagement plan and initiate implementation				★
Task 3.3 – Adoption of Electric Vehicles and Transportation Systems				
3.3.1 – Update and expand adoption curve modeling in the US				
3.3.2 – Impact of media frames on attitudes towards EV policies and adoption				
3.3.3 – Incentives in the primary/secondary EV markets				
3.3.4 – EV perceptions and behaviors for "gig" driving				
3.3.5 – Charging preferences and experiences				
3.3.6 – Assessing policy implications on GhG emissions and adoption				
3.3.7 – Electric micromobility on public lands				
M3.3-1 Diverse personnel are hired.	★			
M3.3-2 Surveys are developed and IRB protocols submitted for approval.	★			
M3.3-3 Data collection is underway.		★		
M3.3-4 External funding sources are identified, and proposals are being developed.		★		
M3.3-5 Data analysis is underway.			★	
M3.3-6 Manuscripts are prepared for submission to journals and conferences.				★
Task 3.4 – Optimization of Transportation Electrification Solutions Through Integrated Techno-Economic and Life-Cycle Assessment				
3.4.1 – Refine integrated techno-economic analysis and life cycle assessment.				
3.4.2 – Update integrated evaluation model.				
M3.4-1 Results that quantify the impact of battery size on global material constraints.	★			
M3.4-2 Public tool developed for DWPT cost evaluation.		★		
M3.4-3 Greenhouse gas estimates with forecasted global supply chains.			★	
M3.4-4 Results that include the latest updates to the integrated evaluation model.				★
M3.4-5 Proposal submission to VTO, transportation planning.				★
Task 3.5 – Combined Simulation Framework for Mass Charger Utilization through Massive Simulation and Distributed Market Approaches				
3.5.1 – Simulation API interface design				
3.5.2 – Single vehicle energy aware planning				
3.5.3 – Multi vehicle planning				
3.5.4 – Multi fleet grid utilization				
M3.5-1 Simulation integration	★			
M3.5-2 Simulation management & result retrieval		★		
M3.5-3 Multi-fleet energy aware paper				★
M3.5-4 Small-scale robotics testbed demonstration			★	
M3.5-5 Proposal submission to NSF robotics initiative / DOE				★
Task 3.6 – Environmentally Aware EV Charging Integration in Energy Systems				
3.6.1 – EV aggregation in the electricity market				
3.6.2 – Greenhouse Reduction Scenarios of Electrified Infrastructure and Assessment of spatial and demographic benefits in the US using TIMES				
3.6.3 – Developing transportation model and coupling it with slow time scale electric roadway control				
M3.6-1 Develop an enhanced EV aggregation model in the electricity market				★

M3.6-2 Analyze greenhouse reduction scenarios of electrified infrastructure and assessment of spatial and demographic benefits in the US using TIMES				★
M3.6-3 Develop transportation model and coupling it with slow time scale electric roadway control				★
Task 3.7 – Integrating Socio-economic Factors and Social Network Information for Modeling, Visualizing, and Understanding Optimal EV Charging Station Placement				
3.7.1 – Develop models for identification and behavior analysis of fleets and freight vehicles				
3.7.2 – Hardening the current visualization prototype developing a set of microservices that would allow a scalable multi-user interactive access				
3.7.3 – GEOTAB extension completed for data analysis				
3.7.4 – Complete integration framework for existing simulator tools at same resolution scale in ASPIRE				
3.7.5 – ASPIRE Data Service architecture completed				
3.7.6 – ASPIRE Data Service online				
3.7.7 – Publication in ITSC 2025				
M3.7-1 Identify and create report on current ASPIRE projects to incorporate into ASPIRE software suite.	★			
M3.7-2 ASPIRE Webservices Online and accessible by remote users (public and internal)		★		
M3.7-3 ASPIRE ChargeSim v0.1 Completed NSF CyberInfrastructure Grant submitted			★	
M3.7-4 REST API Connections to the ASPIRE ChargeSim-Suite of software online. Research projects capable of connecting and using the ASPIRE ChargeSim-Suite				★

Gantt Chart Year 6

Tasks, Subtasks (3.X.X), & Milestones (M3.X-X)	*Year 6*			
	Q1	*Q2*	*Q3*	*Q4*
Task 3.1 – Transportation–Power System Models for DWPT				
3.1.1 – Develop stochastic, multiresolution traffic models, and a power system simulation platform for DWPT at the distribution level.				
3.1.2 – DWC corridor study and simulator.				
3.1.3 – Models and tools for simulating and analyzing spatiotemporal ER charging demands.				
3.1.4 – Develop parametric and non-parametric methods for disaggregating power consumption by EVs.				
M3.1-1 Transportation model development	★			
M3.1-2 Integrated transportation and power system model development		★		
M3.1-3 Optimization of integrated transportation/power system models			★	
M3.1-4 Develop case studies and future scenarios				★
Task 3.2 – Innovations in Electric Vehicle Fleet Operations				
3.2.1 – Charging Scheduling for Long-Haul Vehicle Fleets				
3.2.2 – Modeling for Electrified Fleet Operations				
3.2.3 – AI-Driven Diagnostics and Resilient Fleet Control				
M3.2-1 Initial problem formulation for charging scheduling for long-haul vehicle fleets	★			
M3.2-2 Fleet Intelligence Dashboard Deployment		★		

M3.2-3 AI-Enabled Fault Detection Rollout			★	
M3.2-4 Resilient Fleet Control Validation				★
Task 3.3 – Integrated Electric Transportation System Evaluation Models				
3.3.1 – Develop routing algorithms to assign freight traffic on a national scale.				
3.3.2 – Develop energy consumption models for freight delivery trips.				
M3.3-1 Processed freight truck origin-destination data across the U.S.	★			
M3.3-2 Freight truck routes across the U.S.		★		
M3.3-3 Energy efficiency of freight trucks.			★	
M3.3-4 Energy consumption results for freight trucks nationally.				★
Task 3.4 – Advanced Air Quality Monitoring and Modeling				
3.4.1 – National air quality modeling with python-based ISRM				
3.4.2 – Incorporate health impact analysis (HIA) data pipeline into national air quality modeling				
3.4.3 – Maintain network of air quality monitoring network in Salt Lake City				
3.4.4 – Leverage air quality monitoring network to evaluate source attribution of pollutants				
M3.4-1 Collect at least 3 months of data for assessing sources of coarse PM in Salt Lake County	★			
M3.4-2 Through collaboration with the ASPIRE integrated modeling team, have 2 scenarios developed and run through the air quality and health impact modeling pipelines. Use experience of developing and running these models to adjust the modeling pipeline accordingly, preparing for (1) future scenario runs and (2) further integration into		★		
M3.4-3 Calibration process for coarse PM with low-cost sensor network			★	
M3.4-4 Work with integrated modeling team to incorporate python-based ISRM air quality model into the integrated modeling pipeline				★
Task 3.5 – Adoption of EVs and Charging Systems				
3.5.1 – Relationship between public charging infrastructure expansion and residential charger adoption.				
3.5.2 – Market analysis of electrified roadway systems: Choice experiment in a digital town.				
3.5.3 – Developing a framework for understanding EV adoption across political spectrum.				
3.5.4 – Understanding EV adoption, travel behavior, and suppressed travel.				
M3.5-1 Plans for data collection completed for all subtasks.	★			
M3.5-2 Frameworks for data analysis completed for all subtasks.		★		
M3.5-3 Data collection completed for subtasks 2 and 3. Analysis started for all subtasks.			★	
M3.5-4 Analysis completed for all subtasks. Conference papers and journal articles drafted and/or submitted.				★
Task 3.6 – Project Integration				
3.6.1 – Project Management				
3.6.2 – Data Infrastructure Systems				
M3.6-1 Communication plan and schedule for project-wide meetings.	★			
M3.6-2 Public ASPIRE data catalog		★		
M3.6-3 Knowledge graph toolkit			★	
M3.6-4 Support the development of ASPIRE's Annual Report and presentations at the Annual Meeting.				★

3.3 Project 3 Task Summaries

Project 3 Task 1: Power and Transportation Co-Simulator
In Year 5, Task 3.1 advanced the development of the Power and Transportation Simulator, a key systems-of-systems tool designed to evaluate how widespread EV adoption interacts with both the power grid and transportation networks. This work addresses a critical research gap: the absence of integrated platforms capable of modeling interdependencies between vehicle charging behavior, grid capacity, frequency dynamics, and transportation system performance. Without such tools, planners lack the ability to anticipate bottlenecks, identify optimal charging infrastructure siting, and evaluate long-term system impacts.

To meet this need, the team expanded the simulator to incorporate more diverse datasets and use cases, improving its ability to model EV load profiles, charging patterns, and traffic flow dynamics. Enhancements included integration of connected vehicle data streams, improved forecasting of electricity demand under varying adoption scenarios, and cross-validation with real-world pilot projects. These upgrades ensure the simulator can evaluate not only local effects but also regional and national-scale interactions between energy and transportation systems. The team also studied the dynamic, frequency-domain characteristics of the total demand served at a substation connecting a segment of an electrified roadway instrumented with the dynamic wireless power transfer (DWPT) technology to the power grid.

Milestones in Year 5 included validation of the simulator's predictive models against observed data and the integration of modules for renewable energy and grid-interactive charging. These additions allow researchers to test scenarios where renewable penetration and managed charging strategies reduce system stress while meeting mobility needs. The simulator also advanced in usability, incorporating visualization dashboards that allow stakeholders to interpret results and compare system outcomes under different policy and investment pathways. Regarding the dynamic behavior of the DWPT load, the team established scaling laws to describe how harmonics are affected by different traffic conditions.

The innovations developed through Task 3.1 remain in early stages of readiness but have already demonstrated the ability to generate actionable insights. Planned initiatives include expanding the simulator to model cross-border electricity and travel flows, incorporating additional datasets from CV providers, and aligning outputs with policy-relevant performance metrics such as emissions reductions, return on infrastructure investment, and equity of access.

Overall, Task 3.1 in Year 5 strengthened ASPIRE's technical foundation for integrated systems analysis, providing a powerful decision-support framework to ensure that electrified transportation and power systems evolve in tandem for maximum societal benefit.

Project 3 Task 2: Examining the Air Quality, Health, and Environmental Justice Implications of Vehicle Electrification
Team: Michael Hannigan, Faculty, CU Boulder; Colleen Reid, Faculty, CU Boulder; Daniel

Mendoza, Faculty, University of Utah; Emma Rieves, Student, CU Boulder; Jon Silberstein, Student, CU Boulder

Task Summary:

In Year 5, Task 3.2 advanced ASPIRE's research on the intersection of vehicle electrification, public health, and environment. This task responds to persistent gaps in understanding how electrification impacts air quality and health outcomes, particularly in vulnerable communities. Existing emissions inventories often lack the spatial and demographic resolution needed to capture spatial patterns in air quality concentrations, while health modeling tools do not fully account for the shifts in emissions sources that electrification introduces.

To address these gaps, Task 3.2 integrated emissions modeling with exposure and health impact assessments tailored to electrification scenarios. The team focused on quantifying how reductions in tailpipe emissions translate into improvements in local air quality, as well as estimating associated health benefits. Importantly, the task emphasized the distribution of benefits across different socio-economic and demographic groups. This approach ensures that electrification strategies are assessed not only for aggregate benefits but also for differential outcomes.

Milestones in Year 5 included building linked datasets that connect vehicle activity to emissions profiles, developing exposure models to estimate pollutant concentrations at the community scale, and initiating analyses of health outcomes associated with projected reductions in pollutants. The task also engaged with community stakeholders and public health experts to validate assumptions and contextualize findings, ensuring that the work remains grounded in real-world concerns.

Innovation efforts centered on advancing methods for combining connected vehicle data with air quality and health models. These advances are at early stages of readiness but demonstrate strong potential for informing both policy and infrastructure planning. Planned initiatives include extending analyses to multi-state regions, incorporating scenarios of charging infrastructure siting into health impact projections, and developing decision-support tools that allow stakeholders to visualize both aggregate and distributional impacts.

Overall, Task 3.2 in Year 5 reinforced ASPIRE's role in linking electrification to health and equity outcomes, ensuring that the transition to clean transportation delivers benefits fairly and measurably across communities.

Project 3 Task 3: Adoption of Electric Vehicles and Transportation Systems

Team: Konstantina (Nadia) Gkritza, Faculty, Purdue; Gaia Cervini, PhD Student, Purdue; Bruno Krause Moras, PhD Student, Purdue; Kenny Chandra Wijaya, PhD Student, Purdue; Nadia's student (TBA), PhD Student, Purdue; Adoption PostDoc (TBA), Postdoc, Purdue; Rosalee Clawson, Faculty, Purdue; Antje Graul, Faculty, USU; Antje's student, Student, USU; Patrick Singleton, Faculty, USU; Patrick's student, Student, USU; Janette Goodridge, Faculty, USU; Janette's student, Student, USU; Ole Sleipness, Faculty, USU; Ole's student, Student, USU; Prakash Ranjitkar, Faculty, UA; Selena Sheng, Faculty, UA; Prakash and Selena's student, Student, UA

Task Summary:

In Year 5, Task 3.3 advanced ASPIRE's efforts to understand and model the adoption of electric vehicles (EVs) and their integration into transportation systems. Traditional adoption models often lack the granularity to capture differences—across rural and urban settings, in different climate regions, for multifamily dwellings, and regarding fleet applications—leaving planners without

sufficient tools to anticipate future needs. Task 3.3 addressed this gap by incorporating behavioral and socioeconomic factors (such as housing stock and travel patterns), as well as temperature and policy support, into more realistic adoption models. The team developed and applied data-driven models using multiple real-world sources: connected vehicle datasets, EV registrations, climate data, public opinion surveys, and infrastructure inventories.

Milestone progress in Year 5 included the identification of factors affecting EV adoption across urban and rural contexts, highlighting disparities in charging access and identifying potential bottlenecks in infrastructure deployment. In addition, a major scientific advance was exploring how local thermal dynamics—including daily temperature variability and cold exposure—shape regional patterns of battery EV (BEV) market share, using panel data at the ZIP code level across 12 states spanning a broad range of climate zones. Results showed significant, nonlinear temperature effects on BEV penetration, emphasizing the need for targeted policy and technology to improve performance and consumer confidence in extreme climates.

In parallel, the team conducted a state-by-state review of available policy mechanisms, examining their magnitude and impact, to better understand the role of incentives in driving EV adoption. Findings were mixed, indicating that while incentives can influence adoption, their effectiveness varies widely depending on context. The analysis underscored the need for further research to determine when incentives should be used, which types are most effective, and what their optimal value might be. The team also analyzed factors influencing BEV and PHEV registration fees, identifying fuel tax revenue as a key predictor, along with political, sociodemographic, and regional adoption characteristics. Another innovative study this year was investigating the impact of media frames highlighting a business versus sustainability angle when covering EV adoption trends. A survey of the general population incorporating an experimental design found that despite differences in political party orientation subsist, a sustainability media frame was significantly more effective in driving self-reported EV adoption across participants overall. Our findings suggest that further research is needed to tease apart these effects.

Overall, Task 3.3 in Year 5 provided essential insights into EV adoption trajectories, ensuring that ASPIRE and its partners can anticipate demand, align infrastructure investments, and design strategies that support efficient electrification of transportation systems. These advances are early in readiness but show strong potential for deployment as decision-support tools. Results were published and shared with key stakeholders, including INDOT, UDOT, and the US Department of Energy, ensuring direct policy relevance. Planned initiatives in Year 6 include: extending the adoption models towards integration with Task 3.1; exploring the interdependencies between public and private charging infrastructure developing digital twin simulations to investigate user preferences for DWPT, using mixed-methods approach to advance the current understanding of EV adoption trends across political party orientations, and investigating suppressed travel and travel challenges among EV owners.

Project 3 Task 4: Optimization of Transportation Electrification Solutions Through Integrated Techno-economic and Life-Cycle Assessment
Team: Jason Quinn, Faculty, Colorado State University; Noah Horesh, Research Scientist, Colorado State University; David Trinko, Research Scientist, Colorado State University
Task Summary:

In Year 5, Task 3.4 advanced ASPIRE's mission by developing integrated frameworks that enable concurrent techno-economic analysis (TEA) with life-cycle assessment (LCA) to evaluate and optimize transportation electrification strategies. This work addresses critical gaps in understanding the full costs and environmental impacts of electrification pathways. Traditional approaches often evaluate costs or environmental performance in isolation, leading to incomplete decision-making. By uniting concurrent TEA and LCA, Task 3.4 provides stakeholders with holistic insights into the trade-offs and synergies inherent in electrification solutions.

The team applied these frameworks to assess charging infrastructure deployment, vehicle adoption scenarios, and energy system interactions. By considering factors such as capital and operational costs, emissions across the vehicle and infrastructure life cycle, and long-term sustainability metrics, the task produced analyses that help guide both public and private sector investments. These assessments also integrated with other ASPIRE tasks, such as Task 3.3 on EV adoption and Task 1.4 on infrastructure deployment, ensuring that the findings reflect both behavioral and technical dynamics.

Milestone progress in Year 5 included the development of costing tools for different charging station types, collaboration with stakeholders to model infrastructure deployment scenarios, and completion of comparative LCAs for electrified versus conventional transport systems. These outputs directly contribute to ASPIRE's goal of enabling cost-effective, equitable, and environmentally responsible electrification.

Innovation efforts focused on creating scalable methodologies that can be applied across regions and vehicle classes. These advances remain at early technology readiness levels but have shown strong promise in informing infrastructure planning and policy design. Planned initiatives include expanding analyses to include medium- and heavy-duty applications, integrating renewable energy scenarios into assessments, and refining models to better capture equity impacts in cost-benefit analyses.

Overall, Task 3.4 in Year 5 delivered powerful tools and insights that strengthen ASPIRE's capacity to optimize transportation electrification solutions. By providing a comprehensive understanding of costs, benefits, and impacts, the task ensures that electrification strategies can be both economically viable and environmentally sustainable.

Project 3 Task 5: Combined Simulation Framework for Mass Charger Utilization Through Massive Simulation and Distributed Market Approaches

Team: Greg Droge, Faculty, USU; Mario Harper, Faculty, USU; James Swedeen, Student, USU; Josh Taggart, Student, USU

Task Summary:

Task 3.5 is focused on developing scalable simulation and planning frameworks that address the challenge of modeling energy usage for electric vehicles (EVs) at both individual and fleet levels. A key gap in the field is the limited availability of integrated data and simulation tools capable of predicting grid impacts and energy usage patterns under distributed, market-based approaches. Current frameworks often lack modularity and cannot flexibly incorporate diverse datasets or support large-scale, multi-vehicle scenarios.

In Year 5, the task addressed these challenges by designing a modular simulation API interface that enables scalable integration of datasets and algorithms. This interface supports ongoing development of energy-aware planning algorithms for single vehicles, multiple vehicles, and large

fleets. Early prototypes demonstrated significant promise in improving the ability to predict and optimize energy consumption under realistic mobility scenarios.

Milestones in Year 5 included the design and testing of the simulation API (60% complete), validation of single-vehicle energy models (30% complete), and the development of initial algorithms for distributed multi-vehicle planning (50% complete). These outputs directly contribute to ASPIRE's mission by enhancing the center's ability to model EV energy usage, reduce grid strain, and promote sustainable energy adoption.

Innovation outcomes included the creation of a **Modular Simulation API Interface** (TRL 4), a flexible and scalable tool for EV planning simulations, and the development of **Energy Optimization Algorithms** (TRL 5) for fleet-level distributed energy planning. Both innovations offer clear pathways for commercialization and integration into industry practices. Planned next steps involve extending the API to incorporate real-time grid interaction models and developing training modules to disseminate these tools among students and industry partners.

Overall, Task 3.5's Year 5 contributions strengthen ASPIRE's capacity to simulate, optimize, and scale EV energy planning, ensuring that electrification strategies are efficient, grid-aware, and adaptable to future transportation demands.

Project 3 Task 6: Environmentally Aware EV Charging Integration in Energy Systems
Team: Yuanrui Sang, Faculty, UTEP; Junjie Qin, Faculty, Purdue; Ivonne Santiago, Faculty, UTEP; Sivaranjani Seetharaman, Faculty, Purdue; Francisco Hernandez, Student, UTEP; Adrian Morales, Student, UTEP; Nestor Acosta, Student, UTEP; Yifan Dong, Student, Purdue
Task Summary:
In Year 5, Task 3.6 focused on advancing transportation modeling approaches and integrating them with control strategies for electrified roadway systems. This task addresses a critical gap: the lack of models that capture both traffic dynamics and energy transfer processes in electrified corridors. Traditional transportation models emphasize mobility outcomes but do not adequately account for power flow and roadway-level electrification, limiting their utility for infrastructure planning and system optimization.

To overcome these challenges, the team developed new transportation models that simulate vehicle movement and charging behavior under various roadway electrification scenarios. These models were then coupled with slow time-scale control strategies for electric roadways, enabling the evaluation of how different control policies affect traffic performance, grid demand, and system efficiency. By bridging the gap between mobility and energy domains, Task 3.6 provided insights into the technical feasibility and operational performance of roadway electrification.
Milestone progress in Year 5 included the formulation of a baseline transportation model, integration of electric roadway charging modules, and initial coupling with grid control systems. The models were validated against pilot project data where available, and scenario analyses explored how varying levels of EV adoption and roadway electrification could impact traffic flows, charging demand, and system-level energy balance.

Innovation efforts in this task centered on building flexible, scalable modeling frameworks that can be adapted for regional and national analyses. These frameworks are still at early stages of

readiness but show strong potential to support decision-making by illustrating the operational trade-offs of different electrified roadway strategies. Planned initiatives include extending the models to incorporate connected vehicle datasets, refining control strategies for higher fidelity, and expanding the scope to include freight corridors and multi-modal electrification scenarios. Overall, Task 3.6 in Year 5 laid essential groundwork for integrating transportation modeling with roadway electrification controls. This work advances ASPIRE's goal of creating system-level solutions that ensure electrification strategies are efficient, resilient, and aligned with the mobility and energy needs of future transportation systems.

Project 3 Task 7: Empowering Urban Electrification: Leveraging Socio-Economic and Social Network Insights with CARLA-Charge in the ASPIRE Framework for Optimal EV Charging Solutions
Team: Mario Harper, Faculty, USU; Steve Petruzza, Faculty, USU; Masood Parvania, Faculty, University of Utah; Maryam Mahmoudi, Student, USU; Aashay Maheshwarkar, Student, USU
Task Summaries:
Task 3.7 is focused on developing data-driven and socially informed tools to improve the reliability, equity, and efficiency of EV charging infrastructure in urban environments. The task addresses two pressing gaps: the lack of real-time visibility into charging system downtime and reliability, and the insufficient integration of socio-economic factors into current planning and simulation frameworks. Without these insights, electrification strategies risk overlooking equity concerns and may fail to deliver resilient charging access across diverse communities.

In Year 5, the task advanced multiple fronts. A visualization app tailored for the Utah Transit Authority (UTA) was developed to monitor charger downtime and performance, enabling operators to track infrastructure reliability in real time. Additionally, socio-economic and social network insights are being incorporated into CARLA-ChargeSim, providing a novel capability to evaluate charging strategies in the context of community demographics, accessibility, and equity.

Milestones achieved included the completion of a GEOTAB extension (60%) enabling spatial and temporal data analysis, early progress on an integration framework linking CARLA-Charge and socio-economic data (40%), initial drafting of ASPIRE's data service architecture (30%), and preliminary cloud deployment of backend systems (20%). These milestones directly empower transit operators and municipalities to make evidence-based infrastructure decisions while addressing equity in electrification.

Innovation outcomes this year included the UTA Visualization App (TRL 5), a real-time monitoring tool for charger reliability; the GEOTAB Data Extension (TRL 5), which enhances charger performance analysis; and the CARLA-ChargeSim Integration (TRL 4), a unique platform incorporating socio-economic variables into simulation and optimization. Each of these innovations shows strong commercialization potential, with projected completion dates ranging from mid- to late-2025.

Looking forward, Task 3.7 plans to extend its visualization tools with predictive analytics through a Charger Reliability Dashboard and to develop Social Network Insight Modules that further enhance CARLA-ChargeSim's equity-oriented analysis. These initiatives will expand ASPIRE's capabilities to ensure electrification strategies are sustainable, accessible, and socially informed.

3.4 IS Associated Project Descriptions

IS Associated Project: EV Adoption and Use in Utah

Faculty: Patrick Singleton (USU)

Graduate Students: Fariba Soltani (USU), Aleks Paskett (USU)

Industry Collaborators: Utah Department of Transportation, Wasatch Front Regional Council

Abstract

The primary objective of this research project is to understand differences in (and factors affecting) the trends and patterns of electric vehicle (EV) adoption, use, and charging behavior in rural and urban Utah. To achieve this overall objective, there are three sub-objectives:

Identify factors affecting the adoption (purchase or rental) of EVs, including any differences in urban and rural areas of Utah.

Measure differences in the use of EVs and non-EVs (travel patterns and behaviors of EV and non-EV users), in urban and rural areas of Utah.

Measurable differences in the charging behaviors of EVs (EV users) between urban and rural areas of Utah.

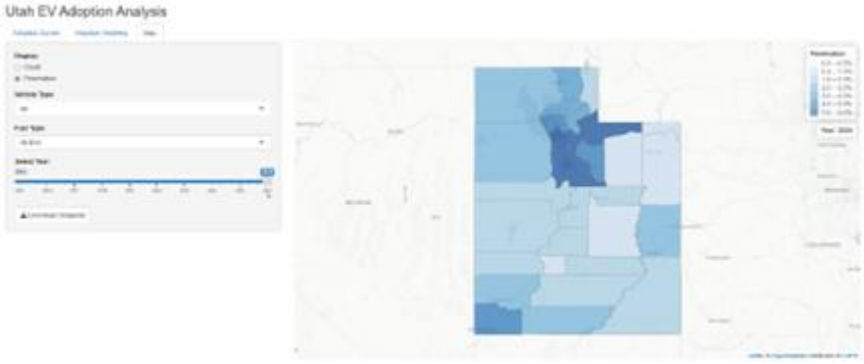
This knowledge will then be utilized to inform EV-related policies and decisions, including siting charging stations, but also potentially including education or public awareness actions.

Alignment with Project and Center Goals

This associated project supports the Integrated Systems project's goal to "Increase ASPIRE's capabilities to model, assess, and evaluate the influences on" EV adoption and use. This work will also support ASPIRE's goal of developing improved "System Models & Tools."

Key Progress

The research team made considerable progress in Year 5 towards achieving this associated project's research objectives. Specific accomplishments included the following:



Assembled and analyzed 10 years of county-level EV registration data in Utah, estimating adoption curves by EV type (BEV, PHEV, all), vehicle type (passenger, light truck, both), and county. Light trucks are electrifying much faster than passenger cars, and BEV adoption is increasing at a rapid rate in all counties, not just those with currently high levels of EV ownership.

Developed a web-app (figure above) to explore EV registration data and trends in Utah.

Processed and analyzed the 2023 Utah Moves Household Travel Survey for factors affecting household vehicle ownership and EV adoption, including differences in rural and urban areas.

Although urban households are more likely to own an EV if they own more vehicles, there is no association between EV adoption and vehicle ownership for rural households. Also, access to public EV charging has a stronger influence on EV adoption among rural households than in urban areas.

Developed preliminary models of EV travel behavior and use (number of trips, distance traveled, and travel time), as well as EV public/home charging behavior, both using Utah travel survey data. This work will be continued in Year 6.

IS Associated Project: Blueprinting Electrified Transit System Implementation

Project Team: Noah Horesh (Optimized Kinetics LLC), David Trinko (Optimized Kinetics LLC), Jason Quinn (Colorado State University)

Funding: U.S. Department of Energy, Small Business Technology Transfer Phase 1 [DE-SC0025006]

Abstract

This project focused on developing and commercializing electrified transit planning software through Optimized Kinetics LLC, a spin-out company from the ASPIRE ERC. The award supported the creation of an advanced modeling and optimization suite for cost-effective transit electrification planning. A central innovation is a multi-objective optimization framework, built with mixed-integer linear programming, that identifies optimal configurations for electric vehicle supply equipment, battery capacities, charging schedules, bus routes, and distributed energy resource integration. The suite integrates techno-economic models with life cycle assessment tools to evaluate both financial impacts and air quality costs at high spatial and temporal resolution. By bringing these tools to market, Optimized Kinetics seeks to (a) reduce planning costs by eliminating the need for agencies to build custom tools and (b) deliver sophisticated, system-level solutions that streamline infrastructure deployment and minimize operational expenses. The technology supports consulting services for transit and commercial fleet electrification and provides the foundation for a scalable software solution.

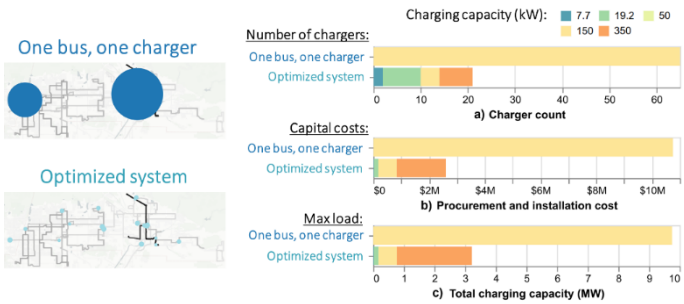
Alignment with Project and Center Goals

This associated project supports the Center's goal to develop system models and tools for integrated power and transportation networks.

Key Progress

This project was successfully completed, achieving all technical milestones. It developed and demonstrated a scalable, repeatable system-level optimization software for fleet electrification, delivering significant real-world impacts:

$28 million reduction in total costs and a 75% decrease in charger capital expenditures compared to the existing plan (one bus, one charger) in San Bernardino, California (figure below) 66% reduction in maximum charging load, substantially lowering grid impacts (figure below)



Cost-optimized planning compared with the current one-charger-per-bus plan using 150-kilowatt (kW) chargers. The left panel shows charger locations, with circle sizes scaled by power capacity: the one charger-per-bus plan concentrates chargers at two depots, while the optimized system strategically places chargers along service routes.

IS Associated Project: DOE-FOA-0002611: MD-HD ZEV Infrastructure Planning with Focus on I-80 Midwest (IN-IL-OH) Corridor

Project Leads: Dionysios Aliprantis, Konstantina Gkritza, Brandon Allen
Students: Zainab Imran, Sarangi Jayaram, Chiara Cervini (Postdoc)
Partners: Cummins Inc. (Lead), National Labs (ANL, NREL), INDOT, industry groups, utilities
Abstract / Summary: This project addresses the critical lack of **EV charging and hydrogen fueling** infrastructure for **medium- and heavy-duty** (MD-HD) Zero-Emission Vehicles (ZEVs). It uses innovative modeling tools and stakeholder outreach to develop a regional infrastructure plan for **the state of Indiana and I-80 corridor across Indiana, Illinois, and Ohio**. Project deliverables are: i) Phase 1: An immediate deployment plan (2025) for high-power EV charging to support 4.27% of the MD-HD fleet being battery electric by 2030; ii) Phase 2: A scenario-based plan for 2035 to support 30% of the MD-HD fleet using ZEV technologies, comparing megawatt charging (MCS), hydrogen refueling, and dynamic wireless power transfer (DWPT).
Alignment with Center Goals:

Goal 1: Charging Hardware: Guides hardware advancement and deployment through strategic planning and business case development.
Goal 2: System Models & Tools: Uses advanced models (POLARIS, EVI-X) and stakeholder data for data-driven planning and creates a replicable template for future use.
Goal 3: Powered Pavements: Creates scenario-based plan to guide DWPT deployment.
Goal 4: Equitable Transition: Improves air quality in deprived communities through equitable planning and community outreach.
Goal 5: Informed Public: Informs communities and industry partners by engaging stakeholders and sharing plans, also incorporating their feedback.
Goal 6: Diverse Workforce: Creates a workforce development model by investigating a technical education program (Cummins TEC) to create a pipeline of skilled technicians.

Barriers or Questions Addressed and Approach:

Transportation Modeling: ANL's POLARIS platform is used to model ZEV charging demand, validated with fleet duty cycles from partners.

Infrastructure Siting/Sizing: NREL's EVI-Pro HD and EVI-Ensite tools determine optimal infrastructure locations and site-specific plans, factoring in grid constraints identified by utility partners.

Community Outreach: Activities are conducted to understand community needs, provide education, and co-develop a Clean Transportation Technical Education high school program.

Progress: The POLARIS model is functional and calibrated for the I-80 corridor and Indiana highway system, generating 24-hour vehicle trajectories. These trajectories are actively being used in EVI-Pro HD to site 350-kW DC fast chargers among 500 candidate locations, optimizing for 4.27% MD-HD fleet penetration by 2030. Input from the grid interconnection team and a Midwest fleet survey for characterizing prospective fleet readiness has refined the model and siting constraints. The working group for Phase 2 advanced technologies (MWC, DWPT, H2) is holding ongoing discussions on technological integration considerations. A public engagement survey was disseminated in Indiana in August 2025 to understand Indiana residents' knowledge and perceptions of ZEVs, particularly medium-duty and heavy-duty (MD-HD) vehicles, fueling options, and charging infrastructure. The survey also explores views on the environmental and social impacts of ZEVs and the I-80 corridor project to inform future planning.

IS Associated Project:
Colorado Higher Education Competitive Research Authority (CHECRA) Fund for NSF ASPIRE ERC

Faculty: Qin Lv, Michael Hannigan, Colleen Reid, Cristina Torres-Machi, Kyri Baker (UCB)

Graduate Students: Emma Rieves, Elijah Evers, Francisco Contreras (UCB)

Abstract

This associated project has two main objectives: (1) Better understanding of the interdependencies between transportation and power infrastructure and how people from different communities use these systems; and (2) modeling the air quality implications of vehicle electrification and analyzing neighborhood-scale air quality concentrations and the sources they come from. To accomplish these goals, we conduct studies and explore the use of supervised machine learning algorithms to better understand the utilization of highway networks during power outage events and how EV adoption and area demographics impact an area's response to outlier weather and outage events. These findings can be extended to predict the impact of weather and power outages on other areas not included in the study and forecast impacts under hypothetical future situations. We develop a modeling framework for air quality impact of vehicle electrification that incorporates various factors: assuming added electric load is powered by a realistic grid; differentiating between light- and heavy-duty vehicle emissions; enhancing our spatial allocation of where vehicle-related emissions reductions occur; and adding in multiple vehicle charging scenarios. We also leverage low-cost sensor measurements and coupled wind data to investigate the spatiotemporal heterogeneity of air pollution to identify air pollution source profiles.

Alignment with Project and Center Goals

This associated project supports the Integrated Systems project's goal to "Increase ASPIRE's capabilities to model, assess, and evaluate the influences on" EV adoption and use. This work will also support ASPIRE's goal of developing improved "System Models & Tools."

Key Progress

The research team made considerable progress in Year 5 towards achieving this associated project's research objectives. Specific accomplishments included the following:

We have completed two studies. The first study established a methodology to determine how power disruptions influence travel behavior compared to weather events in the Denver Metropolitan area. Results indicate that deviation from expected travel is primarily influenced by snowfall and temperature, but also to power outage metrics when snow is present.

The second study analyzed how EV adoption and sociodemographic factors relate to travel impacts from power disruptions in three regions (i.e., the Colorado Front Range, the San Francisco Bay Area, and the North Carolina Research Triangle. Results indicate that power outage statistics are relevant during different weather conditions depending on the region and may either increase or reduce travel depending on conditions.

We have completed analyses that further our understanding of the neighborhood-scale differences in air pollution from on-road sources using a combination of low-cost sensor measurements, source apportionment methodologies, and novel experimental techniques. Our modeling achievements reflect several scientific advancements: exploring changes in air quality at a finer spatial scale (1 x 1 km) than other studies and incorporating $PM_{2.5}$ and NO_2, the latter of which is an air pollutant that is less often considered in assessments of how air pollution affects health.

One PhD student supported by this fund successfully defended their dissertation in Fall 2024.

Results from these studies have been presented at relevant scientific conferences and communicated to community partners. Our work over the last year has resulted in the completion of multiple scientific manuscripts - three of which have been published.

3.5 Project 3 Year 6 Proposal

Project 3 Year 6 Proposal

Project: 3. Integrated Systems
Project Lead: Patrick Singleton (USU)
Project Co-Lead: Sivaranjani Seetharaman (Purdue)

Project Overview

ASPIRE's Project 3 studies the integration of electric vehicles (EVs) and EV charging infrastructure (EVCI)—including electric roads—into transportation systems, energy/power systems, the economy, and society. In order to achieve the Center's mission, vision, societal impacts, and strategic goals, it is crucial for ASPIRE to understand, measure, monitor, model, optimize, and evaluate these complex systems and their connections and interactions. Project 3 provides these strategic advantages through convergent research and training involving a wide range of academic, industrial, governmental, and community partners. This project's work directly connects with ASPIRE's testbeds and pilots and is also supported by funding from associated projects.

In Years 1 through 5 of ASPIRE, Project 3 has taken a broad approach to meeting ASPIRE's needs in these areas. We have evaluated the economic feasibility and environmental impacts of novel EV charging systems (including DWPT). We have developed open-source models, simulators, and other tools to assess the operation and performance of electric transportation systems (ETS). We have worked on novel methods to co-simulate the transportation and power systems, and to optimally schedule EV charging considering travel demand, power generation, and electricity market operations and pricing. We have monitored trends and policies and studied factors (including public perceptions) affecting the adoption of all classes of EVs and multiple types of EVCI. We have studied the societal and environmental implications of ubiquitous charging and widespread EV adoption.

In Project 3 in Year 6, we are refocusing our efforts towards answering the industry's critical system-level questions about ETS amidst an evolving policy and economic landscape. Our work will target important systemic challenges that must be addressed, not just in the next few years but over the next decade, to achieve widespread adoption and deployment of ETS at scale.

First, as DWPT (electric road) demonstration projects are constructed throughout the country and the cost-competitiveness of DWPT systems for EV charging at scale are demonstrated through multiple simulations and studies, **Task 1** is committed to understanding and modeling and optimizing all aspects of integrated transportation–power systems for electric roads (ERs). On the transportation system side, work will continue to improve travel demand forecasting and traffic simulation models with electric roads, to understand charging demand and transportation system implications. On the power system side, work will continue to improve the modeling and optimization of spatial-temporal profiles of charging energy demand from ERs to assess the impact on both transmission and distribution grids, and to ensure reliable grid operation and unlock the demand-side flexibility of ERs through electricity market participation. These models and algorithms will result in a suite of decision-making tools for charging control, coupled infrastructure optimization, and market participation focusing specifically on ERs, complementing similar efforts related to static charging stations in Project 1.

Second, companies are increasingly moving to deploy and operate large electrified fleets of trucks and buses, which promises significant cost savings while simultaneously introducing new operational challenges. In this context, **Task 2** is focused on providing solutions for optimizing the operation of EV fleets. In close collaboration with ASPIRE's industrial and innovation partners, work will involve coordinating the scheduling of charging for long-haul trucks with other operating constraints, using AI to mitigate service disruptions by identifying and responding to charging outages or equipment issues, and developing dashboards and visualizations to support improved fleet management and operations.

Other tasks in Project 3 will support these efforts and additional objectives. The integrated evaluation models (techno-economic analysis and life-cycle assessment) in **Task 3** have already reported findings about ETS that have been published in leading journals and attracted national news attention. These tools will be updated to better identify freight truck corridor charging needs and identify strategic routes for DWPT deployment, thus supporting both major project initiatives (electric roads, fleet electrification). **Task 4** will continue its innovative work in monitoring and modeling air quality with fine-grained precision, helping Project 3 and ASPIRE understand how to meet its goal of reducing emissions from the transportation sector. As more public chargers are built and DWPT systems come online, and a new US Presidential administration brings changes to federal policy and spending, **Task 5** is centered around studying the impacts and implications of policy on ETS adoption. This task will continue its important work in understanding and modeling the adoption of EVs and EV charging systems, specifically seeking to understand, track, and model public perceptions and behaviors surrounding EVs and charging systems in light of evolving infrastructure and policies. Finally, through tight integration across project tasks and continued data infrastructure system improvements, **Task 6** will help coordinate and support Project 3's efforts.

Project Milestones

Name	***Description***	***Center Goal(s)***	***Contributions to Center Goal(s)***	***Societal Impact Target(s)***
Increase ASPIRE's abilities to co-simulate key elements of the power and transportation systems	Modeling the integration of conventional EV charging facilities and ERs in energy systems considering transportation system modeling, transmission and distribution grid modeling, and reducing the cost of charging while meeting the needs of EV owners	2. System Models & Tools	New or enhanced models for EV charging and ER modeling in the energy and transportation systems will be developed.	1. Wide Adoptions of Electrified Transportation Systems, 3. Reduced cost to move people and goods
Increase ASPIRE's capabilities to	Influences on ETS include	2. System Models &	The environmental, health, and societal	1. Wide Adoptions of

model, assess, and evaluate the influences on and impacts of electric transportation systems	adoption, costs, etc. Impacts of ETS include cost, emissions, health, social impacts, etc. This will be done via the integrated evaluation model.	Tools, 4. Equitable Transition	impacts of EV adoption will be evaluated. Metrics for EV/charging adoption will be assessed, with feedback to the power/transportation system modeling.	Electrified Transportation Systems, 2. Reduced Pollution, 3. Reduced cost to move people and goods
Support ASPIRE's Pathways efforts	Work with Project 4 to achieve their milestones in the areas of pre-college, higher ed, center development, community college, community engagement, etc.	5. Informed Public, 6. Diverse Workforce	We will participate in outreach activities to inform the public about up-to-date EV/charging technologies, and train a diverse workforce through our research and classes.	4. Creation of jobs, 5. Increased accessibility for underserved populations
Pursue outside funding to support core project activities and long-term goals	Submit grant applications for external funding to support work to further develop the project's work on developing transportation-power co-simulation models and evaluation tools.	2. System Models & Tools	The project's core activities support the development of open-source models and tools for simulating the power and transportation systems and evaluating the broad impacts of ETS.	1. Wide Adoptions of Electrified Transportation Systems, 4. Creation of jobs

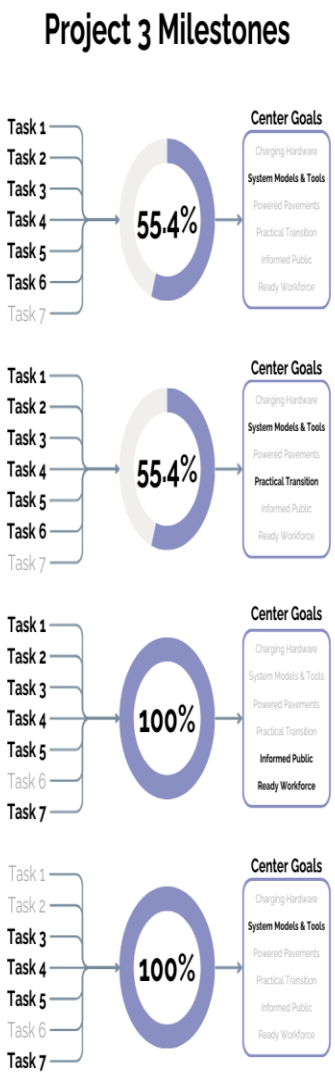
Project Budget: 1,366,383.72

3.6 Project 3 Year 5 Milestones

Project Milestone Name	*Description*	*Center Goal(s) Alignment*	*Please describe how it contributes to the Center Goal*	*How should this milestone be measured?*
Increase ASPIRE's abilities to co-simulate key elements of the power and transportation systems	Modeling the integration of conventional EV charging facilities and electrified roadways in energy systems considering transportation system modeling, reducing the cost of charging while meeting the needs of EV owners	#2 – System Models/Tools	New or enhanced models for EV charging modeling in the energy and transportation systems will be developed.	Papers, presentations, and reports done in this research area.
Increase ASPIRE's capabilities to model, assess, and evaluate the influences on (adoption, costs, etc.) and impacts of (emissions, health, equity, cost, etc.) electric transportation systems (via the integrated evaluation model)		#2 – System Models/Tools, #4 – Equitable Transition	The environmental, health, and societal impacts of EV adoption will be evaluated; Equity metrics in EV/EV charging adoption will be assessed and feedback to the power/transportation system modeling to guide equitable adoption of EV and EV charging.	Papers, presentations, and reports done in this research area.
Support ASPIRE's Learning & Engagement efforts	Work with Project 4 Learning & Engagement to achieve their milestones in the areas of pre-college, higher ed,	#5 – Informed Public, #6 – Diverse Workforce	We will participate in outreach activities to inform the public about up-to-date EV/EV charging technologies, and train a diverse workforce by involving	Number of activities engaged in by participants of this project; number of students trained under this project.

	center development, community college, community engagement, equity/justice.		underrepresented groups in our research and classes.	
Pursue outside funding to support core project activities and long-term goals	Submit grant applications for external funding to support work to further develop the project's work on developing the software testbed (transportation-power co-simulator) and evaluation tools.	#2 – System Models/Tools	The project's core activities support the development of open-source models and tools for simulating the power and transportation systems and evaluating the broad impacts of electric transportation systems.	# and $ of external funding applications submitted

Project 3 Year 5 Project Milestone Progress and Center Goal Alignment



Project 4: Pathways

4.1 Project 4 Quad Chart

YR 5 Project 4: Pathways

Project Goals

Cultivate a robust workforce in electrified transportation systems by developing and implementing replicable and scalable K-trades-22 pathways encompassing education, training, research, community awareness, and industry partnerships.

Results



Approach



Working in parallel with ASPIRE's technical projects (Projects 1–3) that utilize the TRL, Pathways will pilot the Workforce Readiness Level (WRL) framework to support ASPIRE's mission by capturing the full continuum of workforce development—from early-stage awareness and foundational education to advanced technical training and alignment with industry-specific competencies.

Outputs and Outcomes

- Creative Engineering Design revised and published on the Community of Practice webpage of the *TeachEngineering* digital library, reaching over 2.5M K-12 educators.
- Implemented the 3rd year of the "Youth Engineers in the Sustainability of EVs (YES-EV)" HS Technical Education program engaging 5 students.

Industry Engagement

- Project 4 has served as a fundamental catalyst for building industry, trade, union and community partnerships.
- Showcased ASPIRE-trained student talent to Industry partners through networking and Cohort Travel Program.

1

4.2 Project 4 Year 5 and 6 Gantt Chart

Tasks	Year 5				Year 6			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Task 1 - Pre-College Curricula, Engagement & PD								
Task 1.1 Pre-College Curriculum Development	■	■	■	■				
Task 1.2 Pre-College Engagement	■	■	■	■				
Task 1.3 Pre-College Teacher Professional Development			■	■				
Task 2 - REU, Higher Education Curricula & Engagement								
Task 2.1 REU Program	■	■	■	■				
Task 2.2 Higher Ed Curriculum Development & Engagement	■	■						
Task 3 - Student Engagement								
Task 3.1 Cohort Program	■	■	■	■				
Task 3.2 Student Leadership Council	■	■	■	■				
Task 3.3 ASA Support	■	■	■	■				
Task 4 - ETS Pathway Credentials and Connections								
Task 4.1 Connect with USU Distance Education to understand credentialing programs	■	■	■	■				
Task 4.2 Research Distance Education credentialing program requirements, capabilities, and costs at other ASPIRE institutions								
Task 4.3 Conduct sessions with IIB members to determine current "industry critical" ETS knowledge and skills that would be valued in a credentialing program	■	■	■	■				
Task 4.4 Conduct a systematized literature review on best practices for emerging technology postsecondary credentialing programs	■	■	■	■				
Task 4.5 Prepare an ASEE research conference paper abstract, based on results of literature review, for submission				■				
Task 4.6 Develop plan for ASPIRE ETS postsecondary credentialing program	■	■	■	■				
Task 5 - Community Engagement & Governance								
Task 5.1 Design pathways brochure or similar communications in 2 languages	■	■						
Task 5.2 Publish brochure in hard-copy and/or virtual formats			■	■				
Task 5.3 Distribute brochure in public, near-port outlets			■	■				
Task 5.4 Conduct responsive community outreach and education utilizing resources and information developed by UTEP and other ASPIRE campuses	■	■	■	■				
Task 5.5 Develop presentations, flyers, and surveys to facilitate testbed-related community outreach	■	■	■	■				
Task 5.6 Create quality displays, videos, and/or activities for K-12	■	■	■	■				
Task 6 - Social Systems & Impact Research								
Task 6.1 ASPIRE-themed educational impacts research	■	■	■	■				

	Task 6.2 Develop and disseminate best-practices slides								
	Task 6.3 Draft community research paper								
	Task 6.4 Submit community research paper for conference								

4.3 Project 4 Task Summaries

Project 4 Task 1: Pre-College Curricula, Engagement & PD Year 5
Team: Jennifer Taylor, Staff, UCB; Jennifer Ramos-Chavez, Postdoc/Staff, UTEP; Hillary Swanson, Faculty, USU; Lu Lawrence, Faculty, USU; Andrew Budge, Staff-EVR, USU; Brandon Allen, Faculty, PU
Task Summary:
Task 4.1 advances ASPIRE's mission by developing and implementing pre-college curricula, outreach, and professional development (PD) centered on electric vehicle (EV) wireless charging and advanced transportation. In Year 5, the team will expand K-12 curriculum development, student engagement, and teacher PD through collaborative efforts with a range of K-12 ASPIRE partners.
Curriculum Development efforts include continuing the ASPIRE-themed middle school curriculum on energy transformations and electromagnetism and initiating new K-12 modules on EV wireless charging. These resources will be co-designed with educators and added to *TeachEngineering* for broad dissemination.
Outreach and Engagement will build student interest through formal (in-school) and informal (after-school, summer) engineering programs, along with unique activities such as EVR tours and researcher meet-and-greets. A new high school design challenge will focus on a static wireless charging demonstration. The static wireless charging demonstration was implemented at a CU after-school engineering program and demonstrated by the CU Pre-College Engineering team at a high school summer EV academy in Denver. =.
Teacher PD will include workshops on energy transformation, electromagnetism. The final Creative Engineering Design teacher professional development workshop was hosted by the CU team at the annual *Colorado Science Conference*. These programs will support educators in effectively teaching ASPIRE concepts while fostering authentic, hands-on STEM learning. Associated projects enhance this work. At USU faculty lead a parallel project producing and testing new middle school curricular units. Purdue's YES-EV program provides high school students with six-week summer research experiences, mentorship, and professional development, further connecting pre-college students to ASPIRE's vision.
By combining curricula, outreach, and PD, Task 4.1 empowers K-12 students and educators to explore EVs, wireless charging, and advanced energy futures — building early pathways toward a prepared and inspired electrified transportation work

Project 4 Task 2: REU, Higher Education Curricula & Engagement
Team: Brandon Allen, Faculty, Purdue University; Rosalee Clawson, Faculty, Purdue University; TBD, Postdoc, Purdue University; TBD, Grad Student, Purdue University; TBD, Undergrad TA, Purdue University
Task Summary:
Task 4.2 centers on higher education engagement through the Research Experience for Undergraduates (REU) program and the development of graduate and undergraduate curricula. Together, these efforts aim to broaden participation in ASPIRE research, expand professional development opportunities, and prepare students with the knowledge and skills needed to contribute to the electrified transportation workforce.

The REU program provides non-ASPIRE students access to ASPIRE projects, connecting them with faculty mentors, research facilities, and professional development resources. Having successfully hosted REUs in Years 1–5 and with a program planned for Year 6, the team will continue to expand opportunities including the development of a new NSF International Research Experience for Students (IRES) site at the University of Auckland (UoA). This international experience will support student to conduct research under the guidance of a faculty mentor at UoA. Other activities will include submitting a manuscript to share findings on the impact of REUs on student researchers. These efforts strengthen the pathway from undergraduate research to advanced study and professional careers in electrified transportation systems.

In parallel, the higher education curriculum component builds on Purdue's successful 500-level synchronous online course co-taught by Rosalee Clawson, Ivonne Santiago, Amanda Katz which has engaged students across ASPIRE institutions. Based on feedback, they have offered a redesigned version, *Transportation Policy*, in Year 5. The course integrates guest lectures from ASPIRE faculty and emphasizes widespread availability, integrated systems thinking, and social science perspectives — directly aligning with NSF's encouragement to leverage social science expertise.

Key achievements in Year 5 include hosting the Fall 2024 *Transportation Policy class with 17 students across Purdue, UTEP, and USU, and being awarded a $432,600 NSF* International Research Experience for Students (IRES) grant featuring collaboration with the University of Auckland. These accomplishments illustrate Task 4.2's commitment to building scalable higher education pathways, expanding global partnerships, and preparing the next generation of engineers and researchers to lead in electrified transportation.

Project 4 Task 3: Student Engagement and Center-Wide Mentorship
Team: Jennifer Ramos-Chavez, Postdoc/Staff, UTEP; Don Linford, Staff, USU; Brandon Allen, Faculty, Purdue; SLC Students, Students, Center-wide; ASA Students, Students, Center-wide; Melanie Conrad, Staff, USU; Ivonne Santiago, Faculty, UTEP; Penelope Espinoza, Faculty, UTEP
Task Summary:

Task 4.3 advances ASPIRE's commitment to supporting student engagement and professional development across the Center. The work spans the Cohort Program, Student Leadership Council (SLC), ASA student groups, and mentorship initiatives for students, staff, and faculty. Together, these efforts ensure ASPIRE students are supported academically, professionally, and personally while developing the skills needed to succeed in the electrified transportation workforce.

The Cohort Program remains a cornerstone of student engagement. Each trip includes a variety of faculty and staff members alongside students, exposing participants to industry leaders, ASPIRE research, and professional networks. To increase opportunities, ASA representatives now have formal opportunities to participate in select trips. A structured application process will be implemented in Year 5 to ensure widespread representation across campuses.

Another major focus is strengthening the Student Leadership Council. In Year 5, the SLC will transition to a more formalized structure. This model will help with leadership continuity, training, and smoother transitions while elevating the SLC's role in guiding student engagement across ASPIRE.

Mentorship remains central to Task 4.3, with Brandon Allen leading efforts to establish cross-institutional mentoring programs that connect faculty, near-peer student mentors, and professional development resources. These programs aim to expand opportunities for guidance, networking, and collaboration across ASPIRE institutions.

Key accomplishments in Year 5 include student participation in a cohort trip to Raleigh, NC, and Atlanta, GA, where they visited Schneider Electric, the FREEDM Center, and the EV Braintrust; coordination with ASA presidents across campuses to align student support; contributions to ASPIRE Mental Health Week; and development of a new Industry Engagement Cohort trip to launch in Year 6. The team also submitted an NSF Mentoring Hub proposal to expand mentorship programming.

Through these efforts, Task 4.3 continues to foster collaborative, meaningful engagement experiences that prepare ASPIRE students for leadership and success.

Project 4 Task 4: CC and Post-secondary Electrified Transportation Systems (ETS) Pathway Credentialing
Team: Angela Minichiello, Faculty, USU; Foeday Zinnah, Grad Student, USU; Don Linford, Staff, USU; Ivonne Santiago, Faculty, UTEP; Matt Ohland, Faculty, Purdue
Task Summary
Task 4.4 focuses on building a post-secondary credentialing pathway in Electrified Transportation Systems (ETS) to expand opportunities for ETS careers and strengthen the technical workforce needed to support electrified mobility. The vision is to design a stackable, multi-level credentialing program that spans community and technical colleges, four-year institutions, graduate education, and non-academic training providers such as apprenticeship programs, military transition programs, and correctional facilities. This program will provide

learners with clear, accessible routes into ETS careers while signaling job-readiness and specialized knowledge to employers.

The credentialing program is envisioned as a three-tiered model. A **Level 1 credential** will be embedded within two-year colleges, apprenticeships, and workforce transition programs to introduce ETS technologies and their societal benefits to various learners, including veterans, trades workers, and individuals re-entering the workforce. A **Level 2 credential** will connect with undergraduate STEM and engineering programs, focusing on core technical, environmental, and societal aspects of ETS. A **Level 3 credential** will be offered in graduate engineering programs, preparing students for advanced ETS careers and research. Together, these stackable credentials will offer flexible entry points while building a nationally recognized ETS education pathway.

In Year 5, the team concentrated on foundational efforts to scope the program and ensure alignment with industry and institutional needs. Achievements include a USU credentialing program report summarizing requirements and opportunities, an IRB-approved survey instrument for gathering input from ASPIRE's Industry Board members, and initial sessions with industry partners to define critical ETS skills. The team also advanced a systematic literature review on non-degree STEM credentialing and prepared scholarly outputs, including a conference paper. The team continues to ideate on a consortium-level grant proposal aimed at bringing community and technical colleges into ASPIRE as electrification workforce development partners. These potential partnerships would enable community and technical colleges to work regionally with researchers, contractors, and skilled trades workers implementing technology pilots for curriculum design and credential planning.

Looking ahead, Task 4.4 will expand into a broader **ETS Career Pathways initiative**, connecting trades, community colleges, four-year institutions, and beyond, supported by outreach materials that guide students and jobseekers into electrified transportation careers.

Project 4 Task 5: Community Engagement & Governance
Team: Fawn Groves, Staff, USU; Emma Mecham, Faculty, USU; Polly Parkinson, Student, USU; Jennifer Ramos-Chavez, Postdoc/Staff, UTEP; Nick Roberts, Faculty, USU; Jorge Hernandez Ramiro, Student, USU; Nadia Gkritza, Faculty, Purdue; Ben O'Brien, Student, Purdue
Task Summary
Task 4.5 focuses on strengthening ASPIRE's community connections by developing and disseminating educational resources, creating pathways to workforce participation, and supporting mutual understanding between ASPIRE and community members in matters pertaining to electrified transportation. This work emphasizes engagement in urban communities where testbeds are located, as well as in rural communities, ensuring that electrification advances are developed and communicated in decipherable, meaningful, and community-informed ways. ASPIRE faculty, staff, and students alike engage broadly with local communities. Further partnering with local institutions and agencies provides additional opportunities to inform, listen, and collaborate. These activities leverage existing models and engagement frameworks

developed across ASPIRE campuses, ensuring consistent messaging while allowing for local adaptation.

In Year 5, the team made strong progress toward its goals. Highlights include engaging directly with hundreds of community members at events such as UTEP's Orange & Blue Day, USU's E-Week Community Night, and DWPT public information sessions hosted by Purdue in conjunction with INDOT. In Indiana, the team also designed survey tools to measure public perceptions of electrification and medium- and heavy-duty ZEV adoption. Survey analysis of more than 450 residents in Greater Lafayette is yielding key information about how communities perceive EVs and DWPT technology.

The Task 4.5 team further reached its goals through dedicated efforts to impact both youth and adult populations. In Utah, the team developed workforce pathway booklets and related outreach materials that describe ETS careers, required credentials, and local training opportunities. These resources are being shared in print and digital formats and disseminated via career events, community partner outlets, and schools. Task contributors are also creating presentations, surveys, and interactive displays to support outreach around ASPIRE testbeds and broader electrification initiatives. A focus on K–12 audiences ensures that younger learners gain exposure to STEM careers in electrified transportation through hands-on activities, STEM nights, and targeted learning sessions.

Project 4 Task 6: Social Systems and Impact Research
Team: Brandon Allen, Faculty, Purdue; Jennifer Ramos-Chavez, Staff, UTEP; Penelope Espinoza, Faculty, UTEP; TBD, Student, UTEP; Fawn Groves, Staff, USU; Polly Parkinson, Student, USU; Emma Mecham, Faculty, USU; Hillary Swanson, Faculty, USU; Allisia Dawkins, Student, US
Task Summary
Task 4.6 entails research that focuses on impact and outcomes in relation to ASPIRE activities focused on engagement, education, and outreach. Leveraging the ongoing work within other tasks in Project 4, task contributors aim to work on their respective research that leads to conference and/or journal publications that communicate the research findings. In Year 5, the team advanced research across ASPIRE institutions to better understand the learning impacts of ASPIRE-themed curricula, how students develop STEM identity as a result of such exposure, and how community perspectives inform the adoption of electrification technologies.

One major area of effort involved surveying community perceptions of medium- and heavy-duty electric vehicles (MDHD EVs) in Northwest Indiana. Results are being used to inform publications on community engagement and provide practical insights into how electrification is understood and valued at the community level. In Utah, analysis of survey data contributed to the development of a best-practices publication, highlighting strategies for incorporating community perspectives into electrified transportation planning and outreach.

On the educational side, the team investigated the role of EV-focused education programs in shaping student interest in engineering and awareness of the social implications in relations to

electrified transportation systems. This included designing and piloting a technical education program to engage high school students, while also analyzing interviews and surveys from students at ASPIRE partner schools. Findings underscored the importance of culturally relevant education, family influence, and school resources in fostering positive STEM identities and supporting pathways into engineering.

Task 4.6 also produced multiple professional outputs, including conference papers, journal submissions, and presentations. These deliverables documented impacts of ASPIRE-led K–12 programs, community needs and perspectives, and factors influencing the STEM identity of youth. Together, they provide both scholarly contributions and practical resources for embedding justice and widespread availability in electrified transportation initiatives.

Looking forward, the team will continue to strengthen collaborations with schools, community organizations, and industry partners. Through its integration of research and outreach, Task 4.6 ensures that ASPIRE's technical progress remains responsive to community needs while advancing clear pathways for the future engineering workforce.

4.4 Project 4 Associated Project Summaries

Title: WestSmartEV@Scale

Team: Fawn Groves (USU), Emma Mecham (USU), Polly Parkinson (USU)

Partners: Utah Women in Trades, Utah Clean Cities Coalition, SLC Neighborhood House

Abstract / summary: WestSmartEV@Scale (WSEV) reached its close in December 2024. Overarching goals of the project came to fruition through twelve synergistic subprojects encompassing five critical EV application focus areas, one of which was titled Community and Workplace. The project's final desired outcome is to create an enduring regional ecosystem across the Intermountain West to sustain accelerated growth in freight, business, and consumer use of electric vehicles. ASPIRE Task 4.5 supported these outcomes through a pointed focus on workforce development in targeted areas, supported by robust community engagement.
Alignment with Center goals: WSEV efforts associated with ASPIRE Task 4.5 supported Center Goal 5, fostering an informed public across diverse, community-based audiences, and Goal 6, launching community-based efforts to proactively create pathways for this multifaceted workforce. Task 4.5 further supported Goal 4, equitable approaches to electrification, drawing pointed attention and response to community stakeholder perspectives.

Questions addressed and approach: Workforce development efforts concentrated primarily in Salt Lake City's near-port area. Six collaborative neighborhoods, self-branded as the Westside, represent a strong ethic of neighborhood stewardship and community identity. Simultaneously, the Westside has navigated historic challenges around economic growth, including workforce development. This made it an opportune location for focused WSEV efforts.

Given ASPIRE's testbed pilot projects under development at the Utah Inland Port, the Center focused on strong community engagement in the Westside's near-port neighborhoods. In

addition to educating residents generally about transportation electrification and ASPIRE's local projects, WSEV's workforce development efforts culminated in the development of a workforce information brochure highly relevant to Westside audiences. Extensive research into relevant careers, credentials required, and local opportunities for career training resulted in an accessible, information-dense publication that continues to be useful not only for Westside residents, but additionally, for career seekers across northern Utah. The booklet continues to be disseminated through strategic partners and events, and can be accessed electronically at https://utahelectrification.com.

Title: DOE-FOA-0002611: MD-HD ZEV Infrastructure Planning with Focus on I-80 Midwest (IN-IL-OH) Corridor

Team: Brandon Allen, Daniel O'Connor, Ryan Lisek, Chiara Cervini

Partners: Cummins Inc., Drive Clean Indiana, Indiana Toll Road

Abstract / summary:
Zero emission MD-HD vehicles hold great promise for providing reduced operational cost, support of improved air quality especially in disadvantaged communities, and lower carbon emissions from the transportation industry. However, the greatest challenge preventing widespread adoption of zero emissions vehicles (ZEV) is the **lack of adequate charging and/or H2 fueling infrastructure**. This project is applying innovative tools and detailed stakeholder outreach to develop a regional **EV charging and H2 fueling plan**, for **MD-HD vehicles**, for the **state of Indiana road network with a focus on the I-80 corridor in Ohio, Indiana, and Illinois**. This associated project is led by efforts in Project 2, while task 4.5 supports public engagement and perspective research.

Alignment with Center goals:

- **Goal 4: Equitable Transition**
  - Through planning infrastructure to improve air quality and reduce pollution in disadvantaged communities, particularly in Northwest Indiana.
  - Through direct community outreach with minority-owned businesses, faith institutions, and civil rights groups to ensure the benefits of electrification are shared equitably.
  - Through creating a replicable community outreach framework for equitable planning.
- **Goal 5: Informed Public**
  - Through engaging stakeholders and sharing project plans to inform communities and industry partners on the transition to ZEVs, also incorporating their feedback.
- **Goal 6: Diverse Workforce**
  - Through investigating a technical education program (Cummins TEC) to create a model for workforce development, creating a pipeline of skilled technicians.

Questions addressed and approach:

Community Outreach: Task 4.5 is conducting public engagement activities to understand community needs with respect to MD-HD transportation, how MD-HD ZEVs and infrastructure will impact them, and providing education on the technology, plan, and possible benefits. A public engagement survey was disseminated in Indiana in August 2025 to understand Indiana residents' knowledge and perceptions of ZEVs, particularly medium-duty and heavy-duty (MD-HD) vehicles, fueling options, and charging infrastructure. The survey explores views on the environmental and social impacts of ZEVs and the I-80 corridor project to inform future planning. The team is also collaborating to develop a Clean Transportation Technical Education (CTTE) high-school program focused on energy resiliency.

4.5 Project 4 Year 6 Project Proposal

Project Proposal

(Amendments made on 8/12/25 reflected in Task 4.1, 4.5 and 4.6)

Project: 4 - Pathways
Project Lead: Brandon Allen

Project Overview:
The NSF ASPIRE Engineering Research Center aims to develop new infrastructure, specifically 1,000 miles of electrified roadway embedded within US road systems, that will catalyze the widespread adoption of electric vehicles. In support of these goals, Project 4 - Pathways, through ongoing cross-institutional and multidisciplinary collaborations, aims to cultivate and strengthen a multifaceted engineering workforce prepared to take on the challenges of transportation in the US. Project 4's approach is informed by formal engineering education research, theoretical frameworks, and engineering best practices, thus our strategy to achieve our goals entails:

1) Building pathways of support for students with different learning approaches to succeed within the center and beyond;

2) Developing engineering curricula that address key competencies in systems-of-systems thinking, integrating technical knowledge, professional skills, and a human-centric approach to advance sustainable mobility and infrastructure that serves the needs of society as a whole;

3) Deploying participatory learning strategies, from K-12 through undergraduate and graduate education, to the technical and professional workforce, and in informal settings for all ages, including broad public dissemination of technological advances, methods, and tools; and

4) Advance research in EV-related technologies and socio-technical infrastructures that address societal challenges and ensure the needs, concerns, and opportunities of all communities are considered.

Project 4 contributors aim to decipher, understand, and address the challenges of informing the broader public and preparing a workforce equipped to meet the needs and demands of the growing field of transportation electrification. In doing so, Project 4's efforts span a learning spectrum from K-Gray audiences and integrates informed methodologies to develop and disseminate educational and informational resources to targeted and broad audiences. Though there is a strong and urgent need to provide technical training, Project 4 is not structured to directly provide technical workforce training programs for the electrified transportation industry. The Pathways team recognizes this critical need is possible only through collaborations with industry members to co-develop ideas, disseminate opportunities, and serve as a platform for career resources that support workforce development in this rapidly evolving field and hope to engage in this endeavor in forthcoming years.

Meaningful engagement with stakeholders and communities is essential to ensuring that EV-related advancements address real-world transportation challenges and benefit society as a whole. Through partnerships with industry, educators, and local communities, Pathways fosters dialogue and collaboration to align workforce development and educational initiatives with regional and national needs. Community-driven approaches help inform the design, implementation, and accessibility of EV technologies, ensuring their successful integration into diverse environments.

Additionally, the Pathways Project embraces a convergent approach, integrating expertise across ASPIRE Projects (1-4) including engineering disciplines, social sciences, industry, and education to create holistic solutions for electrified transportation. By bridging technical innovation with workforce development and public engagement, we ensure that the transition to sustainable mobility is seamless, broadly available to all, and effective.

Project Milestones:

Project Milestone Name	***Description***	***Center Goal(s) Alignment***	***Please describe how it contributes to the Center Goal***	***Societal Impact Target***
Path1	Develop and implement educational resources and programs supporting electrification technology, policy, and adoption education.	5 & 6	By creating curricula and programs that inform learners of all ages of the implications of transportation, e.g. on the environment, towards the economy and	4 & 5

			for communities, and innovative approaches to transportation, e.g. electric vehicles, they are made aware of the potential benefits of electrification and opportunities for them. Also, engaged audiences will learn of pathways in ETS careers.	
Path2	Develop and disseminate electrified transportation systems (ETS) career pathway resources.	5 & 6	This task provides real-world and up-to-date information on opportunities across all post-secondary spaces (i.e., high school concurrent enrollment, community and technical colleges, trades apprenticeships, former military occupational training, and former incarcerated occupational forging workforce) on pathways in careers related to electrified transportation.	4 & 5

Path 3	Create and implement ASPIRE-themed, EWD-focused and responsive community outreach and education programs and resources.	4 & 5	Community engagement efforts consider stakeholder perspectives and needs, which are then generalized into models integrated into ASPIRE testbeds for broader use. Also, the efforts in this task help us understand public need, in turn inform our learning and engagement strategies to enhance the broader public's awareness and understanding about electrification and workforce opportunities.	4 & 5
Path4	Holistic development in the ERC through cross-institutional mentoring programs, comprehensive involvement of center faculty as well as IIB and EAB members in the Student Cohort program, and additional professional development opportunities for all ERC members.	6	Fostering student engagement, mentorship and industry exposure for students within and outside the center, increases the awareness of ETS technology and career pathways within our own center and beyond.	4 & 5

Path5	Track and evaluate ASPIRE-themed performance metrics in an end-of-year report including: educational impacts, community experiences and perceptions, outreach participation, training effectiveness, and student engagement indicators of success.	4, 5, & 6	Performance metrics allows for evaluation of efforts and the identification of gaps in our aim to publicize and promote ASPIRE's efforts while also providing pathways towards careers and opportunities within ETS.	5

Project Budget:

Project 4 Total NSF Funding Request: $1,031,044.89

- Request by campus:
  - CUB: $106,730.86
  - PU: $374,359.52
  - USU: $300,017.80
  - UTEP: $249,936.71

Budget Spreadsheet

Task Proposals:

Year 6 Pathways Proposed Tasks

Task	Name	Task Lead
4.1	Pre-College Curricula, Engagement and Professional Development	(Removed: Jennifer Taylor, UCB)
4.2	REU, Higher Education Curricula and Engagement	Brandon Allen, PU
4.3	Student Engagement and Center-Wide Mentorship	Melanie Conrad, USU

4.4	Post-secondary Electrification Pathway Non-Degree Credentialing	Angela Minichiello, USU
4.5	Community Engagement and Governance	Fawn Groves, USU
4.6	Social Systems and Impact Research	Brandon Allen, PU
4.7	Economic Impact of Workforce Development on Grid Reliability	Matt Ohland, PU

4.6 Project 4 Year 5 Project Milestones

Project Milestone Name	***Description***	***Center Goal(s) Alignment***	***Please describe how it contributes to the Center Goal***	***How should this milestone be measured?***
L&E 1 *Development and Implementation of Pre-College Programs and Engagement Supporting EV Wireless Charging Technology Education*	*Expand on ongoing ASPIRE-themed K-12 curriculum development, engagement, and teacher professional development. Year 5 curricula, engagement, and PDs will be of high-quality, standards-aligned focused on wireless charging systems with the potential for scalable, cumulative impact.*	*This milestone aligns with Center Goals 5 and 6*	*Pre-College efforts during year 5 contributes to the center goals by producing curricula and activities that inform K-12 learners and their teachers of the implications of transportation on the environment and the economy, and they are aware of the potential benefits of electrification and opportunities for them. Also, engaged audiences will learn of pathways in ETS careers.*	*Number of programs; number of students/ educators served; number of engagement events/ activities*
L&E 2 *Host and support the REU program, conduct an annual analysis of students and program, and implement an*	*Create ASPIRE-related research and educational opportunities for undergraduate and graduate students with the intention to broaden participation of*	*This milestone aligns with Center Goals 5 and 6*	*Higher Education efforts in this task contribute to the center goals by enhancing our efforts to inform audiences of the*	*Number of REU participants; Entrepreneur Workshop Series as a replicable deliverable; Number of students in DCI*

Entrepreneur Workshop series. Refine and expand on DCI courses to be delivered at ASPIRE campuses.	*students, particularly those of under-represented groups, in ETS-related research. Developed and implement a 500-level synchronous, online course on Diversity, Equity, and Inclusion that is open to ERC students across campuses.*		*implications of transportation on the environment and the economy, and building their awareness of the potential benefits of electrification and research/career opportunities for them.*	*courses; publication in academic journal examining impact of REU on student researchers*
***L&E 3** Holistic development in the ERC through cross-institutional mentoring programs, holistic involvement from IIB and EAB members in the Student Cohort program, and create additional professional development opportunities for all ERC members*	*Develop mentoring programs that support mentorship of students, faculty, and staff, consisting of cross-institutional mentoring programs, near-peer student mentoring programs, internships and networking/ mentoring from IIB and EAB members.*	*This milestone aligns with Center Goals 5 and 6*	*Center development efforts in this task contribute to the center goals by increasing the awareness of ETS technology and career pathways within our own center, particularly among the student-base, as well as our IIB partners.*	*Number of students participating in mentorship programs; number of new faculty serving as mentors on cohort trips; number of students placed in internships with IIB; SLC SWOT analysis;*
***L&E 4** Development of Electrified Transportation Systems (ETS) pathway catalogue via ASPIRE-approved leveled stackable credentials (badges and certificates), including 2-year college opportunities and pathways*	*Determine best practices and methodology to develop a framework that outlines pathways for ETS credentialing programs through literature review. Create a report on the credentialing processes at core ASPIRE institutions. Develop initial framework/curricular layout for the 3 credentials (2-yr level, 4 yr level, grad level) and plan of action.*	*This milestone aligns with Center Goals 5 and 6*	*Higher Education efforts, specifically those within the 2-year degree space, in this task contribute to the center goals by providing educational resources and information within the ETS-related engineering workforce. Through the inherent outreach and engagement of this task, audiences are informed of the*	*Development of a framework that outlines pathways for credentialing programs; Literature review that leads to an abstract for academic conference paper*

			implications of transportation on the environment and the economy.	
L&E 5 *Creation and implementation of ASPIRE-themed, EWD-focused, and DCI-responsive informal replicable and scalable education programming and resources emphasizing and building career pathways in ETS.*	*Leverage and expand the impact of ASPIRE's existing relationships with numerous local organizations to create and disseminate engaging, informative resources educating audiences, particularly under-resourced communities, of workforce pathways related to ETS and tangible training opportunities. Continued outreach and engagement associated with ASPIRE-related work and progress through ASPIRE-sponsored and community sponsored events and activities.*	*This milestone aligns with Center Goals 4, 5, and 6*	*Community engagement efforts in this task contribute to the center goals as the engagement taking place takes into account stakeholder perspectives and needs, which are then generalized into models integrated into ASPIRE testbeds for broader use. Similarly to other tasks in this project the efforts in this task helps us understand public need, in turn inform our learning and engagement strategies to enhance public awareness about ETS's and workforce opportunities.*	*Number of outreach events; number of people served; production of scalable and replicable educational materials*
L&E 6 *Conduct research on ASPIRE-themed educational impacts; community experiences, perceptions, and impacts of social justice surveys in Indiana; analyze data from Utah and develop best practice*	*Conduct research on the impacts /effectiveness of ASPIRE-themed educational programs. Use modeled community surveys to conduct research in other ASPIRE affiliated communities, specifically in Indiana. Analyze findings from community research in Utah to produce a publication on best*	*This milestone aligns with Center Goals 4, 5, and 6*	*Social context and justice research efforts in this task contribute to the center goals as the engagement and research taking place take into account stakeholder perspectives, which are then generalized into models integrated into ASPIRE*	*Number of conference presentations communicating research results; number of publications illustrating the research that took place*

publication based on efforts and data; and compile and analyze multi-year REU data.	*practices for community outreach/ engagement.*		*testbeds for broader use. Similarly to other tasks in this project this research helps us understand public need, in turn informing our learning and engagement strategies to enhance public awareness about ETS's and workforce opportunities.*	

Project 4 Year 5 Project Milestone Progress and Center Goal Alignment



Appendix VIII – Bibliography of Publications

Year 5 Publications:

Authors	Title	Where Published or Presented	Date	Link to Publication:	Thrust
M. Gulzar, R. M. Raja, R. Zane, H. Wang	A Novel Direct Duty-to-Current Control for DC Bias Mitigation in Dual Active Bridge Converters for Enhanced EV Applications	2024 IEEE Workshop on Control and Modeling for Power Electronics (COMPEL)	Jun-24	https://ieeexplore.ieee.org/abstract/document/10613974	Charging Stations
G. Plett, M.Trimboli	Perspectives on methods to overcome obstacles to physics-based models of LIB for EV	International Conference on Electrical, Computer and Energy Technologies	Jul-24	https://doi.org/10.1109/ICECET61485.2024.10698098	Charging Stations
M. Trimboli, G. Plett	Perspectives on employing physics-based battery management for electric vehicles	International Conference on Electrical, Computer and Energy Technologies	Jul-24	http://dx.doi.org/10.1109/ICECET61485.2024.10698397	Charging Stations
G. Plett, G. McVeigh	Sensitivity of lithium-ion battery SOH estimates to sensor measurement error and latency	International Conference on Electrical, Computer and Energy Technologies	Jul-24	http://dx.doi.org/10.1109/ICECET61485.2024.10698712	Charging Stations
A. Zade, S. Gurudiwan, D. Maksimovi, R. Zane	High-Bandwidth Control of a 20-kW Single-Stage Unfolding-Based AC-DC Converter Using the Extra Element Theorem and Current Emulation Technique	IEEE Transactions on Power Electronics	Jul-24	https://ieeexplore.ieee.org/abstract/document/10587134	Charging Stations
A. Z. Mohammed, L.Jenkins, R. Hatch, G. Y Dayanikli, C. Simpson, R.	The IEMI Effect: On the Efficacy of PCB-Level Countermeasures in Adversarial Environments	2024 IEEE 9th European Symposium on Security and Privacy (EuroS&P)	Jul-24	https://ieeexplore.ieee.org/abstract/document/10628528	Charging Stations

Gerdes, H. Wang					
A. K. de Souza, G. Plett, M. Trimboli	Interconnected sigma-point Kalman filter application for electrochemical state estimation of lithium-ion batteries	American Control Conference	Jul-24	https://doi.org/10.23919/ACC60939.2024.10645023	Charging Stations
T.Newbolt, P. Mandal, H. Wang, R. Zane	Feasibility of Dynamic Wireless Power Transfer to Mitigate Load Demands Under Resiliency Events	2024 IEEE Power & Energy Society General Meeting (PESGM)	Jul-24	https://ieeexplore.ieee.org/abstract/document/10761075	Charging Stations
D. Bernal, A. Raheem, H. Wang	Assessment of Economic Viability of Direct Current Fast Charging Infrastructure Investments for Electric Vehicles in the United States	Sustainability	Aug-24	https://doi.org/10.3390/su16156701	Charging Stations
J. Whitaker, D. Redmond, G. Droge, J. Gunther	Scheduling Battery-Electric Bus Charging under Stochasticity using a Receding-Horizon Approach	IEEE Transactions on Intelligent Transportation Systems	Aug-24	https://arxiv.org/abs/2408.04087	Charging Stations
W. Hileman, M. Trimboli, G. Plett	Estimating the values of the PDE model parameters of rechargeable lithium-metal battery cells using linear electrochemical impedance spectroscopy	ASME Letters in Dynamic Systems and Control	Oct-24	https://doi.org/10.1115/1.4066464	Charging Stations
A. Sultana, X. Ma, R. Hu, H. Wang	Power Scheduling and Cost Optimization of a Grid Integrated PV and BESS Fast Charging using SARSA Reinforcement Learning	2024 IEEE 100th Vehicular Technology Conference (VTC2024-Fall)	Oct-24	https://ieeexplore.ieee.org/abstract/document/10756801	Charging Stations
G. Plett	A linear method to fit equivalent circuit model parameter values to HPPC	ASME Letters in Dynamic Systems and Control	Oct-24	https://doi.org/10.1115/1.4066626	Charging Stations

	relaxation data from lithium-ion cells				
S. D. Niafenderi, P. Mandal, H. Wang, R. Zane	DER-Integrated Grid Operations Under Extreme Weather Events Incorporating DWPT System	2024 56th North American Power Symposium (NAPS)	Oct-24	https://ieeexplore.ieee.org/abstract/document/10741701	Charging Stations
T. Newbolt, P. Mandal, H. Wang, R. Zane	DWPT-Integrated Microscopic Traffic Flow for Distribution Grid Voltage Stability Analysis	2024 56th North American Power Symposium (NAPS)	Oct-24	https://ieeexplore.ieee.org/abstract/document/10741859	Charging Stations
P. Bradford, A. Zade, S. Gurudiwan, H. Wang	A Novel Thermal Modeling Analysis for Liquid-Cooled High-Power EV Chargers	2024 IEEE Energy Conversion Congress and Exposition (ECCE)	Oct-24	https://ieeexplore.ieee.org/abstract/document/10861307	Charging Stations
T. Newbolt, M. Waite, P. Mandal, H. Wang, R. Zane	Load demand modeling of large-scale charging infrastructure for electric vehicles in-motion	IEEE Access	Nov-24	https://ieeexplore.ieee.org/abstract/document/10750800	Charging Stations
T. Lhaden, H. Xu, Bill Tseng, M. Pokojovy, D. U. Castañeda, F. Rahman, C. Huang	Development and Optimal Design of Electric Vehicle Charging Station Digital Twin	IISE Annual Conference. Proceedings	Nov-24	https://www.proquest.com/openview/60320ae63070362be3b1bc882b49b65f/1?pq-origsite=gscholar&cbl=51908	Charging Stations
J. Desai, J. K. Mathew, N. J. Sturdevant, D. Bullock	Longitudinal Monitoring of Electric Vehicle Travel Trends Using Connected Vehicle Data	World Electric Vehicle Journal	Dec-24	https://doi.org/10.3390/wevj15120560	Charging Stations
S. Gurudiwan, A. Zade, H. Wang, R. Zane	Optimized Timing Control for Leading-Edge Aligned Modulation of a T-Type Bridge in Unfolding-Based AC-DC Converters	IEEE Transactions on Power Electronics	Dec-24	https://ieeexplore.ieee.org/document/10787264	Charging Stations

S. Gurudiwan, A. Zade, H. Wang, R. Zane	Nonlinear Capacitance-Based Accurate ZVS Analysis for Full-Bridge T-Type Resonant Converters	2024 IEEE Energy Conversion Congress and Exposition (ECCE)	Feb-25	https://ieeexplore.ieee.org/abstract/document/10860915	Charging Stations
Z. M. Pinter, M. Marinelli, M. Trimboli, G. Plett	Linear continuous-time regression and dequantizer for lithium-ion battery cells with compromised measurement quality	World Electric Vehicle Journal	Feb-25	https://doi.org/10.3390/wevj16030116	Charging Stations
P. Bradford, C. Deppe, H. Wang	Novel Approach of Determining and Predicting SiC MOSFET's On Resistance From Device Case Temperature Using Machine Learning	2025 IEEE Applied Power Electronics Conference and Exposition (APEC)	Mar-25	https://ieeexplore.ieee.org/abstract/document/10977206	Charging Stations
R. Serrano, A. Sultana, D. Kavanaugh, H. Wang	Increasing Electric Vehicle Charger Availability with a Mobile, Self-Contained Charging Station	Sustainability	Mar-25	https://www.mdpi.com/2071-1050/17/6/2767	Charging Stations
S. Paul, A. Singh, D. Maksimovic, L. Corradini, H. Nguyen, N. Milivojevic, D. Maksimovic, L. Corradini	A Universal DC Fast Charging Front-End with Optimized Film Capacitor Design	40th IEEE Applied Power Electronics Conference and Exposition (APEC)	May-25	https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=10977436	Charging Stations
A. Singh, S. Paul, T. Bhuse, T. Martin, H. Nguyen, I. Vedula, N. Milivojevic, D. Maksimovic, L. Corradini	Versatile Controller Architecture for a Universal DC Fast Charging Front-End	40th IEEE Applied Power Electronics Conference and Exposition (APEC)	May-25	https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=10977448	Charging Stations

D. Goodrich, A. Zade, S. Gurudiwan, M. Mansour, R. Zane, H. Wang	Small-Signal Modeling and Damping Design of Unfolding-Based Single Stage AC-DC Converter Using the Extra Element Theorem	2025 IEEE Applied Power Electronics Conference and Exposition (APEC)	May-25	https://ieeexplore.ieee.org/document/10977164	Charging Stations
A. Zade, S. Gurudiwan, R. Zane	Small-Signal Phasor Modeling of T-Type Bridge-Based Single-Sided and Double-Sided LCC Resonant Converters for WPT Applications	2025 IEEE Applied Power Electronics Conference and Exposition (APEC)	May-25	https://ieeexplore.ieee.org/abstract/document/10977075	Charging Stations
A. Zade, R. Zane	Accurate Small-Signal Phasor Transformation-Based Modeling of Secondary-Side Diode-Bridge Rectifiers for Battery Charging Applications	2025 IEEE Applied Power Electronics Conference and Exposition (APEC)	May-25	https://ieeexplore.ieee.org/abstract/document/10977532	Charging Stations
M. Martin, J. Goodridge	The Economic Feasibility of Electric Vehicle Charging Stations: A Capital Budgeting Approach	International Association of Energy Economics	Jun-25	https://iaee2025paris.org/download/contribution/abstract/527/527_abstract_20250116_211154.pdf	Charging Stations
I. Lopetegui, S. Fernandez, G. Plett, M. Trimboli, U. Iraola	Electrode State of Charge and State of Heanth Estimation with Electrode-Level Equivalent-Circuit Models	Journal of the Electrochemical Society	Jun-25	https://doi.org/10.1149/1945-7111/ade297	Charging Stations
S. Poddar, R. Zane	Estimation of Minimum Dead Time to Counter Resonance Mistuning in DAB-SRC for DCX Operation	COMPEL	Jun-25	https://ieeexplore.ieee.org/document/11121254	Charging Stations
S. Poddar, R. Zane	Dynamic Modeling of the Resonant Series-Bridge DCX Converter	COMPEL 2025	Jul-25	https://ieeexplore.ieee.org/document/11121199	Charging Stations

S. Reese, D. Maksimovic	Data-Driven Component-Level Design of Switching Power Converters Using Predictive Modeling	IEEE Transactions on Power Electronics	Aug-25	https://ieeexplore.ieee.org/document/10938920	Charging Stations
O. Moncada, P. O. Iglesias, J. Haddock	Assessment of Deflections in a Flexible Pavement Section Containing Embedded Dynamic Wireless Power Transfer (DWPT) Components	International Society of Asphalt Pavements (ISAP)	Jun-24	https://link.springer.com/chapter/10.1007/978-3-031-67252-1_105	Electrified Roadways
O. Moncada, P. O. Iglesias, J. Haddock	Assessment of Static Load Strains in a Flexible Pavement with Embedded Dynamic Wireless Power Transfer (DWPT) Components	10th International Conference on Maintenance and Rehabilitation of Pavements (MAIREPAV)	Jul-24	https://link.springer.com/chapter/10.1007/978-3-031-63584-7_18	Electrified Roadways
Z. Imran, O. Moncada, C. Vickers, D. Aliprantis, J. Haddock, S. Pekarek, A. Brovont	Full-scale thermal and mechanical testing of pavement with embedded high-power dynamic wireless power transfer coil	IEEE Trans. Transp. Electrif.	Jun-25	https://ieeexplore.ieee.org/document/10843265	Electrified Roadways
O. Moncada, J. Li, P. O. Iglesias, J. Haddock	Structural Modeling and Assessment of Rigid Pavement with Embedded Dynamic Wireless Power Transfer Components	2025 IEEE Wireless Power Technology Conference and Expo (WPTCE)	Jun-25	https://doi.org/10.1109/WPTCE62521.2025.11062229	Electrified Roadways
V. Mehar, N. Frooninckx, I. Abram, S. Pekarek, D. Aliprantis, A. Brovont, R. Swanson	Receiver-side power control of a 200-kW three-phase DWPT system for heavy-duty vehicles	IEEE Wirel. Power Transf. Conf. Expo (WPTCE)	Jun-25	https://ieeexplore.ieee.org/document/11062153	Electrified Roadways
I. Abram, N. Frooninckx, V. Mehar, A. Brovont, S. Pekarek, D.	Fabrication and characterization of roadway-embedded DWPT transmitter coils	IEEE Transp. Electrif. Conf. Expo (ITEC)	Jun-25	https://ieeexplore.ieee.org/document/11097935	Electrified Roadways

Aliprantis, R. Swanson					
H. Ahmed, R. Zane, A. Kamineni, Y. Liu	Partial Inductance Analysis for PCB Litz Coils in Wireless Power Transfer Systems	2025 IEEE Wireless Power Technology Conference and Expo (WPTCE)	Jul-25	https://ieeexplore.ieee.org/document/11062268	Electrified Roadways
L. Stepback, J. Valle	Engineering Ethics and Unionization: Challenging NSPE's Positions on Engineers' Relationship with Labor Unions	American Society for Engineering Education Annual Conference	Jun-24	https://peer.asee.org/engineering-ethics-and-unionization-challenging-nspe-s-positions-on-engineers-relationship-with-labor-unions	Learning and Engagement
J. Taylor, N. Stites, J. Ramos-Chavez	Developing and Piloting a High School Engineering Design Course with Environmental Justice and Geospatial Visualization	2025 ASEE Annual Conference & Exposition	Jun-25	https://peer.asee.org/developing-and-piloting-a-high-school-engineering-design-course-with-environmental-justice-and-geospatial-visualization-evaluation	Learning and Engagement
P. Parkinson, F. Groves, E. Mecham, A. Wilson-Lopez, I. Santiago	Designing Electric Vehicle Infrastructures and Opportunities to Benefit All Residents	American Society for Engineering Education Conference Publication	Jun-25	https://peer.asee.org/designing-electric-vehicle-infrastructures-and-opportunities-to-benefit-all-residents-traditional-research-paper	Learning and Engagement

F. Zinnah, A. Minichiello, M. Asghar	Work in Progress: Impact of Non-Degree Credentials on STEM Workforce Development-A Systematic Literature Review	2025 ASEE Annual Conference	Jun-25	https://peer.asee.org/work-in-progress-impact-of-non-degree-credentials-on-stem-workforce-development-a-systematic-literature-review	Learning and Engagement
J Ramos-Chavez, J. Taylor, I. Santiago	Redefining High School Engineering Education: Integrating Environmental Justice for Transformative Learning Experiences	American Society for Engineering Education 2025 ASEE Annual Conference & Exposition	Jun-25	https://nemo.asee.org/public/conferences/365/papers/47451/view	Learning and Engagement
G. Cervini, J. Jung, K. Gkritza	Temperature as a Key Predictor of Electric Vehicle Adoption: Insights from California and New York	Forum for Innovative Sustainable Transportation Systems (FISTS)	Feb-24	https://ieeexplore.ieee.org/abstract/document/10485540	Systems of Systems
D. Aliprantis, J. Qin, S. Seetharaman	Real-time charging control for electric roadways: formulation and causal algorithms	IEEE Power Energy Soc. Gen. Meet.	Jul-24	https://ieeexplore.ieee.org/document/10689067/	Systems of Systems
G. Cervini, J. Jung, K. Gkritza	Temperature and electric vehicle adoption: A ZIP code-level analysis in the US	Transportation Research Part D: Transport and Environment	Nov-24	https://doi.org/10.1016/j.trd.2024.104435	Systems of Systems
M. Cruz, E. Y. Rineh, S. Luna, R. Cheu, Z. Song	Using statewide transportation planning model to forecast demand for electric vehicle charging at stations along intercity highways	International Journal of Transportation Science and Technology	Nov-24	https://www.sciencedirect.com/science/article/pii/S2046043024001333	Systems of Systems
N. Horesh, J. Quinn	Fuel shifts reduce most of the greenhouse gas emissions from transportation in the United States	Communications Earth & Environment	Dec-24	https://doi.org/10.1038/s43247-024-01924-4	Systems of Systems

J. Silberstein, D. Mendoza, E. Rieves, C. Reid, M. Hannigan	Investigating the spatiotemporal distribution of fine particulate matter sources during persistent cold air pools in Salt Lake County	Atmospheric Environment	Dec-24	https://doi.org/10.1016/j.aeaoa.2024.100305	Systems of Systems
K. C. Wijaya, P. Humagain, K. Gkritza	Public preferences for stationary wired and dynamic wireless electric vehicle charging technologies	Transportation Research Part D: Transport and Environment	Mar-25	https://doi.org/10.1016/j.trd.2025.104680	Systems of Systems
J. Ling, X. Qian, K. Gkritza	Electric vehicles vs. internal combustion engine vehicles: A comparative study of crashes involving vulnerable road users	International Journal of Transportation Science and Technology	Mar-25	https://doi.org/10.1016/j.ijtst.2025.03.006	Systems of Systems
J. Qin	Joint Optimization of Transportation-Energy Systems Through Electric Vehicle Charging Pricing in the Morning Commute	IEEE Open Journal of Intelligent Transportation Systems	Apr-25	https://ieeexplore.ieee.org/document/10947487	Systems of Systems
J. Silberstein, R. Sasse, M. Harjamaki, M. Rhodes, J. Cooper, R. Downey, M. Ritsch, M. Hannigan, B. Argrow	Deployment of a fixed-wing small uncrewed aircraft system for urban traffic-related air pollution assessment	Journal of Atmospheric and Oceanic Technology	Jul-25	https://journals.ametsoc.org/view/journals/atot/42/4/JTECH-D-24-0042.1.xml	Systems of Systems
A. Paskett, Z. Song, A. Graul	Drivers and barriers to bus electrification in the United States: Transit agency's perspective	Transportation Research Part D: Transport and Environment	Jul-25	https://www.sciencedirect.com/science/article/abs/pii/S1361920925001312	Systems of Systems
A. Graul, S. B. Hasnat	Investigating the Differential Effectiveness of Incentives to Accelerate Consumers' Electric Vehicle Adoption	SCP Annual Conference, Las Vegas, NV. February 2025.	Jul-25	https://myscp.org/wp-content/uploads/2025/02/scp25_det_2-25.pdf	Systems of Systems

C. Frischmon, J. Silberstein, A. Guth, J. Porter, E. Mattson, M. Hannigan	Improving the quantification of peak concentrations for air quality sensors via data weighting	Atmospheric Measurement Techniques	Jul-25	https://doi.org/10.5194/amt-18-3147-2025	Systems of Systems
M. V. Saheli, P. Singleton, A. Graul	Beyond time and cost: Exploring the importance of factors in travel mode choices	Travel Behaviour and Society	Oct-25	https://doi.org/10.1016/j.tbs.2025.101098	Systems of Systems

Year 4 Publications:

Authors	Title	Where Published or Presented	Date	Link to Publication:	Thrust
A. Zade, C. Reddy Teeneti, M. Mansour, S. Gurudiwan, B. Hesterman, H. Wang, R. Zane	A 21 kW Unfolding-Based Single-Stage AC-DC Converter for Wireless Charging Applications	IEEE Journal of Emerging and Selected Topics in Power Electronics	Aug-23	https://ieeexplore.ieee.org/document/10236447	Charging Stations
A. K. de Souza, W. Hileman, M. Trimboli, G. Plett	A closed-form impedance model for rechargeable lithium-metal batteries	IFAC World Congress	Jul-23	https://www.sciencedirect.com/science/article/pii/S2405896323009503	Charging Stations
A. K. de Souza, G. Plett, M. Trimboli	A model predictive control-based state of power estimation algorithm using adaptive weighting	35th Electric Vehicle Symposium	Jun-22	https://doi.org/10.26226/m.628e4d5240b9604ad9d7a039	Charging Stations
J. Whitaker, G. Droge, M. Hansen, D. Mortensen, J. Gunther	A Network Flow Approach to Battery Electric Bus Scheduling	IEEE Transactions on Intelligent Transportation Systems	Sep-23	https://doi.org/10.1109/TITS.2023.3276269	Charging Stations

I. Lopetegui, G. Plett, M. Trimboli, A. K. de Souza, L. Oca, E. Miguel, U. Iraola	A New Battery SOC/SOH/eSOH Estimation Method Using a PBM and Interconnected SPKFs: Part I. SOC and Internal Variable Estimation	Journal of the Electrochemical Society	Mar-24	https://iopscience.iop.org/article/10.1149/1945-7111/ad30d4	Charging Stations
I. Lopetegui, G. Plett, M. Trimboli, A. K. de Souza, L. Oca, E. Miguel, U. Iraola	A New Battery SOC/SOH/eSOH Estimation Method Using a PBM and Interconnected SPKFs: Part II. SOH and eSOH Estimation	Journal of the Electrochemical Society	Mar-24	https://iopscience.iop.org/article/10.1149/1945-7111/ad30d5	Charging Stations
H. Wang, M. Waite	A New Current-fed Inductive Wireless Charging Transmitter for Large-scale EV In-motion Wireless Charging Infrastructure	2024 IEEE Wireless Power Technology Conference and Expo (WPTCE)	Jun-24	https://ieeexplore.ieee.org/abstract/document/10557341/keywords#keywords	Charging Stations
A. K. de Souza, G. Plett, M. Trimboli	A physics-based electrode-level thermal model for advanced battery management	The 35th Electric Vehicle Symposium	Jun-22	https://www.morressier.com/o/event/628df6271ed96000127174c6/article/628e4d5240b9604ad9d7a03a	Charging Stations
D. Mortensen, J. Gunther	A Scalable Approach to Minimize Charging Costs for Electric Bus Fleets	World Electric Vehicle Journal	Apr-24	https://doi.org/10.3390/wevj15040161	Charging Stations
S. Gurudiwan, A. Zade, H.e Wang, R. Zane	Accurate ZVS Analysis of a Full-Bridge T-Type Resonant Converter for a 20-kW Unfolding-Based AC-DC Topology	IEEE Open Journal of Power Electronics	Jul-24	https://ieeexplore.ieee.org/abstract/document/10530476	Charging Stations
M. Rasheed, H. Wang, R. Zane, R. Hassan, M. Kamel, S. Tong, K. Smith	Active Reconditioning of Retired Lithium-ion Battery Packs from Electric Vehicles for Second Life Applications	IEEE Journal of Emerging and Selected Topics in Power Electronics	Oct-23	https://ieeexplore.ieee.org/abstract/document/10286848	Charging Stations

M. Ghorbani, H. Wang, N. Roberts	Analytical and numerical modeling of phase change material and hybrid PCM-heat sinks for high-power wireless EV charging	International Communications in Heat and Mass Transfer	May-24	https://doi.org/10.1016/j.icheatmasstransfer.2024.107460	Charging Stations
H. Wang, R. Hu, T. Nguyen, H. Sun	Authentication and PHY-Security Schemes for Electric Vehicle Dynamic Wireless Charging	IEEE Transactions on Vehicular Technology	Sep-23	https://ieeexplore.ieee.org/abstract/document/10261276	Charging Stations
O. Watson, A. Kamineni, A. Al Mehadi	Comparative Analysis of MILP and RL Algorithms for EV Charging Scheduling at Airport Parking	Kansas Power and Energy Conference 2024	Jul-24	https://www.kpec-ksu.org/home	Charging Stations
S. Alam, M. T. Hassan, J. Merrell, J. Lee	Comparative Analysis of Water-Induced Response in 3D-Printed SCF/ABS Composites under Controlled Diffusion	SAMPE Journal	Jul-24	https://www.nasampe.org/store/viewproduct.aspx?id=24155070	Charging Stations
D. Mortensen, J. Gunther, G. Droge, J. Whitaker	Cost Minimization for Charging Electric Bus Fleets	World Electric Vehicle Journal	Dec-23	https://www.mdpi.com/2032-6653/14/12/351	Charging Stations
W. Hileman, G. Plett, M. Trimboli, T. Rüther, M. A. Danzer	Demystifying the Distribution of Relaxation Times: A Simulation-Based Investigation into the Limits and Possibilities of Interpretation for Lithium-Ion Batteries	Journal of the Electrochemical Society	Jun-24	https://iopscience.iop.org/article/10.1149/1945-7111/ad4fe5	Charging Stations
F. Soltani, P. Singleton	Electric vehicle charging infrastructure deployment: A discussion of equity and justice theories and accessibility measurement	Transportation Research Interdisciplinary Perspectives	Mar-24	https://doi.org/10.1016/j.trip.2024.101072	Charging Stations

J. Morgan, H. Wang, R. Zane	Energy Packet Reservation and Optimization System for Electric Vehicle Energy Cost and Charging Station Peak Demand Reduction	2024 IEEE Power & Energy Society Innovative Smart Grid Technologies Conference (ISGT)	Feb-24	https://ieeexplore.ieee.org/abstract/document/10454209	Charging Stations
J. Mahlberg, J. Desai, D. Bullock	Evaluation of Electric Vehicle Charging Usage and Driver Activity	World Electric Vehicle Journal	Nov-23	https://doi.org/10.3390/wevj14110308	Charging Stations
X. Ma, Y. Zhou, H. Zhang, Q. Wang, H. Sun, H. Wang, R. Q. Hu	Exploring Communication Technologies, Standards, and Challenges in Electrified Vehicle Charging	IET Communication	Jul-24	https://arxiv.org/abs/2403.16830	Charging Stations
M. Rasheed, C. Simpson, H. Wang, R. Zane	Multi-mode Control of the Energy Transfer Unit in Capacitively-coupled Hybrid Battery Packs for Enhanced Auxiliary DC Bus Regulation	2023 IEEE Energy Conversion Congress and Exposition (ECCE)	Oct-23	https://ieeexplore.ieee.org/abstract/document/10362315	Charging Stations
D. Lu, M. Trimboli, G. Plett, G. Fan, C. Zhu, X. Zhang	Nondestructive diagnostics and quantification of battery aging under different degradation paths	Journal of Power Sources	Feb-23	https://www.sciencedirect.com/science/article/abs/pii/S0378775322015324?via%3Dihub	Charging Stations
O. Watson, A. Kamineni, A. Al Mehadi	Optimized Two-Stage Scheduling for Electric Vehicle Charging: A Machine Learning Approach	I-ETC Conference - Innovations & Solutions for Todayâ€™s Challenges	Jul-24	https://www.uvu.edu/cet/i-etc/	Charging Stations
O. Moncada, J. Haddock	Performance Evaluation of Power Transfer Roadways	Purdue 110th Road School	Mar-24	https://docs.lib.purdue.edu/roadschool/2024/presentations/22/	Charging Stations

H. Wang	Silicon Carbide MOSFETs Aging Testing Platform for EV Chargers Using Power Cycling	2024 IEEE 10th International Power Electronics and Motion Control Conference (IPEMC2024-ECCE Asia)	May-24	https://ieeexplore.ieee.org/abstract/document/10567447	Charging Stations
J. Desai, J. Mahlberg, D. Bullock, J. K. Mathew, H. Li	Using Connected Vehicle Data to Evaluate National Trip Trends	Applied Sciences	Sep-23	https://doi.org/10.3390/app131810228	Charging Stations
S. Gurudiwan, A. Zade, R. Hatch, H. Wang, R. Zane	ZVS boundary assessment for t-type-based dual active bridge series resonant converters using state-plane analysis	2024 IEEE Applied Power Electronics Conference and Exposition (APEC)	Feb-24	https://ieeexplore.ieee.org/abstract/document/10509450	Charging Stations
O. Moncada, S. Nazarian, C. Tirado, J. Haddock, H. Cruz, B. Jahangiri	Analyzing the Mechanical Response of a Calibrated Finite Element Model for Flexible Pavement with Embedded Dynamic Wireless Power Transfer Technology.	Transportation Research Record	Apr-24	https://doi.org/10.1177/03611981241242077	Electrified Roadways
S. Pekarek	Calculating inductance in a 2-D method of moments model, Engineering Analysis with Boundary Elements	Engineering Analysis with Boundary Elements	May-24	https://www.sciencedirect.com/science/article/pii/S0955799724000584	Electrified Roadways
A. Brovont, D. Aliprantis, V. Mehar, S. Pekarek	Design of a compact rectangular three-phase dynamic wireless power transfer receiver for compatibility with a preexisting transmitter	IEEE Wireless Power Transfer Conf. & Expo (WPTCE)	May-24	https://ieeexplore.ieee.org/document/10557306	Electrified Roadways

A. Brovont, D. Aliprantis, V. Mehar, S. Pekarek	Design of a Compact Rectangular Three-Phase Dynamic Wireless Power Transfer Receiver for Compatibility with a Preexisting Transmitter	2024 IEEE Wireless Power Technology Conference and Expo (WPTCE)	May-24	https://ieeexplore.ieee.org/abstract/document/10557306	Electrified Roadways
D. Aliprantis	Electric Roadways with Dynamic Wireless Power Transfer	Pylons	May-24	https://cigre.gr/?smd_process_download=1&download_id=1344	Electrified Roadways
V. Mehar, A. Brovont, S. Pekarek, D. Aliprantis	Misalignment estimation in a three-phase transverse-pole DWPT system	2024 IEEE Applied Power Electronics Conference and Exposition (APEC)	Feb-24	https://ieeexplore.ieee.org/document/10509327	Electrified Roadways
V. Mehar, A. Brovont, S. Pekarek, D. Aliprantis	Misalignment Estimation in a Three-Phase Transverse-Pole DWPT System	IEEE Applied Power Electronics Conference	May-24	https://ieeexplore.ieee.org/abstract/document/10509327	Electrified Roadways
M. Chawla, D. Maksimovic, A. Kamineni	Nearly Constant Power Tuning Network for Wireless Inductive Power Transfer Systems	2023 IEEE Wireless Power Technology Conference and Expo (WPTCE)	Aug-23	https://ieeexplore.ieee.org/document/10216214	Electrified Roadways
M. A. Zahid, M. Hansen, M. Chawla, A. Kamineni, R. Zane	Robust Communicationless Control Strategy to Synchronize In-Motion Secondary to the Primary	Wireless Power Technologies Conference and Expo (WPTCE 2024)	Jun-24	https://doi.org/10.1109/WPTCE59894.2024.10557307	Electrified Roadways
H. Swanson, L. Lawrence	A Preliminary Model for Responsive Co-Design	International Conference of the Learning Sciences	Jun-24	https://www.academia.edu/117406701/A_Preliminary_Model_for_Responsive_Co_Design	Learning and Engagement

R. Clawson	Combatting Sexual Harassment in the Field Is Fundamental to the Research Enterprise	PS: Political Science & Politics	Apr-24	https://doi.org/10.1017/S1049096523000951	Learning and Engagement
A. Dawkins	Expanding STEM through Exploration of a STEM Identity Ecosystem	International Conference of the Learning Sciences	Jun-24	https://www.academia.edu/117410570/Expanding_STEM_through_Exploration_of_a_STEM_Identity_Ecosystem	Learning and Engagement
L. Lawrence, I. Solola, H. Swanson, B. Jones	How research practice partnerships build comfort and strengthen collaborations as research agendas shift	International Society of the Learning Sciences	Jun-24	https://par.nsf.gov/biblio/10492192	Learning and Engagement
L. Lawrence, I. Solola, H. Swanson	How research practice partnerships build comfort and strengthen collaborations as research agendas shift.	International Conference of the Learning Sciences	Jun-24	https://doi.org/10.22318/icls2024.948456	Learning and Engagement
J. Valle, L. Stepback, A. Minichiello, M. Ohland, P. Parkinson	Pathways From Engineering Programs to Labor Unions	American Society for Engineering Education. 2024 Conference Proceedings.	Jun-24	https://www.asee.org/events/Conferences-and-Meetings/ASEE-Conference-Proceedings-Search	Learning and Engagement
H. Swanson, L. Lawrence	Responsive Teaching in the Context of Theory-Building Activities	International Conference of the Learning Sciences	Jun-24	https://www.academia.edu/117406628/Responsive_Teaching_in_the_Context_of_Theory_Building_Activities	Learning and Engagement

I. Solola, H. Swanson, L. Lawrence	The Impact of Responsive-Teaching-Focused Co-design on Teacher Practice	International Conference of the Learning Sciences	Jun-24	https://www.academia.edu/117407680/The_Impact_of_Responsive_Teaching_Focused_Co_design_on_Teacher_Practice	Learning and Engagement
I. Solola, H. Swanson, L. Lawrence	The Role of generative AI in qualitative research: GPT-4's contributions to a grounded theory analysis	Learning Design and Technology Symposium	Jun-24	https://doi.org/10.1145/3663433.3663456	Learning and Engagement
N. Horesh, D. Trinko, J. Quinn	Comparing costs and climate impacts of various electric vehicle charging systems across the United States	Nature Communications	Jun-24	https://doi.org/10.1038/s41467-024-49157-5	Systems of Systems
T. Ruan, Q. Lv, T. Priyam	Demographic-Based Public Perception Analysis of Electric Vehicles on Online Social Networks	Sustainability	Dec-23	https://doi.org/10.3390/su16010305	Systems of Systems
J. Sinton, G. Cervini, K. Gkritza, Z. Song, S. Labi	Examining electric vehicle adoption at the postal code level in US states	Transportation Research Part D	Jan-24	https://doi.org/10.1016/j.trd.2024.104068	Systems of Systems
T. Ruan, Q. LV	Exploring equity perception of electric vehicles from a social media perspective	Transportation Research Interdisciplinary Perspectives	May-24	https://www.sciencedirect.com/science/article/pii/S2590198224000897	Systems of Systems
P. Ranjitkar, S. Sheng, R. Majhi	Optimal allocation of dynamic wireless charging facility for electric vehicles	Transportation Research Part D: Transport and Environment	Sep-22	https://doi.org/10.1016/j.trd.2022.103461	Systems of Systems
J. G. Araiza, I. Santiago, S. Luna	Perceptions of Electric Vehicle Adoption Through Natural Language Processing and Machine Learning	2024 IEEE International Systems Conference (SysCon)	Apr-24	https://ieeexplore.ieee.org/abstract/document/10553625	Systems of Systems

T. Ruan, Q. LV	Public Perception of Electric Vehicles on Reddit and Twitter: A Cross-platform Analysis	Transportation Research Interdisciplinary Perspectives	Jun-23	https://authors.elsevier.com/sd/article/S2590-1982(23)00119-7	Systems of Systems
Y. Sang, I. Zunnurain	Real-time Charging Scheduling for Electric Vehicle Aggregators in the Ancillary Service Market	2023 IEEE PES General Meeting	Jul-23	https://ieee-pes.org/	Systems of Systems
K. Santacruz, H. Caballero, Y. Sang, E. Castillo	Reducing Marginal Emissions in Power Systems with Distributed Flexible AC Transmission Systems	2023 North American Power Symposium (NAPS)	Nov-23	https://ieeexplore.ieee.org/abstract/document/10318590	Systems of Systems
J. Anderson, M. Harper	Save Money, Get Charged: Facility-Tied Energy Management with Unknown and Unscheduled EV Charging	International Conference on Intelligent Transportation Systems (ITSC)	Aug-23	https://2023.ieee-itsc.org/	Systems of Systems
X. Qian, K. Gkritza	Spatial and temporal variance in public perception of electric vehicles: A comparative analysis of adoption pioneers and laggards using twitter data	Transport Policy	Feb-24	https://doi.org/10.1016/j.tranpol.2024.02.011	Systems of Systems
J. Montagu, C. Torres-Machi, K. Baker, S. Curtis, C. Crozier	Trends in equitable electric vehicle adoption and impacts on pavement condition and electric power infrastructure	ASCE Construction Research Congress	Mar-24	https://doi.org/10.1061/9780784485279.081	Systems of Systems
J. Dcosta, A. Graul, S. B. Hasnat	Understanding Consumer Adoption of Light-Duty Electric Vehicles: An Interdisciplinary Literature Review	Transportation Research Record	May-24	https://doi.org/10.1177/03611981241231	Systems of Systems

N. Horesh, J. Quinn, J. Ducheine	Understanding the Health Impacts of Vehicular Emissions in South Florida: A Comprehensive Analysis	FIU Undergraduate Research Journal	May-24	https://digitalcommons.fiu.edu/undergraduate-journal/vol2/iss1/5	Systems of Systems

Year 3 Publications:

Authors	Title	Where Published or Presented	Date	Link to Publication:	Thrust
S. Gurudiwan, R. Hatch, M. Mansour, H. Wang, R. Zane	An 18 kW Battery Charger Module for Extreme Fast Charging Applications Using an Unfolding-Based AC-DC Topology	2023 IEEE Applied Power Electronics Conference and Exposition (APEC)	Jun-23	https://ieeexplore.ieee.org/abstract/document/10131542	Charging Stations
A. Zade, C. Teeneti, S. Gurudiwan, S. Poddar, M. Mansour, R. Zane	Analysis and Mitigation of Sector Transition Distortions for Unfolding-based Grid-tied AC-DC Converters	APEC	Jul-23	https://ieeexplore.ieee.org/document/10131393	Charging Stations
L. Miller, J. Morgan, R. Zane, H. Wang	Distribution Bus Voltages as a Metric for Grid Health Considering Widespread Public EV Charging	2023 IEEE 14th International Symposium on Power Electronics for Distributed Generation Systems	Jun-23	http://www.ieee-pedg2023.org/index.html	Charging Stations
M. Rasheed, H. Wang, R. Zane, M. Kamel, K. Smith	Investigation of Active Life Balancing to Recondition Li-ion Battery Packs for 2nd Life	2020 IEEE 21st Workshop on Control and Modeling for Power Electronics (COMPEL)	Sep-20	https://ieeexplore.ieee.org/abstract/document/9265808	Charging Stations
T. Martin, B. Majmunovic, I. Vedula, D. Maksimov	Modular Series-Stacked Bidirectional AC/DC Architecture for 3-Phase Grid-Tied Applications	2023 IEEE Applied Power Electronics Conference and Exposition	Mar-23	https://ieeexplore.ieee.org/document/10131613	Charging Stations

M. Rasheed, C. Simpson, H. Wang, R. Zane	Multi-Loop Control of Hybrid Li-ion Battery Packs Using the Auxiliary DC Bus for State-of-Charge Regulation	2022 IEEE Energy Conversion Congress and Exposition (ECCE)	Oct-22	https://ieeexplore.ieee.org/abstract/document/9947462	Charging Stations
J. Larsen, A. Kamineni, N. Roberts, M. Halling, P. Vaikasi, A. Barnes	Test Platform to Evaluate Pavement Embedded Wireless Charging Pads	WPW	May-23	https://ieeexplore.ieee.org/document/9901325	Charging Stations
H. Xu, M. Pokojovy, B. Tseng, A. Anum, D. Gyalpo, Y. Wen	Advanced technology for stationary charging -- remaining useful life prediction for batteries	The Southwest Data Science Conference 2023 at Baylor University	Mar-23	http://www.doi.org/10.13140/RG.2.2.12205.87524	Charging Stations
B. Majmunovic, S. Mukherjee, T. Martin, D. Maksimov	1 kV, 10-kW SiC-Based Quadruple Active Bridge DCX Stage in a DC to Three-Phase AC Module for Medium-Voltage Grid Integration	IEEE Transactions on Power Electronics	Jul-23	https://ieeexplore.ieee.org/document/9827483	Charging Stations
A. Kawakit, W. Hileman, M. Trimboli, G. Plett	A Control-Oriented Reduced-Order Model for Lithium-Metal Batteries	IEEE Control Systems Letters	Dec-22	https://ieeexplore.ieee.org/document/9999023	Charging Stations
J. Whitaker, G. Droge, M. Hansen, D. Mortensen, J. Gunther	A Network Flow Approach to Battery Electric Bus Scheduling	IEEE Transactions on Intelligent Transportation Systems	Sep-23	https://ieeexplore.ieee.org/document/10137347	Charging Stations
H. Wang, R. Zane, R. Hassan	A New Online Continuous Stability Monitoring Method for DC Microgrids	IEEE Transactions on Power Electronics	Jun-23	https://ieeexplore.ieee.org/abstract/document/10147367	Charging Stations
H. Wang, M. Rasheed, R. Zane, R. Hassan, M. Kamel, S. Tong	Life-Extended Active Battery Control for Energy Storage Using Electric Vehicle Retired Batteries	IEEE Transactions on Power Electronics	Mar-23	https://ieeexplore.ieee.org/abstract/document/10058580/	Charging Stations
D. Lu, M. Trimboli, G. Plett, Y. Wang	Modeling Voltage Decay During Calendar-Life Aging	Journal of the Electrochemical Society	Dec-22	https://iopscience.iop.org/article/10.1149/1945-7111/acaa5d	Charging Stations

D. Lu, M. Trimboli, G. Plett, G. Fan, Y, Wang	Nondestructive EIS Testing to Estimate a Subset of Physics-Based-Model Parameter Values for Lithium-Ion Cells	Journal of the Electrochemical Society	Aug-22	https://iopscience.iop.org/article/10.1149/1945-7111/ac824a	Charging Stations
Y. Gao, V. Sankaranarayanan, D. Maksimov, E. Dede, Y. Zhou, F. Zhou, R. Erickson	Thermal Design, Optimization, and Packaging of Planar Magnetic Components	IEEE Transactions on Components, Packaging and Manufacturing Technology	May-23	https://ieeexplore.ieee.org/document/9514527	Charging Stations
B. Hesterman, M. Mansour, R. Zane, D. Yelaverthi	CLLLC Dual Active Bridge with Novel Insulation Approach for SST Applications	2021 IEEE Applied Power Electronics Conference and Exposition (APEC)	Jun-23	https://ieeexplore.ieee.org/document/9487105	Charging Stations
T. Skinner, D. Goodrich, C. Sabin, M. Waite, A. Zade, H. Wang	Design and Control of Three-phase Smart Inverter Using Gate-drive Integrated Gallium Nitride (GaN) Devices for Solar Energy Integration	2023 IEEE Applied Power Electronics Conference and Exposition (APEC)	Jun-23	https://ieeexplore.ieee.org/abstract/document/10131198	Charging Stations
T. Newbolt, P. Mandal, H. Wang, R. Zane	Diverse Effects of Dynamic Wireless Power Transfer Roadway In-Motion Electric Vehicle Charging	2023 IEEE Power & Energy Society Innovative Smart Grid Technologies Conference (ISGT)	Mar-23	https://ieeexplore.ieee.org/document/10066429	Charging Stations
R. Nimri, M. Mansour, B. Hesterman, R. Zane, C. Teeneti, A. Kamineni, H. Wang, D. Yelaverthi	Hardware Considerations of an Inductive Power Transfer Pad For Heavy-Duty Electric Vehicle Charging	2022 Wireless Power Week (WPW), Bordeaux, France, 2022	Jun-23	https://ieeexplore.ieee.org/document/9901330	Charging Stations
T. Newbolt, P. Mandal, H. Wang	Implementation of Battery EVs and BESS into RAPSim Software to Enrich Power Engineering Education	2021 North American Power Symposium (NAPS)	Jun-23	https://ieeexplore.ieee.org/document/9654476	Charging Stations

	in DER-Integrated Distribution Systems				
A. Agostino, A. Prasad, D. Haddad, S. Pekarek, A. Brovont	Modeling and Multi-Physics Optimization of High-Power Dynamic Wireless Charging Systems	IEEE Transportation Electrification Conference & Expo (ITEC)	May-23	10.1109/ITEC53557.2022.9813848	Charging Stations
P. Ziegenfelder, N. Roberts, H. Wang	Novel Gerber File-based Numerical Modeling and Simulation for Thermal Analysis of Printed Circuit Boards	2023 IEEE Applied Power Electronics Conference and Exposition (APEC)	Jun-23	https://ieeexplore.ieee.org/abstract/document/10131578	Charging Stations
M. Ghorbani, H. Wang, N. R	Numerical Study of Thermal Management Systems Using Phase Change Materials integrated with heat sink for Wireless Super-Fast Charging Stations of EVs in Constant Heat Flux Condition	Summer Heat Transfer Conference - ASME (American Society of Mechanical Engineering)	Jul-23	https://event.asme.org/Events/media/library/resources/shtc/SHTC-2023-Final-Program.pdf	Charging Stations
A. Wilson-Lopez, J. Taylor, I. Santiago	Principles for Designing Engineering Curricula Grounded in Environmental Justice	American Society of Engineering Education	May-23	https://strategy.asee.org/principles-for-designing-engineering-curricula-grounded-in-environmental-justice	Charging Stations
T. Newbolt, P. Mandal, H. Wang, R. Zane	Priority Load Control for Dynamic WPT Roadway in Electrified Transportation Infrastructure	2023 IEEE Power and Energy Society General Meeting (PESGM)	Nov-23	https://pes-gm.org/gm-2023/program/	Charging Stations
J. Valle, N. Maiga, R. Krishnan, J. Ng, J. Mulrow	Reconfigurations of Life Cycle Assessment: Valuing Life over Lithium	American Society for Engineering Education	Jun-23	https://nemo.asee.org/public/conferences/327/papers/38821/view	Charging Stations
N. Horesh, J. Quinn, Y. Zhou	Home charging for all: Techno-economic and life cycle assessment of multi-unit dwelling	Journal of Cleaner Production	May-23	https://doi.org/10.1016/j.jclepro.2022.135551	Charging Stations

	electric vehicle charging hubs				
I. Zunnurain	Improving the resilience of large-scale power systems using distributed static series compensators	International Journal of Electrical Power & Energy Systems	Jul-23	https://www.sciencedirect.com/science/article/abs/pii/S0142061522006986	Charging Stations
A. Brovont, S. Pekarek	Integral Evaluation for a Closed-Form 2-D Potential Formulation of the Galerkin BEM	, Engineering Analysis with Boundary Elements	May-23	https://doi.org/10.1016/j.enganabound.2021.03.007	Charging Stations
J. Desai, D. Bullock, J. Mathew, H. Li	Leveraging Connected Vehicle Data to Assess Interstate Exit Utilization and Identify Charging Infrastructure Investment Allocation Opportunities	World Electric Vehicle Journal	May-23	https://doi.org/10.3390/wevj13090167	Charging Stations
T. Newbolt, P. Mandal, H. Wang, R. Zane	Sustainability of Dynamic Wireless Power Transfer Roadway for In-motion Electric Vehicle Charging	IEEE Transactions on Transportation Electrification	Mar-23	https://ieeexplore.ieee.org/document/10081503	Charging Stations
D. Lu, M. Trimboli, G. Plett	Cell Discharge Testing to Calibrate a Positive-Electrode Open-Circuit-Potential Model for Lithium-Ion Cells	Journal of the Electrochemical Society	Jul-22	https://iopscience.iop.org/article/10.1149/1945-7111/ac8249	Charging Stations
J. Larsen, M. Zahid, A. Kamineni, R. Zane, A. Baig	Investigation of Split LCCL Tuning Network for High Power WPT Systems	IEEE Wireless Power Technology Conference and Expo 2023	Jul-23	https://ieee-wptce.org/	Electrified Roadways
A. Brovont, S. Pekarek, C. Vickers, V. Mehar, R. Swanson	Characterization and validation of a rectangular three-phase dynamic wireless power transfer system with low output-power ripple	2023 IEEE Wireless Power Technology Conference and Expo (WPTCE)	Jun-23	https://ieee-wptce.org	Electrified Roadways

A. Brovont, D. Aliprantis, S. Pekarek, A. Agostino, D. Haddad	Design and Analysis of a Three-Phase Dynamic Wireless Power Transfer System for Heavy-Duty Electric Vehicles Considering Misalignment	2022 Wireless Power Week (WPW), Bordeaux, France	Jul-22	https://ieeexplore.ieee.org/abstract/document/9901341	Electrified Roadways
S. Inoue, A. Kamineni, R. Zane, A. Curtis, S. Oni, N. Flann	Generative Neural Network Approach to Designing Dynamic Inductive Power Transfer Systems	IEEE Wireless Power Technologies and Expo 2023	Jun-23	https://ieee-wptce.org/program-overview/	Electrified Roadways
M. Chawla, A. Zade, T. Newbolt, P. Mandal, A. Kamineni, H. Wang, R. Zane	Modeling and Comparative Analysis of Power Distribution Architectures for Large-scale Electric Vehicle In-motion Wireless Charging Infrastructures	2022 Wireless Power Week (WPW)	Jun-23	https://ieeexplore.ieee.org/abstract/document/9901363	Electrified Roadways
S. Inoue, D. Goodrich, R. Nimri, A. Kamineni, R. Zane, S. Saha, N. Flann	Fast Design Optimization Method Utilizing a Combination of Artificial Neural Networks and Genetic Algorithms for Dynamic Inductive Power Transfer Systems	IEEE Open Journal of Power Electronics	Nov-22	https://doi.org/10.1109/OJPEL.2022.3224422	Electrified Roadways
A. Brovont, D. Aliprantis, S. Pekarek, C. Vickers, V. Mehar	Magnetic Design for Three-Phase Dynamic Wireless Power Transfer With Constant Output Power	IEEE Transactions on Energy Conversion	Jun-23	https://ieeexplore.ieee.org/abstract/document/10041972	Electrified Roadways
A. Dawkins, L. Lawrence, H. Swanson,	Comparing the pedagogical strategies of teachers who codesigned units to support students' theory building	International Conference of the Learning Sciences	Jun-23	https://www.academia.edu/102360052/Comparing_the_pedagogical_strategies_of_teachers_who_codesigned_units_to_support_students_theory_building	Learning and Engagement

H. Swanson, L. Lawrence, J. Arnell, A. Dawkins, B. Jones, B. Sherin, U. Wilensky	How Co-Designing Computational Modeling Activities Helped Teachers Implement Responsive Teaching Strategies	ACM Conference on Learning Design and Technology	Jun-23	https://www.academia.edu/102811450/How_Co_Designing_Computational_Modeling_Activities_Helped_Teachers_Implement_Responsive_Teaching_Strategies?sm=b	Learning and Engagement
A. Wilson-Lopez, I. Santiago, E. Mecham, F. Groves, J. Ramos-Chavez, P. Parkinson	Community Perceptions of Procedural and Distributive Justice in Engineered Systems: A Case Study of Community-Engaged Vehicular Electrification	2023 American Society of Engineering Education Annual Conference	Jun-23	https://peer.asee.org/community-perceptions-of-procedural-and-distributive-justice-in-engineered-systems-a-case-study-of-community-engaged-vehicular-electrification	Learning and Engagement
J. Desai, R. Sakhare, D. Bullock, J. Mathew, H. Li, D. Horton	National Mobility Analysis for All Interstate Routes in the United States: August 2022	Purdue e-Pubs	Jan-23	https://doi.org/10.5703/1288284317585	Systems of Systems
J. Desai, R. Sakhare, D. Bullock, J. Mathew, H. Li, D. Horton	National Mobility Analysis for All Interstate Routes in the United States: December 2022	Purdue e-Pubs	Feb-23	https://doi.org/10.5703/1288284317591	Systems of Systems
C. Allred, M. Harper, H. Kocabas	Divide and Survey: Observability Through Multi-Drone City Roadway Coverage	International Smart Cities Conference (ISC2)	Jun-23	https://ieeexplore.ieee.org/abstract/document/9922207	Systems of Systems
C. Bailey, M. Harper,	Improving Real-Time Energy-Efficient Trajectory Planning Via Machine Learning	International Conference on Robotic Computing (IRC)	Jun-23	https://ieeexplore.ieee.org/abstract/document/9699988	Systems of Systems
C. Bailey, M. Harper, B. Jones, M. Clark, R. Buck	Electric Vehicle Autonomy: Realtime Dynamic Route Planning and Range Estimation Software	International Conference on Intelligent Transportation Systems (ITSC)	Jun-23	https://ieeexplore.ieee.org/document/9922244	Systems of Systems

N. Gkritza, K. Kuy, D. Chen, C. Peng, S. Labi	Agent-based Simulation Model for Electric Vehicle Long-Distance Trips in the State of Indiana	Transportation Research Record, Journal of the Transportation Research Board	Jun-23	https://doi.org/10.1177/03611981221107921	Systems of Systems
T. Konstantinou, K. Gkritza	A multi-criteria decision-making approach for a statewide deployment of dynamic wireless charging for electric vehicles	Advances in Transportation Studies: an international Journal	May-23	https://tinyurl.com/2p9p8pue	Systems of Systems
T. Konstantinou, S. Labi, K. Gkritza	Assessing highway revenue impacts of electric vehicles using a case study	Research in Transportation Economics	May-23	https://doi.org/10.1016/j.retrec.2022.101248	Systems of Systems
T. Konstantinou, K. Gkritza	Examining the barriers to electric truck adoption as a system: A Grey-DEMATEL approach	Transportation Research Interdisciplinary Perspectives	May-23	https://www.sciencedirect.com/science/article/pii/S2590198222002068?via%3Dihub	Systems of Systems
S. Sheng, B. Sharp, L. Wen, T. Meng, B. Du, M. Yi, K. Suomalainen, K. Gritza	Exploration of the nexus between solar potential and electric vehicle uptake: A case study of Auckland, New Zealand	Energy Policy	May-23	https://doi.org/10.1016/j.enpol.2022.113406	Systems of Systems
T. Konstantinou, C. Gkartzonikas, K. Gkritza	Public acceptance of electric roadways: The case of Los Angeles, California	International Journal of Sustainable Transportation	May-23	https://doi.org/10.1080/15568318.2021.1983675	Systems of Systems

Year 2 Publications:

Authors	Title	Where Published or Presented	Date	Link to Publication	Thrust
K. Khatun, R. Zane, H. Wang, A. K. Rathore	High Gain Non-isolated Interleaved Current-fed 3-Phase Partial Series Resonance Pulse Based ZCS Voltage Quadrupler	2022 IEEE Applied Power Electronics Conference and Exposition (APEC)	Mar-2022	https://ieeexplore.ieee.org/document/9773759/	Power

M. Hansen. A. Kamineni, R. Zane	Current Harmonics Dead Time Design Method to Achieve VS with Non-Linear Output Capacitance	2021 IEEE Energy Conversion Congress and Exposition (ECCE)	Oct-21	https://ieeexplore.ieee.org/document/9595311	Power
S. Inoue, R. Nimri, A. Kamineni, R. Zane	A New Design Optimization Method for Dynamic Inductive Power Transfer Systems utilizing a Neural Network	2021 IEEE Energy Conversion Congress and Exposition (ECCE)	Oct-21	https://ieeexplore.ieee.org/document/9595560/	Power
M. Kamel, R. Zane, D. Maksimovic	Voltage Sharing with series output connected battery modules in a plug-and-play dc microgrid	IEEE Transactions on power Electronics, vol. 3, no. 11	Nov-21	https://ieeexplore.ieee.org/document/8769609/	Power
M. Kamel, V. Sankatanacavanan, R. Zane, D. Maksimovic	State-of-Charge Balancing with Parallel and Series Output Connected Battery Power Modules	IEEE Transactions on Power Electronics, vol. 37, no. 6	Jan-22	https://ieeexplore.ieee.org/document/9684985	Power
H. Alan Mantooth, R. Zane, M. Manjrekar	Guest Editorial Special Section on Cybersecurity of Power Electronics Through Hardware Hardening	IEEE Journal of Emerging and Selected Topics in Power Electronics, vol. 10, no, 1	Feb-22	https://ieeexplore.ieee.org/document/9701604/	Power
M. Mansour, D. B. Valaverthi, R. Zane	Voltage Balancing Control for Input-Series-Output-Parallel Three-Port Series Resonant Converter Modules	2022 IEEE Applied Power Electronics Conference and Exposition (APEC)	Mar-22	https://ieeexplore.ieee.org/abstract/document/9773534	Power
M. Kamel, M. M. U. Rehman, F. Zhang, R. A. Zane and D. Maksimovic	Differential Input Current Regulation in Parallel Output Connected Battery Power Modules in Parallel Output Connected Battery Power Modules	IEEE Transactions on Power Electronics, vol. 37, no. 4	Apr-22	https://ieeexplore.ieee.org/document/9573292/	Power
T. Saha, A. C. Bagchi, H. Wang, R. Zane	Bidirectional LCL-T Resonant DC-DC Converter for Priority Loads in Undersea Distribution Networks	IEEE Transactions on Power Electronics	Jun-22	https://ieeexplore.ieee.org/document/9810550/	Power

M. Rasheed, H. Wang, R. Zane	Analysis of a Five-Port Differential Power Processing Triple Active Bridge Converter for Active Cell Balancing in Lithium-ion Battery Packs	2022 IEEE 23rd Workshop on Control and Modeling for Power Electronics (COMPEL)	Jun-22	https://ieeexplore.ieee.org/document/9829999	Power
B. Maughan, A. Mustafa, R. Zane, H. Wang	Hot Swapping Analysis and System Operation of Series Connected Converters in Active Battery Reconditioning Systems for Second Life Battery Applications	2022 IEEE 23rd Workshop on Control and Modeling for Power Electronics (COMPEL)	Jun-22	https://ieeexplore.ieee.org/document/9830014	Power
A. Palomino, M. Parvania, R. Zane	Impact of COVID-19 on Mobility and Electric Vehicle Charging Load	2021 IEEE: Power & Energy, Society, General meetiong (PESGM)	Jul-21	https://ieeexplore.ieee.org/document/9638077	Adoption Power
C. Teeneti, U. Pratil G. Philips, A. Azad, M. Greig, R. Zane, C. Bodine, C. Coopmans, Z. Pantic	System-level approach to designing a smart wireless charging system for power wheelchairs	IEEE Transactions on Industry Applications, vol. 57, no. 5	Sep-21	https://ieeexplore.ieee.org/document/9468911/	Adoption Power
A Bagchi, A Kaminen;, R. Zane, R. Carison	Review and comparative analysis of topologies and control methods in dynamic wireless charging of electric vehicles	IEEE Journal of Emerging and Selected Topics in Power Electronics, vol. 9, no. 4	Aug-21	https://ieeexplore.ieee.org/document/9353572/	Transportation Power
Satyaki Mukherjee, Dragan Maksimovic	Application of Orthogonal Airgaps in High Frequency Coupled Inductors	2022 IEEE Applied Power Electronics Conference and Exposition (APEC)	Mar-22	https://ieeexplore.ieee.org/document/9773537	Power

Yeongrack Son, Satyaki Mukherjee, Rahul Mallik, Branko Majmunovic, Soham Dutta, Brian Johnson, Dragan Maksimovic, Gab-Su Seo	Levelized Cost of Energy-Oriented Modular String Inverter Design Optimization for PV Generation System Using Geometric Programming	IEEE Access (Volume 10)	Mar-22	https://ieeexplore.ieee.org/document/9729732	Adoption Power
E. Deanne Brocato, Antje R. H. Graul, Jacob Huff, Alysa Hu, Jeremy Harms	Understanding How Stand-Alone Sustainability Courses Are Taught in Marketing: A Global Baseline Analysis	Journal of Marketing Education	Mar-22	https://journals.sagepub.com/doi/abs/10.1177/02734753221083257	Adoption Equity
Jairaj Desai, Jijo K Mathew, Howell Li, Darcy M Bullock	Using Connected Vehicle Data for Assessing Electric Vehicle Charging Infrastructure Usage and Investment Opportunities	LTE Journal	Mar-22	https://ite.ygsclicbook.com/pubs/itejournal/2022/march-2022/stage/index.html#p=22	Transportation Adoption Data
Vivek Sankaranarayanan, Yucheng Gao, Robert W. Erickson, Dragan Maksimovic	Online Efficiency Optimization of a Closed-Loop Controlled SiC-Based Bidirectional Boost Converter	IEEE Transactions on Power Electronics (Volume: 37, Issue: 4)	Apr-22	https://ieeexplore.ieee.org/document/9599499	Power
Yucheng Gao, Vivek Sankaranarayanan, Ercan M. Dede, Yuqing Zhou, Feng Zhou, Robert W. Erickson, Dragan Maksimovic	Modeling and Design of High-Power, High-Current-Ripple Planar Inductors	IEEE Transactions on Power Electronics (Volume: 37, Issue: 5)	May-22	https://ieeexplore.ieee.org/document/9635661	Power
Marium Rasheed, Hongjie Wang, Regan Zane, Dragan Maksimovic, Khurram Afridi,	Composite Hybrid Energy Storage System utilizing Capacitive Coupling for Hybrid and Electric Vehicles	2021 IEEE Applied Power Electronics Conference and Exposition (APEC)	Jun-22	https://ieeexplore.ieee.org/abstract/document/9487261	Adoption Power

Gregory L. Plett, M. Scott Trimboli					
Jianglin Zhu, Dragan Maksimovic	Transformerless Stacked Active Bridge Converters: Analysis, Properties, and Synthesis	IEEE Transactions on Power Electronics (Volume: 36, Issue: 7)	Jul-22	https://ieeexplore.ieee.org/document/9288766	Power
Jairaj Desai, Jijo K. Mathew, Howell Li, Darcy M. Bullock	Analysis of Electric and Hybrid Vehicle Usage in Proximity to Charging Infrastructure in Indiana	Journal of Transportation Technologies, 11, 577-596	Oct-22	https://doi.org/10.4236/jtts.2021.114036	Transportation Adoption Power
Travis M.M. Newbolt, Paras Mandal, Hongjie Wang	Implementation of Battery EVs and BESS into RAPSim Software to Enrich Power Engineering Education in DER-Integrated Distribution Systems	2021 North American Power Symposium (NAPS)	Nov-22	https://ieeexplore.ieee.org/document/9654476	Power
Satyaki Mukherjee, Vahid Yousefzadeh, Alihossein Sepahvand, Montu Doshi, Dragan Maksimovic	A Two-Stage Automotive LED Driver with Multiple Outputs	IEEE Transactions on Power Electronics (Volume: 36, Issue: 12)	Dec-22	https://ieeexplore.ieee.org/document/9423599	Power
Hector Cruz, Adeeba Raheem, Soheil Nazarian	Digital Twin Technology Applications for Transportation Infrastructure - A Survey-Based Study	ASCE International Conference of Civil Engineering in Computing	Sep-2021	https://ascelibrary.org/doi/book/10.1061/9780784483893	Transportation
N. Horesh, C. Quinn, H. Wang, R. Zane, M. Ferry, S. Tong, J.C. Quinn	Driving to the Future of Energy Storage: Techno-economic Analysis of a Novel Method to Recondition Second Life Electric Vehicle Batteries	Applied Energy	Aug-21	https://www.sciencedirect.com/science/article/pii/S030626192100475X	Transportation Adoption Power Data

J.C. Quinn, N. Horesh, D. Trinko, T.H. Bradley	Economic and Environmental Benefits of Electrified Transportation	ITS World Congress 2021	Oct-2021	https://www.hamburg.com/mobility/its/	Transportation Adoption Data
Diala Hadda, Paloma Arellano, Daniel Bernicke, Miguel Castilho, Bryson Gilley, Zach Lagpacan, Chris Maxey, Artur Pilaszewicz, Will Young, Dionysios Aliprantis	Economic Feasibility of Dynamic Wireless Power Transfer Lanes in Indiana Freight Corridors	2022 IEEE Power & Energy Conference at Illinois (PECI)	Sep-2022	https://ieeexplore.ieee.org/document/9744037	Transportation Adoption Power Data
D. Trinko, N. Horesh, R. Zane, Z. Song, A. Kamineni, T. Konstantinou, K. Gkritza, C. Quinn, T.H. Bradely, J.C. Quinn	Economic Feasibility of In-Motion Wireless Power Transfer in A High-Density Traffic Corridor	eTransportation Volume 11, February 2022, 100154	Feb-22	https://www.sciencedirect.com/science/article/pii/S2590116821000527?casa_token=1DJ5uFY7MHUAAAAA:wTrtltVvcqSh0u0lgvVUHfx-h_ZJ4yuyiNAXEvgxnPnCxaj3nAXQ36oHD6-72rK_GWCmlrVeC6g	Transportation Adoption Power Data
Zhaocai Liu, Zhibin Chen, Yi He, Ziqi Song	Network user equilibrium problems with infrastructure-enabled autonomy	Transportation Research Part B: Methodological Volume 154, Pages 207-241	Dec-21	https://www.sciencedirect.com/science/article/pii/S0191261521001442	Data Transportation
Hossein Nasr Esfahani, Zhaocai Liu, Ziqi Song	Optimal pricing for bidirectional wireless charging lanes in coupled transportation and power networks	Transportation Research Part C: Emerging Technologies Volume 135, 103419	Feb-22	https://www.sciencedirect.com/science/article/pii/S0968090X21004137	Transportation Adoption Data
Tao Ruan, Qin Lv	Public perception of electric vehicles on reddit over the past decade	Science Direct: Elsevier: Communications in	Dec-22	https://doi.org/10.1016/j.commtr.2022.100070	Adoption Data

		Transportation Research Volume 2, 100070			
Mahmoud Mansour, Dorai Yelaverthi , Regan Zane	Voltage Balancing Control for Input-Series-Output-Parallel Three-Port Series Resonant Converter Modules	2022 IEEE Applied Power Electronics Conference and Exposition (APEC)	Mar-2022	https://ieeexplore.ieee.org/abstract/document/9773534	Power

Year 1 Publications:

Authors	Title	Where Published	Date	Link to Publication	Thrust
Al-Waled Al-Dualimi, Todd Moon, Jake Gunther	Voice Transformation Using Two-Level Dynamic Warping and Neural Networks	MDPI Signals - Special Issue on Machine Learning and SIgnal Processing	Jun-21	https://www.mdpi.com/2624-6120/2/3/28/pdf	Data
Todd Moon, Jake Gunther	Kurtosis-Based Symbol Timing and Carrier Phase/Frequency Tracking	MDPI Entropy	May-21	https://www.mdpi.com/1099-4300/23/7/819/pdf	Data
Colton Lindstrom, Randall Christensen, Jake Gunther	An Investigation of GPS-Denied Navigation Using Airborne Radar Telemetry	IEEE/ION Position, Location and Navigation Symposium (PLANS)	Apr-20	https://ieeexplore.ieee.org/document/9110233	Data
Sohan Gyawali, Shengjie Xu, Yi Qian, Rose Qingyang Hu	Challenges and Solutions for Cellular Based V2X Communications	IEEE Communications Surveys & Tutorials	Mar-21	https://ieeexplore.ieee.org/document/9217500	Data
M. Ahmadi, O. B. Adewuyi, M. S. S. Danish, P. Mandal, A. Yona, and T. Senjyu	Optimum Coordination of Centralized and Distributed Renewable Power Generation Incorporating	International Journal of Electrical Power & Energy Systems	Feb-21	https://www.sciencedirect.com/science/article/abs/pii/S0142061519341675	Power

	Battery Storage System into the Electric Distribution Network				
Y. Huang, A. Yona, H. Takahashi, A. M. Hemeida, P. Mandal, A. Mikhaylov, T. Senjyu and M. E. Lotfy	Energy Management System Optimization of Drug Store Electric Vehicles Charging Station Operation	Sustainability	May-21	https://www.mdpi.com/2071-1050/13/11/6163	Power
Chakridhar Reddy Teeneti, Rees Hatch, Dorai Babu Yelaverthi, Abhilash Kamineni, Hongjie Wang, Regan Zane	Unfolder-Based Single-Stage AC-AC Conversion System for Wireless Charging Applications	IEEEXplore	Oct-20	https://ieeexplore.ieee.org/document/9235936/	Power
Anindya Chitta Bagchi, Abhilash Kamineni, Regan Zane, Richard Barney Carlson	Comparative Analysis of DWPT Topologies and Regulation Schemes for Improved Controllability	IEEEXplore	Oct-20	https://ieeexplore.ieee.org/document/9235424/	Power
Benny J. Varghese, Regan A. Zane, Abhilash Kamineni, Reza Tavakoli, Zeljko Pantic, Chungchih Chou, Leo Liu	Multi-Pad Receivers for High Power Dynamic Wireless Power Transfer	IEEEXplore	Oct-20	https://ieeexplore.ieee.org/document/9235918/	Power
Reebal Majed Nimri, Abhilash Kamineni, Regan Zane	A Modular Pad Design compatible with SAE J2954 for Dynamic Inductive Power Transfer	IEEEXplore	Dec-20	https://ieeexplore.ieee.org/document/9291322/	Power

Benny J. Varghese, Abhilash Kamineni, Nicholas Roberts, Marv Halling, Duleepa J. Thrimawithana, Regan A. Zane	Design Considerations for 50 kW Dynamic Wireless Charging with Concrete-Embedded Coils	IEEEXplore	Dec-20	https://ieeexplore.ieee.org/document/9291275/	Power
Anindya Chitta Bagchi, Abhilash Kamineni, Regan Andrew Zane, Richard Carlson	Review and Comparative Analysis of Topologies and Control Methods in Dynamic Wireless Charging of Electric Vehicles	IEEEXplore	Feb-21	https://ieeexplore.ieee.org/document/9353572/	Power
M. Sugimura, M. M. Gamil, H. Akter, N. Krishna, M. Abdel-Akher, P. Mandal	Optimal sizing and operation for microgrid with renewable energy considering two types demand response,	Journal of Renewable and Sustainable Energy,	Nov-20	https://aip.scitation.org/doi/abs/10.1063/5.0008065?journalCode=rse	Power
S. Mukherjee, Y. Gao and D. Maksimović	Reduction of AC Winding Losses Due to Fringing-Field Effects in High-Frequency Inductors With Orthogonal Air Gaps	IEEE Transactions on Power Electronics	Jan-21	https://ieeexplore.ieee.org/document/9117192	Power
M. Khatua, A. Kumar, V. Yousefzadeh, A. Sepahvand, M. Doshi, D. Maksimovic, K. Afridi	High-Performance Megahertz-Frequency Resonant DC–DC Converter for Automotive LED Driver Applications	IEEE Transactions on Power Electronics	Oct-20	https://ieeexplore.ieee.org/document/9003198	Power

S. Mukherjee, B. Majmunovic, G.S. Seo, S. Dutta, R. Mallik, B. Johnson, D. Maksimovic	A High-Frequency Planar Transformer with Medium-Voltage Isolation	IEEE APEC 2021	Jun-21	https://ieeexplore.ieee.org/document/9487061	Power
Soham Dutta, Branko Majmunovic, Satyaki Mukherjee, Rahul Mallik, Gab-Su Seo, Dragan Maksimovic, Brian Johnson	A Novel Decentralized PWM Interleaving Technique for Ripple Minimization in Series-stacked DC-DC Converters	IEEE APEC 2021	Jun-21	https://ieeexplore.ieee.org/document/9487386	Power
Marium Rasheed, Hongjie Wang, Regan Zane, Dragan Maksimovic, Khurram Afridi, Gregory L. Plett, M. Scott Trimboli	Composite Hybrid Energy Storage System utilizing Capacitive Coupling for Hybrid and Electric Vehicles	IEEE APEC 2021	Jun-21	https://ieeexplore.ieee.org/document/9487261	Power
S. Mukherjee, A. Sepahvand, V. Yousefzadeh, M. Doshi and D. Maksimović	A Two-Stage Multiple-Output Automotive LED Driver Architecture	IEEE ECCE 2020	Oct-20	https://ieeexplore.ieee.org/document/9235835	Power
Y. Gao, V. Sankaranarayanan, R. W. Erickson and D. Maksimovic	Soft Startup Strategies for DAB-Based DCX in Composite Converters	IEEE ECCE 2020	Oct-20	https://ieeexplore.ieee.org/document/9235773	Power
Soham Dutta, Minghui Lu, Rahul Mallik, Branko Majmunovic, Satyaki Mukherjee, Gab-Su Seo, Dragan Maksimovic, Brian Johnson	Decentralized Control of Cascaded H-Bridge Inverters for Medium-Voltage Grid Integration	IEEE COMPEL 2020	Nov-20	https://ieeexplore.ieee.org/document/9265657	Power
Kyle J. Goodrick, Gab-Su Seo, Satyaki Mukherjee, Jinia Roy, Rahul Mallik, Branko Majmunovic, Soham Dutta, Dragan	LCOE Design Optimization Using Genetic Algorithm with Improved Component	IEEE ECCE 2020	Oct-20	https://ieeexplore.ieee.org/document/9236092	Power

Maksimović, Brian Johnson	Models for Medium-Voltage Transformerless PV Inverters				
Marium Rasheed, Mohamed Kamel, Hongjie Wang, Regan Zane, Kandler Smith	Investigation of Active Life Balancing to Recondition Li-ion Battery Packs for 2nd Life	2020 IEEE 21st Workshop on Control and Modeling for Power Electronics (COMPEL)	Nov-20	https://ieeexplore.ieee.org/document/9265808	Power
Mohamed Kamel, Regan Zane, Dragan Maksimovic	Voltage sharing with series output connected battery modules in a plug-and-play dc microgrid	IEEE Transactions on Power Electronics	Apr-21	https://ieeexplore.ieee.org/document/9419783	Power
Tarak Saha, Anindya Bagchi, Regan Zane	Analysis and Design of an LCL-T Resonant DC-DC Converter for Underwater Power Supply	IEEE Transactions on Power Electronics	Oct-20	https://ieeexplore.ieee.org/document/9242276	Power
Dorai Yelaverthi, Bryce Hesterman, Mahmoud Mansour, Regan Zane	CLLLC Dual Active Bridge with Novel Insulation Approach for SST Applications	IEEE Applied Power Electronics Conference, APEC	Jun-21	https://ieeexplore.ieee.org/document/9487105	Power
Tarak Saha, Anindya Bagchi, Regan Zane	Time-domain and ZVS Assistance Design for a DAB LCL-T Resonant Converter in Underwater DC Current Distribution Network	IEEE 21st Workshop on Control and Modeling for Power Electronics, COMPEL	Nov-20	https://ieeexplore.ieee.org/document/9265721	Power

Brandon Guest, M. Scott Trimboli, Gregory L. Plett	Pseudo-Steady-State Reduced-Order-Model Approximation for Constant-Current Parameter Identification in Lithium-Ion Cells	Journal of the Electrochemical Society	Jan-21	https://iopscience.iop.org/article/10.1149/1945-7111/abd44c	Power
Marcelo A. Xavier, Aloisio Kawakita de Souza, M. Scott Trimboli	A Computational Framework for Lithium Ion Cell-Level Model Predictive Control Using a Physics-Based Reduced-Order Model	IEEE Letters of the Control System Society	Dec-21	https://ieeexplore.ieee.org/document/9259035	Power
Marcelo A. Xavier, Aloisio Kawakita de Souza, M. Scott Trimboli	An LPV-MPC Inspired Battery SOP Estimation Algorithm Using a Coupled Electro-Thermal Model	Proeedings of the American Control Conference 2020	May-21	https://ieeexplore.ieee.org/document/9483433	Power
Yi He, Zhaocai Liu, Ziqi Song	Optimal charging scheduling and management for a fast-charging battery electric bus system	Transportation Research Part E: Logistics and Transportation Review	Oct-20	https://doi.org/10.1016/j.tre.2020.102056	Transportation
Sarawut Jansuwan, Zhaocai Liu, Ziqi Song, Anthony Chen	An evaluation framework of automated electric transportation system	Transportation Research Part E: Logistics and Transportation Review	Apr-21	https://doi.org/10.1016/j.tre.2021.102265	Transportation
Noah Horesh, Casey Quinn, Hongjie Wang, Regan Zane, Mike Ferry, Shijie Tong, Jason C. Quinn	Driving to the future of energy storage: Techno-economic analysis of a novel method to recondition second life	Applied Energy	Apr-21	https://www.sciencedirect.com/science/article/pii/S0306261921000475X	Power Adoption Transportation

	electric vehicle batteries				
Gökçen Yilmaz Dayanikli, Rees R. Hatch, Ryan M. Gerdes, Hongjie Wang, Regan Zane	Electromagnetic Sensor and Actuator Attacks on Power Converters for Electric Vehicles	2020 IEEE Security and Privacy Workshops (SPW)	Dec-20	https://ieeexplore.ieee.org/document/9283869	Power Data

Appendix IX: Data Management Plan

This Data Management Plan addresses NSF's policy on the dissemination and sharing of research results within a reasonable time. In accordance with this policy, this plan does not include preliminary analyses, drafts of scientific papers, plans for future research, peer reviews, or communications with colleagues. Furthermore, data to enable peer review and publication/dissemination and/or to protect intellectual property may be temporarily withheld from distribution and other proposed data management. This plan will make certain that the data produced during the period of this ERC is appropriately managed to ensure its usability, accessibility, and preservation. The ASPIRE ERC team has a strong track record with timely scientific publications and adherence to NSF's Data Management policy.

Products of Research: The vision of the ASPIRE ERC is to achieve widely adopted electrified transportation through widespread electrification of roadway vehicles. The proposed engineered system leading to this vision consists of a ubiquitous network of standardized plug-in and wireless charging solutions that provide power to vehicles both while parked and in-motion. The engineered system is seamlessly integrated into the transportation and grid infrastructure, interoperable across all vehicle classes, and cloud connected with distributed controls to minimize cost and emissions. We expect to generate the following data and software throughout the course of the ASPIRE ERC:

(1) We will collect large amounts of data that are relevant to transportation electrification, including charging systems, power grids, transportation infrastructure, traffic data, weather/road conditions, individual and fleets of vehicles, government policies, consumers' driving needs and preferences, as well as potential impacts on economic, environmental, and social behaviors.

(2) The data we collect above may include raw sensor data and configurations regarding specific experiments and simulations, as well as case studies and user survey data. The data may require transformation and further processing, in which case both the original data and processed data will be retained, along with metadata that document the processing steps and software used.

(3) Detailed data regarding the electronic and mechanical designs and specifications, roadway materials fabrication methods, design and development of algorithms and computer software for data analysis, (sub-)system modeling/simulation, communication, control and optimization, user study protocols, as well as their implementation, integration, and evaluation will be collected and retained.

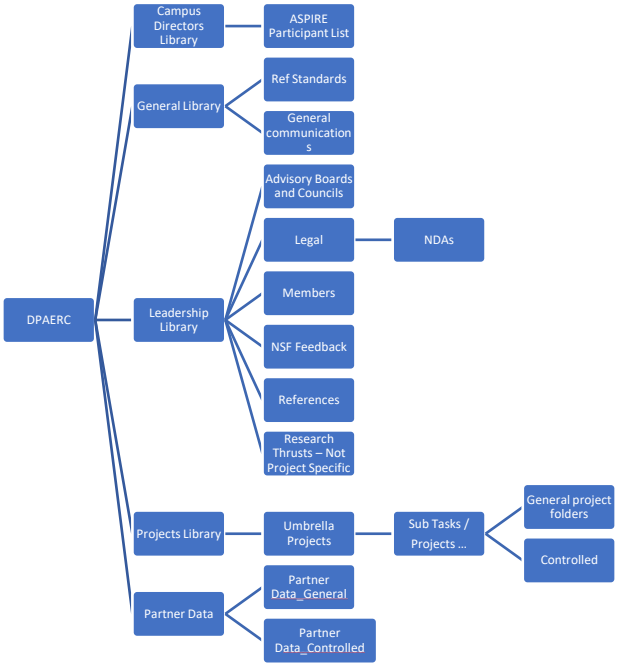
(4) Results generated by the ASPIRE ERC will be published at a wide range of scientific venues and professional societies and integrated into curriculum and other educational materials for a diverse audience. Such data, in the form of scientific publications and educational materials, will also be retained.

Data Formats and Standards: Data will be recorded and stored in the format prescribed by the generating university's Good Laboratory Practices (e.g., the use of notebooks, witnessing of results). Electronic and mechanical designs will be stored in digital form in the format native to the design software used to generate the design (with paper copies where practical). The software we create, including source code and binary files, will be recorded in standard format depending on the programming language and environment used, such as C/C++, Java, Python, R, and MATLAB. The raw data and processed data may be available in different database formats and

converted to other formats as needed (e.g., Microsoft Azure SQL Database, Google Cloud SQL). Other data will be stored as ASCII text files, CSV files, images, audio and video files, etc. Some processed data may be stored as Microsoft Excel spreadsheet files and descriptions will be stored as Microsoft Word, Latex, HTML files, PDF files, and presentation slides (e.g., Microsoft PowerPoint or Keynote). Metadata describing specific data formats and the software needed for processing/conversion will also be provided to ensure easy data access.

Dissemination, Access and Sharing of Data: A dedicated ASPIRE ERC website has been set up (https://aspire.usu.edu/) and serves as the frontend of ASPIRE-related data dissemination, access, and sharing. The backend services include Box.com for secure cloud-based content management and collaboration and general-purpose cloud computing (e.g., Google Cloud Platform) for data storage, code development, data analysis, system modeling, simulation, evaluation, demonstration, etc. Research publications and educational materials produced by ASPIRE will be accessible through the ASPIRE ERC website. The software produced as part of the ERC will be written under an open source license and will be made publicly available for download, along with some online simulation support. The distance education technologies developed and used extensively by USU and UCB will be used to enhance data sharing, especially for educational materials. Much of the data collected and studied in the ASPIRE ERC can be made publicly available without additional requirements stipulated by the funding or the participating universities. The data will be classified as publishable data, which we have processed for easier understanding and reuse, and intermediate results, which require extra effort to parse. Some community- or user-specific data may be sensitive and require careful anonymization and aggregation before they can be shared publicly. To maintain this data privacy and meet compliance standards, ASPIRE ERC has implemented additional layers of access restriction and agreements. These include, but are not limited to:

- Individuals seeking permission for data must submit a Data Access Request form, as identified on the ASPIRE ERC website. These requests are processed by the ASPIRE ERC IT Technician, for approval by the appropriate center and project leadership to verify the requesting individual and grant access to the specific project folders.
- Each participating member of the ASPIRE ERC completes a Participation and Confidentiality Agreement. These are maintained on file and are requisite to gaining access to ASPIRE ERC's project files.
- Box.com folder structuring to provide general knowledge library access to all participants, and encourage the dissemination of center level knowledge and training, communications, outreach documents, un-restricted presentations and workshops. Other more sensitive data, that may be subject to partner agreement restrictions or proprietary information, are maintained in Partner Data and Projects Library folders. Permissions to these folders are obtained via to the Data Access Request process and are maintained through a participant permission tracking database. Access to files are logged by user and time stamped. Permissions are reviewed, at a minimum, annually by center and project leadership.



EXAMPLE ASPIRE ERC BOX.COM FOLDER STRUCTURING AND PERMISSIONS

Some other data may be restricted due to privacy, confidentiality, or intellectual property, e.g., data of a proprietary nature that are required to support patent applications or are otherwise deemed as proprietary by reason of contracts between ASPIRE and private companies. For those who access, use, and share our data with others, their rights and obligations regarding re-use, re-distribution and production of derivatives will be clearly articulated via formal training and certification, i.e. Participation and Confidentially Agreement.

The ASPIRE ERC team's experience with, and commitment to, secure data archiving is well established and is in keeping with information security policies established by the participating universities. While most of the data are publicly available, any user-sensitive or proprietary data collected as part of this project will be stored securely, and only authorized project personnel will have login permission to access such data. Data regarding user surveys, focus groups, and interviews will be stored according to IRB standards. They will not include identifiable information where the human subjects can be directly linked and associated with. No disclosure of the subjects' responses outside the research could place the human subjects at risk or damaging their financial standing, employability, insurability, or reputation. Human subjects will be protected from research risks in conformance with the relevant Federal policy known as the Common Rule (Federal Policy for the Protection of Human Subjects, 45 CFR 690). The data will be encrypted as needed. Administrative access to the cloud servers and their associated virtual machines is password-protected and will be restricted to authorized project personnel only. Verified user accounts and proper access control will be used to guard third-party access to non-public data.

Archiving of Data: Data generated by the ASPIRE ERC will be retained for at least three years after conclusion of the award or three years after public release, whichever is later. Data may be retained for longer periods of time as required by patent applications, agreements with industry partners, or other contractual agreements. In addition, given the particular value and wide

community interest, we will make an effort to release them publicly as soon as possible and retain such data for as long as possible. We expect to be able to retain the data and analysis results for five to ten years post project completion. We will also explore partnerships with interested parties such that the data can be retained for even longer term. To ensure timely public release of the research data generated by ASPIRE, we will seek scientific submission in top conferences and journals within one or two months of obtaining the research results. Counting the reviewing process and publication latency, we expect to publish our research results in approximately one year. All publications will be reviewed by the Intellectual Property Services Offices at the participating universities to ensure that proprietary information is not being disclosed and that publication at that point in time does not diminish potential patent and IP rights. When IP protection has been secured, then the ASPIRE ERC team, including industry partners, will be encouraged to publish information as soon as possible consistent with commercialization strategies and constraints.

Roles, Responsibilities, and Resources: The ASPIRE project leaders are responsible for overseeing data management and dissemination among project members within and across their respective areas. A data manager who is knowledgeable of the various datasets within ASPIRE is responsible for data management and dissemination, both internally and externally. They are jointly supported by a systems engineer who manages the EVR facility and oversees ASPIRE's integrated hardware demonstrations, and a software engineer who develops the city-scale and inter-city simulation testbed. The team has ready access to data management expertise within ASPIRE, research computing support among the participating universities, cloud computing services, as well as the Space Dynamics Laboratory (close to EVR) and NCAR's Research Applications Laboratory, which have decades of experience in developing, documenting, and managing data for complex space, defense, weather, energy systems, and transportation systems. This data management plan will be reviewed by the ASPIRE leadership team at least annually to ensure compliance and improvements will be made as needed.

Appendix X: Postdoc Mentoring Plan

ASPIRE's vision for an electrified transportation future requires the participation of postdoctoral researchers. Our goal is to provide the skills, knowledge, and experiences for postdoctoral researchers to flourish in their roles, contribute to the ERC, and excel in their future career paths. We accomplish this goal by providing mentoring activities appropriate for all postdocs as well as creating individually tailored plans to accommodate the unique interests, aspirations, and backgrounds of each postdoc.[1] Specific elements of the mentoring include the following:

Orientation activities introduce the postdoctoral researcher to the ASPIRE team, institutional postdoc policies, and the ERC's orientation program. Mentors and postdoctoral researchers establish an Individual Development Plan to ensure that expectations and opportunities match. Orientation topics include (a) the amount of independence the postdoctoral researcher requires; (b) interaction with coworkers; (c) productivity, work habits, and laboratory safety; (d) appropriate documentation of research methodologies; and (e) expectations regarding the team's commitment to diversity and inclusion. Policies and expectations are shared with postdoctoral researchers in writing. In addition, faculty mentors are encouraged to participate in a training program to ensure they are prepared to properly mentor post-docs.

Formal Technical Mentoring activities include regular postdoc interactions with mentors and research teams. These activities include lab meeting presentations, webinars, one-on-one meetings to review progress and gather feedback, exposure to the convergent research conducted in the ASPIRE ERC, and training in the preparation of manuscripts for scientific journals and presentations at conferences.

Workforce Development, Expanded Participation, and Innovation Mentoring activities ensure postdoctoral researchers are prepared for future faculty positions or nonacademic opportunities. All postdoctoral researchers receive guidance on mentoring graduate and undergraduate students and participate in the ERC's activities to ensure they effectively collaborate with researchers from all disciplines and backgrounds and are prepared to join a skilled workforce. Postdocs interested in future faculty positions participate in various pedagogical workshops and have opportunities to teach on the campuses of the participating institutions. Postdoctoral researchers interested in non-academic positions are assisted in developing collaborative opportunities with industry. Postdocs are given the opportunity to participate in entrepreneurship activities at different campuses so they can learn about the commercialization process and how it relates to research activities.

Professional Development opportunities emphasize translatable and transferable skills to ensure postdocs are prepared for a range of careers. Postdocs receive advice on the job market, the opportunity to give practice job talks, training on the Responsible Conduct of Research through CITI courses, grant writing guidance, and mentoring on communicating research to academic and general audiences. Postdocs have travel support opportunities to attend scientific meetings or conferences to advance their scientific knowledge and professional networking. There is

[1] National Academy of Sciences, National Academy of Engineering, and Institute of Medicine. 2014. *The Postdoctoral Experience Revisited*. Washington, DC: The National Academies Press. https://doi.org/10.17226/18982; Institute of Medicine, National Academy of Sciences, and National Academy of Engineering. 2000. *Enhancing the Postdoctoral Experience for Scientists and Engineers: A Guide for Postdoctoral Scholars, Advisers, Institutions, Funding Organizations, and Disciplinary Societies*. Washington, DC: The National Academies Press. https://doi.org/10.17226/9831.

protected time for postdocs to pursue career development activities and to participate in postdoc associations on campus, within professional societies, and with the National Postdoctoral Association https://www.nationalpostdoc.org/.

Evaluation of the mentoring plan occurs by tracking the progress of postdoctoral researchers through their Individual Development Plan, interviews with the postdocs to assess satisfaction with the mentoring program, and tracking of their progress toward career goals after finishing the postdoc.

Appendix XI - Biographical Sketches

Effective 05/20/2024 NSF BIOGRAPHICAL SKETCH OMB-3145-0279

IDENTIFYING INFORMATION:

NAME: AFRIDI, KHURRAM K

POSITION TITLE: Associate Professor

PRIMARY ORGANIZATION AND LOCATION: Cornell University, Dept. of ECE, Ithaca, NY, USA

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
MIT, Cambridge, MA, United States	PHD	02/1998	Electrical Eng. & Computer Science
MIT, Cambridge, MA, USA	MS	05/1992	Electrical Eng. & Computer Science
Caltech, Pasadena, CA, USA	BS	05/1989	Electrical Engineering

Appointments and Positions

2018 - present	Associate Professor, Cornell University, Dept. of ECE, Ithaca, NY, USA
2014 - 2018	Assistant Professor, Department of ECEE, University of Colorado, Boulder, CO, USA
2009 - 2014	Visiting Associate Professor, Department of EECS, MIT, Cambridge, MA, USA
2008 - 2014	Associate Professor, Electrical Engineering, LUMS School of Science and Engineering, Lahore, Not Applicable, N/A, Pakistan
2004 - 2009	Project Director, LUMS School of Science and Engineering, Lahore, Not Applicable, N/A, Pakistan
2000 - 2010	Chief Operating Officer, Techlogix, Woburn, Massachusetts, United States
1997 - 2000	Chief Technology Officer, Techlogix, Woburn, Massachusetts, United States

Products

Products Most Closely Related to the Proposed Project

1. Sinha S, Kumar A, Regensburger B, Afridi K. Active Variable Reactance Rectifier—A New Approach to Compensating for Coupling Variations in Wireless Power Transfer Systems. IEEE Journal of Emerging and Selected Topics in Power Electronics. 2020; 8(3):2022-2040. Available from: https://ieeexplore.ieee.org/document/8932570/ DOI: 10.1109/JESTPE.2019.2958894
2. Regensburger B, Sinha S, Kumar A, Maji S, Afridi K. High-Performance Multi-MHz Capacitive Wireless Power Transfer System for EV Charging Utilizing Interleaved-Foil Coupled Inductors. IEEE Journal of Emerging and Selected Topics in Power Electronics. 2022; 10(1):35-51. Available from: https://ieeexplore.ieee.org/document/9222168/ DOI: 10.1109/JESTPE.2020.3030757
3. Sreyam Sinha, Ashish Kumar, Brandon Regensburger, Khurram K. Afridi. A New Design Approach to Mitigating the Effect of Parasitics in Capacitive Wireless Power Transfer Systems for Electric Vehicle Charging. IEEE Transactions on Transportation Electrification. 2019 December; 5(4):1040--1059. Available from: https://doi.org/10.1109/TTE.2019.2931869

DOI: 10.1109/TTE.2019.2931869

4. Sinha S, Kumar A, Regensburger B, Afridi K. Design of High-Efficiency Matching Networks for Capacitive Wireless Power Transfer Systems. IEEE Journal of Emerging and Selected Topics in Power Electronics. 2022; 10(1):104-127. Available from: https://ieeexplore.ieee.org/document/9194001/ DOI: 10.1109/JESTPE.2020.3023121
5. Kumar A, Sinha S, Sepahvand A, Afridi K. Improved Design Optimization for High-Efficiency Matching Networks. IEEE Transactions on Power Electronics. 2018; 33(1):37-50. Available from: http://ieeexplore.ieee.org/document/7858797/ DOI: 10.1109/TPEL.2017.2670640

Other Significant Products, Whether or Not Related to the Proposed Project

1. Khatua M, Afridi K, et al. High-Performance Megahertz-Frequency Resonant DC–DC Converter for Automotive LED Driver Applications. IEEE Transactions on Power Electronics. 2020 October; :1--1. Available from: https://doi.org/10.1109/TPEL.2020.2974970 DOI: 10.1109/TPEL.2020.2974970
2. Saad Pervaiz, Ashish Kumar, Khurram K. Afridi. GaN-Based High-Power-Density Electrolytic-Free Universal Input LED Driver. IEEE Transactions on Industry Applications. 2018 July; 54(4):3890--3901. Available from: https://doi.org/10.1109/TIA.2018.2817620 DOI: 10.1109/TIA.2018.2817620
3. Khatua M, Kumar A, Pervaiz S, Chakraborty S, Afridi K. Performance Enhancement of ICN-Based Single-Stage AC–DC Converters Using Reconfigurable Inverters. IEEE Transactions on Power Electronics. 2022; 37(7):8217-8231. Available from: https://ieeexplore.ieee.org/document/9707654/ DOI: 10.1109/TPEL.2022.3149565
4. Shahzad D, Pervaiz S, Zaffar N, Afridi K. GaN-Based High-Power-Density AC–DC–AC Converter for Single-Phase Transformerless Online Uninterruptible Power Supply. IEEE Transactions on Power Electronics. 2021 December; 36(12):13968-13984. Available from: https://ieeexplore.ieee.org/document/9454343/ DOI: 10.1109/TPEL.2021.3089079
5. Daryaei M, Khajehoddin S, Mashreghi J, K. Afridi K. A New Approach to Steady-State Modeling, Analysis, and Design of Power Converters. IEEE Transactions on Power Electronics. 2021 November; 36(11):12746-12768. Available from: https://ieeexplore.ieee.org/document/9420284/ DOI: 10.1109/TPEL.2021.3076745

Certification:

I certify that the information provided is current, accurate, and complete. This includes but is not limited to current, pending, and other support (both foreign and domestic) as defined in 42 U.S.C. § 6605.

I also certify that, at the time of submission, I am not a party to a malign foreign talent recruitment program.

Misrepresentations and/or omissions may be subject to prosecution and liability pursuant to, but not limited to, 18 U.S.C. §§ 287, 1001, 1031 and 31 U.S.C. §§ 3729-3733 and 3802.

Certified by AFRIDI, KHURRAM K in SciENcv on 2024-08-14 16:14:43

IDENTIFYING INFORMATION:

NAME: Aliprantis, Dionysios

POSITION TITLE: Professor, Electrical & Computer Engineering

PRIMARY ORGANIZATION AND LOCATION: Purdue University, West Lafayette, Indiana, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
Purdue University, West Lafayette, Indiana, United States	PHD	12/2003	Electrical and Computer Engineering
National Technical University of Athens, Athens, Not Applicable, N/A, Greece	OTH	07/1999	Electrical and Computer Engineering

Appointments and Positions

2019 - present Professor, Electrical & Computer Engineering, Purdue University, West Lafayette, Indiana, United States

2013 - 2019 Associate Professor, Electrical & Computer Engineering, Purdue University, West Lafayette, Indiana, United States

2007 - 2013 Assistant Professor, Electrical & Computer Engineering, Iowa State University, Ames, Iowa, United States

2006 - 2007 Research Scientist, Electrical & Computer Engineering, Purdue University, West Lafayette, Indiana, United States

2004 - 2005 Computer Programmer, Hellenic Army, Research and Informatics Corps, Athens, Not Applicable, N/A, Greece

2000 - 2000 Graduate Teaching Assistant, Purdue University, West Lafayette, Indiana, United States

1999 - 2003 Graduate Research Assistant, Energy Sources and Systems laboratory, Purdue University, West Lafayette, Indiana, United States

Products

Products Most Closely Related to the Proposed Project

1. Aliprantis D, Pekarek S. The unsung hero of the electric vehicle revolution: the role of computational electromagnetics in electric machine design and analysis. IEEE Electrification Magazine. 2023 December; 11(4):64-68. DOI: 10.1109/MELE.2023.3320510
2. Brovont AD, Aliprantis D, Pekarek S, Vickers C, Mehar V. Magnetic design for three-phase dynamic wireless power transfer with constant output power. IEEE Transactions on Energy Conversion. 2023 June; 38(2):1481-1484. DOI: 10.1109/TEC.2023.3244074
3. V. Mehar, A. D. Brovont, S. D. Pekarek, D. Aliprantis. Misalignment Estimation in a Three-Phase Transverse-Pole DWPT System. 2024 IEEE Applied Power Electronics Conference and Exposition (APEC). 2024; :1909-1913. DOI: 10.1109/APEC48139.2024.10509327

4. Haddad D, Konstantinou T, Aliprantis D, Gkritza K, Pekarek S, Haddock J. Analysis of the financial viability of high-power electric roadways: a case study for the state of Indiana. Energy Policy. 2022 December; 171. DOI: 10.1016/j.enpol.2022.113275
5. Wu D, Aliprantis D, Ying L. Load Scheduling and Dispatch for Aggregators of Plug-In Electric Vehicles. IEEE Transactions on Smart Grid. 2012 March 01; 3(1):368-376. DOI: 10.1109/TSG.2011.2163174

Other Significant Products, Whether or Not Related to the Proposed Project

1. Aliprantis D, Wasynczuk O. Electric Machines: Theory and Analysis Using the Finite Element Method. Cambridge: Cambridge University Press; 2023.
2. Pico H, Aliprantis D. Voltage Ride-Through Capability Verification of Wind Turbines With Fully-Rated Converters Using Reachability Analysis. IEEE Transactions on Energy Conversion. 2014 June 01; 29(2):392-405. DOI: 10.1109/TEC.2013.2295168
3. Pico H, Aliprantis D. Voltage Ride-Through Capability Verification of DFIG-Based Wind Turbines Using Reachability Analysis. IEEE Transactions on Energy Conversion. 2016 December 01; 31(4):1387-1398. DOI: 10.1109/TEC.2016.2563320
4. Jahangiri P, Aliprantis D. Distributed Volt/VAr control by PV inverters. IEEE Transactions on Power Systems. 2013 August 01; 28(3):3429-3439. DOI: 10.1109/TPWRS.2013.2256375
5. A. Beltrán-Pulido, I. Bilionis, D. Aliprantis. Physics-Informed Neural Networks for Solving Parametric Magnetostatic Problems. IEEE Transactions on Energy Conversion. 2022; 37(4):2678-2689. DOI: 10.1109/TEC.2022.3180295

Certification:

I certify that the information provided is current, accurate, and complete. This includes but is not limited to current, pending, and other support (both foreign and domestic) as defined in 42 U.S.C. § 6605.

I also certify that, at the time of submission, I am not a party to a malign foreign talent recruitment program.

Misrepresentations and/or omissions may be subject to prosecution and liability pursuant to, but not limited to, 18 U.S.C. §§ 287, 1001, 1031 and 31 U.S.C. §§ 3729-3733 and 3802.

Certified by Aliprantis, Dionysios in SciENcv on 2024-07-25 15:36:18

IDENTIFYING INFORMATION:

NAME: Allen, Brandon Chase Mykel

ORCID iD: https://orcid.org/0000-0002-2232-3076

POSITION TITLE: Assistant Research Professor

PRIMARY ORGANIZATION AND LOCATION: Purdue University, Engineering Education, West Lafayette, Indiana, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
Purdue University, West Lafayette, Indiana, United States	PHD	05/2020	Agricultural Sciences Education and Communication
Virginia Tech, Blacksburg, Virginia, United States	Graduate Student	08/2011 - 08/2013	Animal Science
Virginia State University, Petersburg, Virginia, United States	BS	05/2011	Animal Science

Appointments and Positions

2021 - present Assistant Research Professor, Purdue University, Engineering Education, West Lafayette, Indiana, United States

2023 - present Director for Diversity and Culture of Inclusion, ASPIRE Engineering Research Center, West Lafayette, Indiana, United States

2021 - present Adjunct Online Professor, University of Oklahoma, Human Relations, Norman, Oklahoma, United States

2020 - 2021 Adjunct Online Professor, Widener University, Organizational Equity and Inclusion Certificate Program, Chester, Pennsylvania, United States

Products

Products Most Closely Related to the Proposed Project

1. Allen B. A case study evaluation of a mentoring training program focused on women and underrepresented minorities in Ag+STEM programs. . North American Colleges and Teachers of Agriculture Journal. 2019 May; 63(1).

Other Significant Products, Whether or Not Related to the Proposed Project

1. Allen B. Using critical race theory to redefine the 12 professional dispositions of chief diversity officers. Journal of Critical Scholarship in Higher Education and Student Affairs. 2020; 5(3).

Certification:

I certify that the information provided is current, accurate, and complete. This includes but is not limited to current, pending, and other support (both foreign and domestic) as defined in 42 U.S.C. § 6605.

I also certify that, at the time of submission, I am not a party to a malign foreign talent recruitment

program.

Misrepresentations and/or omissions may be subject to prosecution and liability pursuant to, but not limited to, 18 U.S.C. §§ 287, 1001, 1031 and 31 U.S.C. §§ 3729-3733 and 3802.

Certified by Allen, Brandon Chase Mykel in SciENcv on 2024-08-05 07:06:04

IDENTIFYING INFORMATION:

NAME: Baker, Kyri

ORCID iD: https://orcid.org/0000-0002-6854-9134

POSITION TITLE: Associate Professor

PRIMARY ORGANIZATION AND LOCATION: University of Colorado Boulder, Boulder, CO, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
National Renewable Energy Laboratory, Golden, CO, United States	Postdoctoral Fellow	01/2015 - 12/2015	Buildings
Carnegie Mellon University, Pittsburgh, PA, US	PhD	12/2014	Electrical and Computer Engineering
Carnegie Mellon University, Pittsburgh, PA, US	MS	05/2010	Electrical and Computer Engineering
Carnegie Mellon University, Pittsburgh, PA, US	BS	05/2009	Electrical and Computer Engineering

Appointments and Positions

2024 - present Associate Professor, University of Colorado Boulder, Boulder, CO, United States
2020 - present Fellow, Renewable and Sustainable Energy Institute (RASEI), Boulder, CO, USA
2017 - 2024 Assistant Professor, University of Colorado Boulder, Boulder, Colorado, United States
2016 - 2017 Research Engineer, National Renewable Energy Laboratory, Power Systems Engineering Center, Golden, CO, US

Products

Products Most Closely Related to the Proposed Project

1. Busby JW, Baker K, Bazilian M, Gilbert AQ, Grubert E, Rai V, Rhodes JD, Shidore S, Smith CA, Webber ME. Cascading risks: Understanding the 2021 winter blackout in Texas. Energy Research & Social Science. 2021 July 01; 77:102106. Available from: https://www.sciencedirect.com/science/article/pii/S2214629621001997
2. Baker K, Hug G, Li X. Energy Storage Sizing Taking Into Account Forecast Uncertainties and Receding Horizon Operation. IEEE Transactions on Sustainable Energy. 2017; 8(1):331-340. Available from: http://ieeexplore.ieee.org/document/7536653/ DOI: 10.1109/TSTE.2016.2599074
3. Crozier C, Pigott A, Baker K. Price Perturbations for Privacy Preserving Demand Response With Distribution Network Awareness. IEEE Transactions on Smart Grid. 2023; :1-1. Available from: https://ieeexplore.ieee.org/document/10207772/ DOI: 10.1109/TSG.2023.3299668
4. Allen A, Henze G, Baker K, Pavlak G. Evaluation of low-exergy heating and cooling systems and topology optimization for deep energy savings at the urban district level. Energy

Conversion and Management. 2020 October; 222:113106-. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0196890420306506 DOI: 10.1016/j.enconman.2020.113106

5. Kravits J, Kasprzyk J, Baker K, Stillwell A. Balancing cost, water, emissions, and reliability in power systems operations. Environmental Research Letters. 2023 December 08; 19(1):014035-. Available from: https://iopscience.iop.org/article/10.1088/1748-9326/ad0d3a DOI: 10.1088/1748-9326/ad0d3a

Other Significant Products, Whether or Not Related to the Proposed Project

1. Baker K, Bernstein A, Dall'Anese E, Zhao C. Network-Cognizant Voltage Droop Control for Distribution Grids. IEEE Transactions on Power Systems. 2018; 33(2):2098-2108. Available from: https://ieeexplore.ieee.org/document/8003321/ DOI: 10.1109/TPWRS.2017.2735379
2. Garifi K, Baker K, Christensen D, Touri B. Convex Relaxation of Grid-Connected Energy Storage System Models With Complementarity Constraints in DC OPF. IEEE Transactions on Smart Grid. 2020; 11(5):4070-4079. Available from: https://ieeexplore.ieee.org/document/9082838/ DOI: 10.1109/TSG.2020.2987785
3. DallAnese E, Baker K, Summers T. Chance-Constrained AC Optimal Power Flow for Distribution Systems With Renewables. IEEE Transactions on Power Systems. 2017; 32(5):3427-3438. Available from: https://ieeexplore.ieee.org/document/7828060/ DOI: 10.1109/TPWRS.2017.2656080
4. Guo Y, Baker K, Dall'Anese E, Hu Z, Summers T. Data-Based Distributionally Robust Stochastic Optimal Power Flow—Part I: Methodologies. IEEE Transactions on Power Systems. 2019; 34(2):1483-1492. Available from: https://ieeexplore.ieee.org/document/8513852/ DOI: 10.1109/TPWRS.2018.2878385
5. Wang J, Garifi K, Baker K, Zuo W, Zhang Y, Huang S, Vrabie D. Optimal Renewable Resource Allocation and Load Scheduling of Resilient Communities. Energies. 2020 October 30; 13(21):5683-. Available from: https://www.mdpi.com/1996-1073/13/21/5683 DOI: 10.3390/en13215683

Certification:

I certify that the information provided is current, accurate, and complete. This includes but is not limited to current, pending, and other support (both foreign and domestic) as defined in 42 U.S.C. § 6605.

I also certify that, at the time of submission, I am not a party to a malign foreign talent recruitment program.

Misrepresentations and/or omissions may be subject to prosecution and liability pursuant to, but not limited to, 18 U.S.C. §§ 287, 1001, 1031 and 31 U.S.C. §§ 3729-3733 and 3802.

Certified by Baker, Kyri in SciENcv on 2024-07-24 10:58:11

IDENTIFYING INFORMATION:

NAME: Banerji, Srishti

ORCID iD: https://orcid.org/0000-0002-2330-3683

POSITION TITLE: Assistant Professor

PRIMARY ORGANIZATION AND LOCATION: Utah State University, Logan, UT, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
Michigan State University, East Lansing, Michigan, United States	PHD	05/2021	Civil (Structural) Engineering
Concordia University, Montreal, Quebec, Canada	MS	08/2016	Civil (Structural) Engineering
National Institute of Technology Silchar, Silchar, Assam, India	BS	05/2013	Civil Engineering

Appointments and Positions

2022 - present Assistant Professor, Utah State University, Logan, UT, United States
2021 - 2022 Teaching Specialist, Michigan State University, East Lansing, MI, United States
2016 - 2021 Graduate Research/ Teaching Assistant, Michigan State University, East Lansing, MI, United States
2014 - 2016 Graduate Research Assistant, Concordia University, Montreal, Quebec, Canada
2013 - 2014 Data Scientist, Mu Sigma, Bangalore, Not Applicable, N/A, India

Products

Products Most Closely Related to the Proposed Project

1. Kodur V, Banerji S, Solhmirzaei R. Test methods for characterizing concrete properties at elevated temperature. Fire and Materials. 2019 November 17; 44(3):381-395. Available from: https://onlinelibrary.wiley.com/doi/10.1002/fam.2777 DOI: 10.1002/fam.2777
2. Banerji S, Kodur V, Solhmirzaei R. Experimental behavior of ultra high performance fiber reinforced concrete beams under fire conditions. Engineering Structures. 2020 April; 208:110316-. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0141029619347480 DOI: 10.1016/j.engstruct.2020.110316
3. Banerji S, Kodur V. Effect of temperature on mechanical properties of ultra-high performance concrete. Fire and Materials. 2021 April 30; 46(1):287-301. Available from: https://onlinelibrary.wiley.com/doi/10.1002/fam.2979 DOI: 10.1002/fam.2979
4. Kodur V, Banerji S, Solhmirzaei R. Effect of Temperature on Thermal Properties of Ultrahigh-Performance Concrete. Journal of Materials in Civil Engineering. 2020 August; 32(8):-. Available from: https://ascelibrary.org/doi/10.1061/%28ASCE%29MT.1943-5533.0003286

DOI: 10.1061/(ASCE)MT.1943-5533.0003286

5. Comparative Fire Behavior of Reinforced Concrete Beams Made of Different Concrete Strengths. Fire Technology. 2023. DOI: https://doi.org/10.1007/s10694-023-01375-x

Other Significant Products, Whether or Not Related to the Proposed Project

1. Kodur V, Banerji S. Modeling the fire-induced spalling in concrete structures incorporating hydro-thermo-mechanical stresses. Cement and Concrete Composites. 2021 March; 117:103902-. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0958946520304066 DOI: 10.1016/j.cemconcomp.2020.103902
2. Zaker Esteghamati M, Gernay T, Banerji S. Evaluating fire resistance of timber columns using explainable machine learning models. Engineering Structures. 2023 December; 296:116910-. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0141029623013251 DOI: 10.1016/j.engstruct.2023.116910
3. Gil A, Banerji S, Kodur V. Factors influencing pore pressure measurements in concrete during heating and its influence on fire-induced spalling. Cement and Concrete Composites. 2023 September; 142:105228-. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0958946523003025 DOI: 10.1016/j.cemconcomp.2023.105228
4. Solhmirzaei R, Kodur V, Banerji S. Shear Behavior of Ultra High Performance Concrete Beams without Stirrups. Second International Interactive Symposium on UHPC. Second International Interactive Symposium on UHPC; ; Iowa State University Digital Press; c2019. Available from: https://www.iastatedigitalpress.com/uhpc/article/id/9665/ DOI: 10.21838/uhpc.9665
5. Banerji S, Kodur V. Numerical model for tracing the response of Ultra-High performance concrete beams exposed to fire. Fire and Materials. 2022 July 28; 47(3):322-340. Available from: https://onlinelibrary.wiley.com/doi/10.1002/fam.3099 DOI: 10.1002/fam.3099

Certification:

I certify that the information provided is current, accurate, and complete. This includes but is not limited to information related to domestic and foreign appointments and positions.

I also certify that, at the time of submission, I am not a party to a malign foreign talent recruitment program.

Misrepresentations and/or omissions may be subject to prosecution and liability pursuant to, but not limited to, 18 U.S.C. §§ 287, 1001, 1031 and 31 U.S.C. §§ 3729-3733 and 3802.

Certified by Banerji, Srishti in SciENcv on 2025-09-09 20:14:50

IDENTIFYING INFORMATION:

NAME: Brovont, Aaron Dean

POSITION TITLE: Research Assistant Professor

PRIMARY ORGANIZATION AND LOCATION: Purdue University, West Lafayette, Indiana, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
Purdue University, West Lafayette, Indiana, United States	PHD	08/2016	Electrical and Computer Engineering
Purdue University, West Lafayette, Indiana, United States	MS	05/2013	Electrical and Computer Engineering
Purdue University, West Lafayette, Indiana, United States	BS	12/2011	Electrical Engineering

Appointments and Positions

2021 - present Research Assistant Professor, Purdue University, West Lafayette, Indiana, United States

2019 - present Senior Lead Engineer, P. C. Krause and Associates, Inc., West Lafayette, Indiana, United States

2016 - 2019 Assistant Professor, The University of Alabama, Tuscaloosa, Alabama, United States

Products

Products Most Closely Related to the Proposed Project

1. Brovont AD, Aliprantis D, Pekarek SD, Vickers CJ, Mehar V. Magnetic Design for Three-Phase Dynamic Wireless Power Transfer With Constant Output Power. IEEE Transactions on Energy Conversion. 2023 June; 38(2):1481-1484. DOI: 10.1109/TEC.2023.3244074
2. Brovont AD, Pekarek SD. Integral Evaluation for a Closed-Form 2-D Potential Formulation of the Galerkin BEM. Engineering Analysis with Boundary Elements. 2021 November 01; 132:77-93. Available from: https://www.sciencedirect.com/science/article/pii/S0955799721000527 DOI: 10.1016/j.enganabound.2021.03.007
3. Brovont AD. Generalized differential-common-mode decomposition for modeling conducted emissions in asymmetric power electronic systems. IEEE Transactions on Power Electronics. 2018 August; 33(8):6461-6466. DOI: 10.1109/TPEL.2018.2789348
4. Brovont AD, Pekarek SD. Derivation and application of equivalent circuits to model common-mode current in microgrids. IEEE Journal of Emerging and Selected Topics in Power Electronics. 2017 March; 5(1):297-308. DOI: 10.1109/JESTPE.2016.2642835
5. Howard R, Brovont AD, Pekarek SD. Analytical Evaluation of 2-D Flux Integral for Magnetostatic Galerkin Method of Moments. IEEE Transactions on Magnetics. 2016 April; 52(4):1-8. DOI: 10.1109/TMAG.2015.2501280

Other Significant Products, Whether or Not Related to the Proposed Project

1. Lemmon AN, Brovont AD, New CD, Nelson BW, DeBoi BT. Modeling and Validation of Common-Mode Emissions in Wide Bandgap-Based Converter Structures. IEEE Transactions on Power Electronics. 2020 August; 35(8):8034-8049. DOI: 10.1109/TPEL.2019.2963883
2. Brovont AD, Lemmon AN, New CD, Nelson BW, DeBoi BT. Analysis and Cancellation of Leakage Current Through Power Module Baseplate Capacitance. IEEE Transactions on Power Electronics. 2020 May; 35(5):4678-4688. DOI: 10.1109/TPEL.2019.2944410
3. Lemmon AN, Cuzner R, Gafford J, Hosseini R, Brovont AD, Mazzola M. Methodology for Characterization of Common-Mode Conducted Electromagnetic Emissions in Wide-Bandgap Converters for Ungrounded Shipboard Applications. IEEE Journal of Emerging and Selected Topics in Power Electronics. 2017 June; 6(1):300-314. DOI: 10.1109/JESTPE.2017.2721429
4. New CD, Lemmon AN, Brovont AD. Influence of Output Terminations on Common-Mode Conducted Emissions Evaluation of Interface Converters. IEEE Open Journal of Power Electronics. 2024; :1-14. DOI: 10.1109/OJPEL.2024.3433605
5. Mehar V, Brovont AD, Pekarek SD, Aliprantis D. Misalignment Estimation in a Three-Phase Transverse-Pole DWPT System. 2024 IEEE Applied Power Electronics Conference and Exposition; 2024 February; IEEE. DOI: 10.1109/APEC48139.2024.10509327

Certification:

I certify that the information provided is current, accurate, and complete. This includes but is not limited to current, pending, and other support (both foreign and domestic) as defined in 42 U.S.C. § 6605.

I also certify that, at the time of submission, I am not a party to a malign foreign talent recruitment program.

Misrepresentations and/or omissions may be subject to prosecution and liability pursuant to, but not limited to, 18 U.S.C. §§ 287, 1001, 1031 and 31 U.S.C. §§ 3729-3733 and 3802.

Certified by Brovont, Aaron Dean in SciENcv on 2024-08-05 11:51:09

IDENTIFYING INFORMATION:

NAME: Bullock, Darcy

ORCID iD: https://orcid.org/0000-0002-7365-1918

POSITION TITLE: Lyles Family Professor of Civil Engineering

PRIMARY ORGANIZATION AND LOCATION: Purdue University, West Lafayette, Indiana, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
Carnegie Mellon University, Pittsburgh, Pennsylvania, United States	PHD	09/1992	Civil Engineering
Carnegie Mellon University, Pittsburgh, Pennsylvania, United States	MCE	08/1988	Civil Engineering
University of Vermont, Burlington, Vermont, United States	BCE	05/1987	Civil Engineering

Appointments and Positions

2017 - present Lyles Family Professor of Civil Engineering, Purdue University, West Lafayette, Indiana, United States

2020 - present Courtesy Faculty Appointment, School of Mechanical Engineering, Purdue University, West Lafayette, Indiana, United States

2010 - present Director, Joint Transportation Research Program, Purdue University, West Lafayette, Indiana, United States

2006 - present Courtesy Faculty Appointment, School of Electrical and Computer Engineering, Purdue University, West Lafayette, Indiana, United States

2008 - 2010 Associate Director, Joint Transportation Research Program, Purdue University, West Lafayette, Indiana, United States

2006 - 2007 Associate Head & Academic Director of Graduate Programs School of Civil Engineering, Purdue University, West Lafayette, Indiana, United States

2003 - 2006 Assistant Head for Graduate Programs, School of Civil Engineering, Purdue University, West Lafayette, Indiana, United States

2002 - 2017 Professor, School of Civil Engineering, Purdue University, West Lafayette, Indiana, United States

1998 - 2002 Associate Professor, School of Civil Engineering, Purdue University, West Lafayette, Indiana, United States

1997 - 1997 Associate Professor, Department of Civil and Environmental Engineering, Louisiana State University, Baton Rouge, Louisiana, United States

1995 - 1997 Associate Director, Remote Sensing and Image Processing Laboratory, Louisiana State University, Baton Rouge, Louisiana, United States

1993 - 1997 Assistant Professor, Department of Civil and Environmental Engineering, Louisiana State University, Baton Rouge, Louisiana, United States

Products

Products Most Closely Related to the Proposed Project

1. Desai J, Mathew J, Li H, Sakhare R, Horton D, Bullock D. Analysis of Connected Vehicle Data to Quantify National Mobility Impacts of Winter Storms for Decision Makers and Media Reports. Future Transportation. 2023 November 09; 3(4):1292-1309. Available from: https://www.mdpi.com/2673-7590/3/4/71 DOI: 10.3390/futuretransp3040071
2. Mahlberg J, Desai J, Bullock D. Evaluation of Electric Vehicle Charging Usage and Driver Activity. World Electric Vehicle Journal. 2023 November 08; 14(11):308-. Available from: https://www.mdpi.com/2032-6653/14/11/308 DOI: 10.3390/wevj14110308
3. Desai J, Mathew J, Li H, Bullock D. Leveraging Connected Vehicle Data to Assess Interstate Exit Utilization and Identify Charging Infrastructure Investment Allocation Opportunities. World Electric Vehicle Journal. 2022 September 02; 13(9):167-. Available from: https://www.mdpi.com/2032-6653/13/9/167 DOI: 10.3390/wevj13090167
4. Sakhare R, Desai J, Saldivar-Carranza E, Bullock D. Methodology for Monitoring Border Crossing Delays with Connected Vehicle Data: United States and Mexico Land Crossings Case Study. Future Transportation. 2024 February 02; 4(1):107-129. Available from: https://www.mdpi.com/2673-7590/4/1/7 DOI: 10.3390/futuretransp4010007
5. Saldivar-Carranza E, Gayen S, Bullock D. Intersection Type Classification from Connected Vehicle Data Using a Convolutional Neural Network. Data Science for Transportation. 2024 February 09; 6(1):-. Available from: https://link.springer.com/10.1007/s42421-023-00087-6 DOI: 10.1007/s42421-023-00087-6

Other Significant Products, Whether or Not Related to the Proposed Project

1. Saldivar-Carranza E, Bullock D. Deriving Verified Vehicle Trajectories from LiDAR Sensor Data to Evaluate Traffic Signal Performance. Future Transportation. 2024 July 09; 4(3):765-779. Available from: https://www.mdpi.com/2673-7590/4/3/36 DOI: 10.3390/futuretransp4030036
2. Desai J, Mathew J, Mahlberg J, Li H, Bullock D. Using Connected Vehicle Data to Evaluate National Trip Trends. Applied Sciences. 2023 September 12; 13(18):10228-. Available from: https://www.mdpi.com/2076-3417/13/18/10228 DOI: 10.3390/app131810228
3. Sakhare R, Desai J, Li H, Kachler M, Bullock D. Methodology for Monitoring Work Zones Traffic Operations Using Connected Vehicle Data. Safety. 2022 June 01; 8(2):41-. Available from: https://www.mdpi.com/2313-576X/8/2/41 DOI: 10.3390/safety8020041
4. Saldivar-Carranza E, Li H, Gayen S, Taylor M, Sturdevant J, Bullock D. Comparison of Arrivals on Green Estimations from Vehicle Detection and Connected Vehicle Data. Transportation Research Record: Journal of the Transportation Research Board. 2023 May 15; 2677(12):328-342. Available from: http://journals.sagepub.com/doi/10.1177/03611981231168116 DOI: 10.1177/03611981231168116
5. Sakhare R, Li H, Bullock D. Methodology for the Identification of Shock Wave Type and Speed in a Traffic Stream Using Connected Vehicle Data. Future Transportation. 2023 October 01; 3(4):1147-1174. Available from: https://www.mdpi.com/2673-7590/3/4/63 DOI: 10.3390/futuretransp3040063

Certification:

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Certified by Bullock, Darcy in SciENcv on 2024-08-01 18:57:43

IDENTIFYING INFORMATION:

NAME: Cheu, Ruey

ORCID iD: https://orcid.org/0000-0002-0791-2972

POSITION TITLE: Professor

PRIMARY ORGANIZATION AND LOCATION: The University of Texas at El Paso, El Paso, Texas, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
University of California, Irvine, Irvine, California, United States	PHD	03/1994	Transportation Engineering
The National University of Singapore, Singapore, Not Applicable, N/A, Singapore	MENG	08/1989	Transportation Engineering
The National University of Singapore, Singapore, Not Applicable, N/A, Singapore	BENG	06/1987	Civil Engineering

Appointments and Positions

2014 - present Professor, The University of Texas at El Paso, El Paso, Texas, United States

2006 - 2014 Associate Professor, The University of Texas at El Paso, El Paso, Texas, United States

1998 - 2001 Assistant Professor, The National University of Singapore, Singapore, Not Applicable, N/A, Singapore

Products

Products Most Closely Related to the Proposed Project

1. Michael Cruz, Ehsan Yahyazadeh Rineh, Sergio Alberto Luna Fong, Ruey Long Cheu, Ziqi Song. Using statewide transportation planning model to forecast demand for electric vehicle charging at stations along intercity highways. International Journal of Transportation Science and Technology. 2024 November. DOI: 10.1016/j.ijtst.2024.11.001
2. Balal E, Cheu R, Sarkodie-Gyan T. A binary decision model for discretionary lane changing move based on fuzzy inference system. Transportation Research Part C: Emerging Technologies. 2016 June; 67:47-61. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0968090X16000620 DOI: 10.1016/j.trc.2016.02.009
3. Wang H., Cheu R.L., Balal E.. Operations of electric taxis to serve advance reservations by trip chaining: Sensitivity analysis on network size, customer demand and number of charging stations. International Journal of Transportation Science and Technology. 2016; 5(2):47-59.

DOI: 10.1016/j.ijtst.2016.09.002

4. Wang H, Cheu R, Balal E. Operations of electric taxis to serve advance reservations by trip chaining: Sensitivity analysis on network size, customer demand and number of charging stations. International Journal of Transportation Science and Technology. 2016 October; 5(2):47-59. Available from: https://linkinghub.elsevier.com/retrieve/pii/S2046043016300107 DOI: 10.1016/j.ijtst.2016.09.002
5. Wang H, Cheu R. Operations of a Taxi Fleet for Advance Reservations Using Electric Vehicles and Charging Stations. Transportation Research Record: Journal of the Transportation Research Board. 2013 January 01; 2352(1):1-10. Available from: http://journals.sagepub.com/doi/10.3141/2352-01 DOI: 10.3141/2352-01

Other Significant Products, Whether or Not Related to the Proposed Project

1. Rodrigo Garcia, Okan Gurbuz, Ruey Long Cheu, Danielle Madrid. Methodology to Determine Faculty and Staff Parking Permit Fees on University Campuses. Journal of Transportation Engineering, Part A: Systems. 2023 April. DOI: 10.1061/JTEPBS.0000757
2. Okan Gurbuz, Ruey Long Cheu, Danielle Madrid. Allocation of Student Parking Permits across a University Campus Based on Course Registration and Schedule. Journal of Transportation Engineering, Part A: Systems. 2022 January; 148(1). Available from: https://doi.org/10.1061%2Fjtepbs.0000623 DOI: 10.1061/JTEPBS.0000623
3. Gurbuz O, Cheu R. Survey to Explore Behavior, Intelligent Transportation Systems Needs, and Level of Service Expectations for Student Parking at a University Campus. Transportation Research Record: Journal of the Transportation Research Board. 2020 January 15; 2674(1):168-177. Available from: http://journals.sagepub.com/doi/10.1177/0361198119900169 DOI: 10.1177/0361198119900169
4. Okan Gurbuz, Ruey Long Cheu, Carlos M. Ferregut. Estimating Total Demand and Benchmarking Base Price for Student Parking on University Campuses. Journal of Transportation Engineering, Part A: Systems. 2020 October. DOI: 10.1061/JTEPBS.0000439
5. Gurbuz O, Cheu R, Madrid D. Allocation of Student Parking Permits across a University Campus Based on Course Registration and Schedule. Journal of Transportation Engineering, Part A: Systems. 2022 January; 148(1):-. Available from: https://ascelibrary.org/doi/10.1061/JTEPBS.0000623 DOI: 10.1061/JTEPBS.0000623

Certification:

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Certified by Cheu, Ruey in SciENcv on 2025-09-08 16:41:51

IDENTIFYING INFORMATION:

NAME: Coopmans, Calvin

ORCID iD: https://orcid.org/0000-0002-9421-3829

POSITION TITLE: Assistant Research Professor and Director of USU AggieAir Group

PRIMARY ORGANIZATION AND LOCATION: Utah State University, Logan, UT, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
Utah State University, Logan, UT, USA	Postdoctoral Fellow	08/2014 - 08/2016	Electrical Engineering
Utah State University, Logan, UT, USA	PHD	05/2014	Electrical Engineering
Utah State University, Logan, UT, USA	MS	05/2010	Electrical Engineering
Montana State University, Bozeman, MT, USA	BS	05/2004	Computer engineering

Appointments and Positions

2016 - present Assistant Research Professor and Director of USU AggieAir Group, Utah State University, Logan, UT, United States

2014 - 2016 Postdoctoral Researcher, AggieAir Group, Utah Water Research Laboratory, Utah State University, Logan, UT, USA

2007 - 2014 Research Assistant, Center for Self-Organizing and Intelligent Systems, Utah State University, Logan, UT, USA

Products

Products Most Closely Related to the Proposed Project

1. Coopmans C, Slack S, Schwemmer N, Vance C, Beckwith A, Robinson D. GreatBlue: a 55-Pound Vertical-Takeoff-and-Landing Fixed-Wing sUAS for Science; Systems, Communication, Simulation, Data Processing, Payloads, Package Delivery, and Mission Flight Performance. Journal of Intelligent & Robotic Systems. 2024; 110(3). Available from: https://link.springer.com/epdf/10.1007/s10846-024-02052-z DOI: 10.1007/s10846-024-02052-z
2. Coopmans C, Snider R, Beckwith A. sUAS Command-and-Redundant-Control Communications System with ROS 2 Data Bridge for Aerial Remote Sensing Rapid Development. Proceedings of 2024 International Conference on Unmanned Aircraft Systems (ICUAS). 2024 International Conference on Unmanned Aircraft Systems (ICUAS); 2024 June 04; Chania, Crete, Greece. IEEE Xplore; c2024.

3. Coopmans C, Brimhall S, Goodman R, Petruzza S. Scientific timely actionable robotic data operating system (STARDOS): architecture and progress. Proceedings Volume 11747, Autonomous Air and Ground Sensing Systems for Agricultural Optimization and Phenotyping VI; 2021 April 12. DOI: 10.1117/12.2588009
4. McKee M, Torres-Rua A, Aboutalebi M, Nassar A, Coopmans C, Kustas W, Gao F, Dokoozlian N, Sanchez L, Alsina M. Challenges that beyond-visual-line-of-sight technology will create for UAS-based remote sensing in agriculture (Conference Presentation). ; International Society for Optics and Photonics; c2019.
5. Coopmans C. Cyber-Physical Systems Enabled by Unmanned Aerial System-Based Personal Remote Sensing: Data Mission Quality-Centric Design Architectures. Logan, UT: Utah State University; 2014. DOI: 10.26076/3def-1d13

Other Significant Products, Whether or Not Related to the Proposed Project

1. Coopmans C, Snider R, Toki S, Sewell A, Petruzza S, Montgomery E. A Real-Time Aerial Imagery Collection, Mapping, and Remote Sensing Testbench for Uncrewed Missions. Proc. of the 2025 IEEE ICUAS. 2025 International Conference on Unmanned Aircraft Systems (ICUAS); 2025 May; Charlotte, NC, USA. IEEE; c2025. Available from: https://ieeexplore.ieee.org/document/11007796 DOI: 10.1109/ICUAS65942.2025.11007796
2. Sewell A, Payne E, Coopmans C, Torres-Rua A, Petruzza S. Towards Real-Time SLAM-Based Orthomosaic Generation for High-Resolution Scientific Multi-Band sUAS Imagery. Proc. of the 2025 IEEE ICUAS. 2025 International Conference on Unmanned Aircraft Systems (ICUAS); 2025 May; Charlotte, NC, USA. IEEE; c2025. Available from: https://ieeexplore.ieee.org/document/11007794 DOI: 10.1109/ICUAS65942.2025.11007794
3. Gao R, Torres-Rua A, Nassar A, Alfieri J, Aboutalebi M, Hipps L, Bambach Ortiz N, Mcelrone AJ, Coopmans C, Kustas W, White W, McKee L, Del Mar Alsina M, Dokoozlian N, Sanchez L, Prueger JH, Nieto H, Agam N. Evapotranspiration partitioning assessment using a machine-learning-based leaf area index and the two-source energy balance model with sUAV information. Proc SPIE Int Soc Opt Eng. 2021;11747 PubMed Central PMCID: PMC8739084.
4. McKee M, Torres-Rua A, Aboutalebi M, Hassan Esfahani L, ELarab M, Kustas W, Coopmans C. Fusion of satellite and UAV imagery and big data for smarter farming. ; NASA ADS; c2018. Available from: https://ui.adsabs.harvard.edu/abs/2018AGUFM.B24D..05M
5. Torres-Rua A, Aboutalebi M, Wright T, Nassar A, Guillevic P, Hipps L, Gao F, Jim K, Alsina M, Coopmans C, others. Estimation of surface thermal emissivity in a vineyard for UAV microbolometer thermal cameras using NASA HyTES hyperspectral thermal, and landsat and AggieAir optical data. Autonomous Air and Ground Sensing Systems for Agricultural Optimization and Phenotyping IV. International Society for Optics and Photonics CDS; 2019; International Society for Optics and Photonics. DOI: 10.1117/12.2518958

Certification:

I certify that the information provided is current, accurate, and complete. This includes but is not limited to information related to domestic and foreign appointments and positions.

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Certified by Coopmans, Calvin in SciENcv on 2025-09-17 13:59:11

IDENTIFYING INFORMATION:

NAME: Corradini, Luca

ORCID iD: https://orcid.org/0000-0002-5397-7590

POSITION TITLE: Associate Professor

PRIMARY ORGANIZATION AND LOCATION: University of Colorado Boulder, Boulder, Colorado, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
University of Padova, Padova, Not Applicable, N/A, Italy	PHD	03/2008	Electrical Engineering
University of Padova, Padova, Not Applicable, N/A, Italy	MS	04/2004	Electrical Engineering

Appointments and Positions

2022 - present Associate Professor, University of Colorado Boulder, Boulder, Colorado, United States
2017 - present Associate Professor, University of Padova, Padova, Not Applicable, N/A, Italy
2021 - 2021 Visiting Associate Professor, University of Colorado, Boulder, Colorado, United States
2011 - 2017 Assistant Professor, University of Padova, Padova, Not Applicable, N/A, Italy
2008 - 2011 Research Associate, University of Colorado, Boulder, Colorado, United States

Products

Products Most Closely Related to the Proposed Project

1. Corradini L, Seltzer D, Bloomquist D, Zane R, Maksimović D, Jacobson B. Minimum Current Operation of Bidirectional Dual-Bridge Series Resonant DC/DC Converters. IEEE Transactions on Power Electronics. 2012 July; 27(7):3266-3276. Available from: http://ieeexplore.ieee.org/document/6111489/ DOI: 10.1109/TPEL.2011.2181421
2. Corradini L, Stefanutti W, Mattavelli P. Analysis of Multisampled Current Control for Active Filters. IEEE Transactions on Industry Applications. 2008; 44(6):1785-1794. Available from: http://ieeexplore.ieee.org/document/4681952/ DOI: 10.1109/TIA.2008.2006327
3. Corradini L, Mattavelli P, Corradin M, Polo F. Analysis of Parallel Operation of Uninterruptible Power Supplies Loaded Through Long Wiring Cables. IEEE Transactions on Power Electronics. 2010 April; 25(4):1046-1054. Available from: http://ieeexplore.ieee.org/document/5226592/ DOI: 10.1109/TPEL.2009.2031178
4. Rodriguez M, Stahl G, Corradini L, Maksimovic D. Smart DC Power Management System Based on Software-Configurable Power Modules. IEEE Transactions on Power Electronics. 2013 April; 28(4):1571-1586. Available from: http://ieeexplore.ieee.org/document/6247512/ DOI: 10.1109/TPEL.2012.2209681
5. Chen W, Zane R, Corradini L. Isolated Bidirectional Grid-Tied Three-Phase AC–DC Power

Conversion Using Series-Resonant Converter Modules and a Three-Phase Unfolder. IEEE Transactions on Power Electronics. 2017 December; 32(12):9001-9012. Available from: https://ieeexplore.ieee.org/document/7815415/ DOI: 10.1109/TPEL.2017.2652477

Other Significant Products, Whether or Not Related to the Proposed Project

1. Corradini L, Maksimović D, Mattavelli P, Zane R. 1 ed. Digital Control of High-Frequency Switched-Mode Power Converters [Internet] Wiley; 2015-06-22. -p. Available from: https://onlinelibrary.wiley.com/doi/book/10.1002/9781119025498 DOI: 10.1002/9781119025498
2. Corradini L, Mattavelli P, Tedeschi E, Trevisan D. High-Bandwidth Multisampled Digitally Controlled DC–DC Converters Using Ripple Compensation. IEEE Transactions on Industrial Electronics. 2008 April; 55(4):1501-1508. Available from: http://ieeexplore.ieee.org/document/4441343/ DOI: 10.1109/TIE.2008.917144
3. Han W, Corradini L. Wide-Range ZVS Control Technique for Bidirectional Dual-Bridge Series-Resonant DC–DC Converters. IEEE Transactions on Power Electronics. 2019 October; 34(10):10256-10269. Available from: https://ieeexplore.ieee.org/document/8613853/ DOI: 10.1109/TPEL.2019.2893282
4. Corradini L, Seltzer D, Bloomquist D, Zane R, Maksimovic D, Jacobson B. Zero Voltage Switching Technique for Bidirectional DC/DC Converters. IEEE Transactions on Power Electronics. 2014; 29(4):1585-1594. Available from: https://ieeexplore.ieee.org/document/6521503/ DOI: 10.1109/TPEL.2013.2265019
5. Bez F, Han W, Corradini L. A Low-Complexity Trajectory Controller for Reduced Conduction Losses in Series-Resonant Dual Half-Bridge Converters. IEEE Transactions on Power Electronics. 2018 November; 33(11):9963-9974. Available from: https://ieeexplore.ieee.org/document/8265608/ DOI: 10.1109/TPEL.2018.2796141

Certification:

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Certified by Corradini, Luca in SciENcv on 2024-07-25 16:19:40

IDENTIFYING INFORMATION:

NAME: Dai, Hang

ORCID iD: https://orcid.org/0000-0003-2470-9412

POSITION TITLE: Assistant Professor

PRIMARY ORGANIZATION AND LOCATION: Utah State University, Logan, Utah, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
University of Wisconsin-Madison, Madison, Wisconsin, United States	PHD	01/2021	Electrical Engineering
University of Wisconsin-Madison, Madison, Wisconsin, United States	MS	05/2018	Electrical Engineering
North China Electric Power University, Beijing, Not Applicable, N/A, China	BENG	06/2015	Electrical Engineering and its Automation

Appointments and Positions

2025 - present Assistant Professor, Utah State University, Logan, Utah, United States
2024 - 2025 Lead Engineer, GE Aerospace Research, Niskayuna, New York, United States
2021 - 2024 Research Engineer, GE Research, Niskayuna, New York, United States

Products

Products Most Closely Related to the Proposed Project

1. Hang Dai, Renato Amorim Torres, Feida Chen, Thomas M. Jahns, Bulent Sarlioglu. An H8 Current-Source Inverter Using Single-Gate WBG Bidirectional Switches. IEEE Transactions on Transportation Electrification. 2023 March. DOI: 10.1109/TTE.2022.3202303
2. Hang Dai, Renato Amorim Torres, Thomas M. Jahns, Bulent Sarlioglu. Analysis and Suppression of Conducted Common-Mode EMI in WBG-Based Current-Source Converter Systems. IEEE Transactions on Transportation Electrification. 2022 June. DOI: 10.1109/TTE.2022.3144426
3. Hang Dai, Renato Amorim Torres, Jerome Gossmann, Woongkul Lee, Thomas M. Jahns, Bulent Sarlioglu. A Seven-Switch Current-Source Inverter Using Wide Bandgap Dual-Gate Bidirectional Switches. IEEE Transactions on Industry Applications. 2022 May. DOI: 10.1109/TIA.2022.3149461
4. Hang Dai, Renato Amorim Torres, Thomas M. Jahns, Bulent Sarlioglu. Comparative Study of Conducted Common-Mode EMI in WBG-Enabled DC-Fed Three-Phase Current-Source Inverter. IEEE Journal of Emerging and Selected Topics in Power Electronics. 2022 December. DOI: 10.1109/JESTPE.2022.3161422

5. Thomas. M. Jahns, Hang Dai. The past, present, and future of power electronics integration technology in motor drives. CPSS Transactions on Power Electronics and Applications. 2017; 2(3):197-216. DOI: 10.24295/CPSSTPEA.2017.00019

Other Significant Products, Whether or Not Related to the Proposed Project

1. Hang Dai, et al. Supercritical Carbon Dioxide (sCO2)-Cooled Current Source Inverter-based Integrated Motor Drive for MW-scale Electric Aviation Applications. 2025 IEEE Applied Power Electronics Conference and Exposition (APEC); 2025 March 16; Atlanta, Georgia. c2025. DOI: 10.1109/apec48143.2025.10977553
2. Hang Dai, et al. A Hydrokinetic Energy Conversion System using Underwater LLC-type Resonant Converter. 2023 IEEE Energy Conversion Congress and Exposition (ECCE); 2023 November 02; c2023. DOI: 10.1109/ecce53617.2023.10362197
3. Hang Dai, R. A. Torres, T. M. Jahns, B. Sarlioglu. Characterization and Implementation of Hybrid Reverse-Voltage-Blocking and Bidirectional Switches using WBG Devices in Emerging Motor Drive Applications. 2019 IEEE Applied Power Electronics Conference and Exposition (APEC); 2019 ch; c2019. DOI: 10.1109/APEC.2019.8721910
4. Thomas M. Jahns, Bulent Sarlioglu, Hang Dai, Renato Torres. Wide Bandgap Power Electronics: Emerging Converter Technologies and Applications. Switzerland: Springer Nature; 2025. WBG-Based Integrated Motor Drive Using a Current Source Inverter.
5. Hang Dai, et al. Symmetric Dual-Buck Front-End Current-Source Converter with Low Common-Mode EMI. 2024 IEEE 11th Workshop on Wide Bandgap Power Devices & Applications (WiPDA); 2024 November 06; c2024. DOI: 10.1109/wipda62103.2024.10773149

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Certified by Dai, Hang in SciENcv on 2025-09-12 16:44:50

IDENTIFYING INFORMATION:

NAME: Gerdes, Ryan

ORCID iD: https://orcid.org/0000-0003-0876-1181

POSITION TITLE: Associate Professor

PRIMARY ORGANIZATION AND LOCATION: Virginia Polytechnic Institute and State University, Arlington, Virginia, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
Iowa State University of Science and Technology, Ames, Iowa, United States	PHD	08/2011	Electrical Engineering
Iowa State University of Science and Technology, Ames, Iowa, United States	MS	08/2006	Electrical Engineering
Iowa State University of Science and Technology, Ames, Iowa, United States	BS	05/2006	Electrical Engineering
Iowa State University of Science and Technology, Ames, Iowa, United States	BS	05/2004	Computer Engineering

Appointments and Positions

2020 - present Associate Professor, Virginia Polytechnic Institute and State University, Arlington, Virginia, United States

2016 - 2020 Assistant Professor, Virginia Polytechnic Institute and State University, Arlington, Virginia, United States

2011 - 2016 Assistant Professor, Utah State University, Logan, Utah, United States

Products

Products Most Closely Related to the Proposed Project

1. Dayanıklı G, Sinha S, Muniraj D, Gerdes R, Farhood M, Mina M. {Physical-Layer} attacks against pulse width {Modulation-Controlled} actuators. 31st USENIX Security Symposium (USENIX Security 22). 2022; :953-970. isbn: 1939133319
2. Dayanıklı G, Mohammed A, Gerdes R, Mina M. Wireless manipulation of serial communication. Proceedings of the 2022 ACM on Asia Conference on Computer and Communications Security. 2022; :222-236.
3. Man Y, Li M, Gerdes R. Remote perception attacks against camera-based object recognition systems and countermeasures. ACM Transactions on Cyber-Physical Systems. 2024; 8(2):1-27. issn: 2378-962X
4. Man Y, Muller R, Li M, Celik Z, Gerdes R. That person moves like a car: Misclassification attack detection for autonomous systems using spatiotemporal consistency. 32nd USENIX Security Symposium (USENIX Security 23). 2023; :6929-6946. isbn: 1939133378
5. Garrett I, Gerdes R. On the efficacy of model-based attack detectors for unmanned aerial systems. Proceedings of the Second ACM Workshop on Automotive and Aerial Vehicle

Security. 2020; :11-14.

Other Significant Products, Whether or Not Related to the Proposed Project

1. Mishra T, Wang J, Chantem T, Gerdes R, Zhang N. A Procrastinating Control-Flow Integrity Framework for Periodic Real-Time Systems. Proceedings of the 31st International Conference on Real-Time Networks and Systems. 2023; :132-142.
2. Mishra T, Chantem T, Gerdes R. Survey of control-flow integrity techniques for real-time embedded systems. ACM Transactions on Embedded Computing Systems (TECS). 2022; 21(4):1-32. issn: 1539-9087
3. Costley A, Kunz C, Sharma R, Gerdes R. Low cost, open-source platform to enable full-sized automated vehicle research. IEEE Transactions on Intelligent Vehicles. 2020; 6(1):3-13. issn: 2379-8904
4. Wu Z, Alizadeh O, Lelic M, Irfan W, Gerdes R. Test bed development for evaluating extremely fast charging stations. 2021 IEEE Transportation Electrification Conference & Expo (ITEC). 2021; :2-8. isbn: 1728175836
5. Gundu P, Vamvoudakis K, Gerdes R. An intermittent learning algorithm for high-speed autonomous driving in unknown environments. 2019 American Control Conference (ACC). 2019; :4286-4292. isbn: 1538679264

Certification:

I certify that the information provided is current, accurate, and complete. This includes but is not limited to current, pending, and other support (both foreign and domestic) as defined in 42 U.S.C. § 6605.

I also certify that, at the time of submission, I am not a party to a malign foreign talent recruitment program.

Misrepresentations and/or omissions may be subject to prosecution and liability pursuant to, but not limited to, 18 U.S.C. §§ 287, 1001, 1031 and 31 U.S.C. §§ 3729-3733 and 3802.

Certified by Gerdes, Ryan in SciENcv on 2025-01-24 11:20:28

IDENTIFYING INFORMATION:

NAME: Gkritza, Konstantina

ORCID iD: https://orcid.org/0000-0002-6598-4771

POSITION TITLE: Professor

PRIMARY ORGANIZATION AND LOCATION: Lyles School of Civil and Construction Engineering, Purdue University, West Lafayette, Indiana, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
Purdue University, West Lafayette, Indiana, United States	Postdoctoral Fellow	01/2007 - 08/2007	Civil Engineering
Purdue University, West Lafayette, Indiana, United States	PHD	12/2006	Civil Engineering
Virginia Polytechnic Institute and State University, Falls Church, Virginia, United States	MCE	08/2003	Civil Engineering
National Technical University of Athens, Athens, Not Applicable, N/A, GR	OTH	11/2001	Civil Engineering

Appointments and Positions

2019 - present Professor, Lyles School of Civil and Construction Engineering, Purdue University, West Lafayette, Indiana, United States

2020 - present Campus Director, National Science Foundation Engineering Research Center ASPIRE, Purdue University, West Lafayette, Indiana, United States

2013 - 2019 Associate Professor, Lyles School of Civil Engineering, Purdue University, West Lafayette, Indiana, United States

2012 - 2013 Associate Director, Mid-American Transportation Center, Region 7 University Transportation Center, US Department of Transportation, Ames, Iowa, United States

2011 - 2013 Director, Sustainable Transportation Systems Program, Institute for Transportation, Iowa State University, Ames, Iowa, United States

2007 - 2013 Assistant Professor, Department of Civil, Construction, and Environmental Engineering, Iowa State University, Ames, Iowa, United States

Products

Products Most Closely Related to the Proposed Project

1. Sinton J, Cervini G, Gkritza K, Labi S, Song Z. Examining electric vehicle adoption at the postal code level in US states. Transportation Research Part D: Transport and Environment. 2024 February 01; 127:104068. Available from:

https://www.sciencedirect.com/science/article/pii/S1361920924000257 issn: 1361-9209

2. Wijaya K, Humagain P, Gkritza K. Public preferences for stationary wired and dynamic wireless electric vehicle charging technologies. Transportation Research Part D: Transport and Environment. 2025 May 01; 142:104680. Available from: https://www.sciencedirect.com/science/article/pii/S1361920925000902 issn: 1361-9209
3. Qian X, Gkritza K. Spatial and temporal variance in public perception of electric vehicles: A comparative analysis of adoption pioneers and laggards using twitter data. Transport Policy. 2024 April 01; 149:150-162. Available from: https://www.sciencedirect.com/science/article/pii/S0967070X24000532 issn: 0967-070X
4. Konstantinou T, Gkritza K. Are we getting close to truck electrification? U.S. truck fleet managers' stated intentions to electrify their fleets. Transportation research part A: Policy and Planning. 2023 July; 173(1103697). Available from: https://doi.org/10.1016/j.tra.2023.103697
5. Flaris K, Gkritza K, Singleton PA, Graul ARH, Song Z. Riders' perceptions towards transit bus electrification: Evidence from Salt Lake City, Utah. Transportation research. Part D, Transport and environment. 2023 April; 117(1103642). Available from: https://doi.org/10.1016/j.trd.2023.103642

Other Significant Products, Whether or Not Related to the Proposed Project

1. Cervini G, Jung J, Gkritza K. Temperature and electric vehicle adoption: A ZIP code-level analysis in the US. Transportation Research Part D: Transport and Environment. 2024 November 01; 136:104435. Available from: https://www.sciencedirect.com/science/article/pii/S1361920924003924 issn: 1361-9209
2. Konstantinou T, Labi S, Gkritza K. Assessing highway revenue impacts of electric vehicles using a case study. Research in transportation economics. 2023 September; 100(1101248). Available from: https://doi.org/10.1016/j.retrec.2022.101248
3. Wen L, Sheng MS, Sharp B, Meng T, Du B, Yi M, Suomalainen K, Gkritza K. Exploration of the nexus between solar potential and electric vehicle uptake: A case study of Auckland, New Zealand. Energy Policy. 2023 February; 173(1113406). Available from: https://doi.org/10.1016/j.enpol.2022.113406
4. Konstantinou T, Gkritza K. Examining the barriers to electric truck adoption as a system: A Grey-DEMATEL approach Author links open overlay panel. Transportation research interdisciplinary perspectives. 2023 January; 17(1100746). Available from: https://doi.org/10.1016/j.trip.2022.100746
5. Haddad D, Konstantinou T, Aliprantis D, Gkritza K, Pekarek S, Haddock J. Analysis of the financial viability of high-powered electric roadways: A case study for the state of Indiana. Energy Policy. 2022 December; 171(1113275). Available from: https://doi.org/10.1016/j.enpol.2022.113275

Certification:

I certify that the information provided is current, accurate, and complete. This includes but is not limited to information related to domestic and foreign appointments and positions.

I also certify that, at the time of submission, I am not a party to a malign foreign talent recruitment

program.

Misrepresentations and/or omissions may be subject to prosecution and liability pursuant to, but not limited to, 18 U.S.C. §§ 287, 1001, 1031 and 31 U.S.C. §§ 3729-3733 and 3802.

Certified by Gkritza, Konstantina in SciENcv on 2025-09-05 10:54:59

IDENTIFYING INFORMATION:

NAME: Goodridge, Janette

POSITION TITLE: Professional Practice Assistant Professor

PRIMARY ORGANIZATION AND LOCATION: Utah State University, Logan, Utah, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
Utah State University, Logan, Utah, United States	PHD	12/2022	Economics
Utah State University, Logan, Utah, United States	MS	05/2018	Financial Economics
Utah State University, Logan, Utah, United States	BS	12/2005	Family, Consumer, and Human Development

Appointments and Positions

2023 - present Professional Practice Assistant Professor, Utah State University, Logan, Utah, United States

2018 - 2023 Adjunct Lecturer, Utah State University, Logan, Utah, United States

2017 - 2022 Graduate Research Fellow, Utah State University, Logan, Utah, United States

Products

Products Most Closely Related to the Proposed Project

1. Martin M, Goodridge J. The economic feasibility of electric vehicle charging stations: A capital budgeting approach. 46th Annual IAEE International Conference; 2025 June 15; Paris, France.
2. Peterson L, Goodridge J. Economic models aren't enough to convince companies to invest in heavy weight electric trucks. Nineteenth Annual Utah Conference on Undergraduate Research; 2025 February 28; Cedar City, UT, United States.
3. Garcia Weidling N, Goodridge J. Estimating equivalent annual costs: A comparative analysis of electric and traditional roadways. USU Undergraduate Research Symposium; 2025 April 09; Logan, UT, United States.
4. Garcia Weidling N, Goodridge J. Understanding the economic impacts of inductive roadway charging. USU Undergraduate Research Symposium; 2024 December 04; Logan, UT, United States.

Other Significant Products, Whether or Not Related to the Proposed Project

1. Pound M, Clemens S, Brough T, Jahangiry P, Goodridge J. Bruno: A Julia package for simulation, financial asset pricing, and delta hedging. Journal of Open Source Software. 2023; 8(82):1. Available from: https://joss.theoj.org/papers/10.21105/joss.05056.pdf

2. DeLisle R, Goodridge J. Executive portfolio diversification through dividends. 43rd Annual Meeting of the Association of Private Enterprise Education; 2018 April 04; Las Vegas, NV, United States.
3. Brough T, Goodridge J. Metallgesellschaft's hedging revisited: A superior predictive ability test analysis. Fifth International Conference on Econometrics and Statistics; 2022 June 04; Kyoto, Japan.

Certification:

I certify that the information provided is current, accurate, and complete. This includes but is not limited to information related to domestic and foreign appointments and positions.

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Certified by Goodridge, Janette in SciENcv on 2025-09-10 10:35:45

IDENTIFYING INFORMATION:

NAME: Goodridge, Wade

POSITION TITLE: Associate Professor

PRIMARY ORGANIZATION AND LOCATION: Utah State University, Logan, Utah, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
Utah State University, Logan, Utah, United States	PHD	05/2009	Civil & Environmental Engineering
Utah State University, Logan, Utah, United States	MS	05/2006	Civil & Environmental Engineering
Utah State University, Logan, Utah, United States	BS	05/2006	Civil Engineering
Utah State University, Logan, Utah, United States	BS	05/1998	Industrial Teacher Education

Appointments and Positions

2013 - present Associate Professor, Utah State University, Logan, Utah, United States
2016 - 2026 CUR Engineering Division Representative, The Council on Undergraduate Research , Gaithersburg, Maryland, United States
2013 - 2019 Assistant Professor, Utah State University, Logan, Utah, United States
2009 - 2013 Principal Lecturer, Utah State University, Logan, Utah, United States
2005 - 2008 Graduate Research Assistant, Utah Water Research Labratory, Logan, Utah, United States
2000 - 2009 Adjunct Professor, Utah State University, Logan, Utah, United States
1998 - 2000 Industrial Technology Teacher, Mountain Crest High School, Hyrum, Utah, United States

Products

Products Most Closely Related to the Proposed Project

1. Hamilton C., Stratman E., Kane D., Blonquist J.L., Shaheen N.L., Goodridge W.H.. Parallel Form Reliability Analysis of a Tactile Mental Cutting Test for Assessing Spatial Ability in Blind and Low-vision Populations. ASEE Annual Conference and Exposition, Conference Proceedings. ASEE Annual Conference and Exposition, Conference Proceedings; 2023; c2023. eid: 2-s2.0-85172109796
2. Green T., Kane D., Timko G.M., Shaheen N.L., Goodridge W.H.. Spatial Language Used by

Blind and Low-Vision High School Students During a Virtual Engineering Program (Research). ASEE Annual Conference and Exposition, Conference Proceedings. ASEE Annual Conference and Exposition, Conference Proceedings; 2022; c2022. eid: 2-s2.0-85138244012

3. Call BJ, Goodridge W, Villanueva I, Wan N, Jordan K. Utilizing Electroencephalography Measurements for Comparison of Task-Specific Neural Efficiencies: Spatial Intelligence Tasks. J Vis Exp. 2016 Aug 9; PubMed Central PMCID: PMC5091793.
4. Oyewola Y.V., Cowburn B.D., Green T., Goodridge W.H., Becker K.H.. The Effect of Introducing Biological and Environmental Discipline-Themed Problems in Statics on Students' Self-Efficacy and Perceived-Value of the Course. ASEE Annual Conference and Exposition, Conference Proceedings. ASEE Annual Conference and Exposition, Conference Proceedings; 2022; c2022. eid: 2-s2.0-85138298537
5. Goodridge, W. H., Shaheen, N., Bartholomew, S. W., Cunningham, A. Proposing Accessible Line Standards for Tactile Drafting Accessibility for Blind and Low-Vision Students. Technology and Engineering Teacher. 2023.

Other Significant Products, Whether or Not Related to the Proposed Project

1. Anderson JD, Goodridge W, Lawanto O, Crookston BM. Students Recorded Online Learning Task Value during Covid-19 in a Foundational Statics Course and Upper Level Hydraulics Course. International Journal of Engineering Pedagogy. 2023; ??(?).
2. Fang N, Farooq A, Goodridge WH. Enhancing Undergraduate Engineering Students' Spatial Skills through a 3D Interactive Virtual and Physical Manipulatives (VPM) Technology. International Journal of Engineering Education. 2022; 28(1):90-100. Available from: https://www.ijee.ie/contents/c380122.html
3. Strimel G, Huffman T, Grubbs M, Gurganus J, Sabarre A, Bartholomew SR, Goodridge e. Framework for P-12 Engineering Learning: A Defined and Cohesive Educational Foundation for P-12 Engineering, AEEE. 2020. Available from: https://p12framework.asee.org/
4. Davishahl E, Haskell TR, Davishahl J, Singleton L, Goodridge WH. Do They Understand Your Language? Assess their Fluency with Vector Representations. In:Wade Goodridge, editor. 126th Annual Conference Proceedings of the American Society for Engineering Education; 2019; Tampa, FL. c2019. Available from: https://peer.asee.org/do-they-understand-your-language-assess-their-fluency-with-vector-representations
5. Minichiello A, Lawanto O, Goodridge W, Iqbal A, Asghar M. Flipping the digital switch: Affective responses of STEM undergraduates to emergency remote teaching during the COVID-19 pandemic. Project Leadership and Society. 2022 December; 3:100043-. Available from: https://linkinghub.elsevier.com/retrieve/pii/S2666721522000035 DOI: 10.1016/j.plas.2022.100043

Certification:

I certify that the information provided is current, accurate, and complete. This includes but is not limited to information related to domestic and foreign appointments and positions.

I also certify that, at the time of submission, I am not a party to a malign foreign talent recruitment program.

Misrepresentations and/or omissions may be subject to prosecution and liability pursuant to, but not limited to, 18 U.S.C. §§ 287, 1001, 1031 and 31 U.S.C. §§ 3729-3733 and 3802.

Certified by Goodridge, Wade in SciENcv on 2025-09-08 13:06:07

IDENTIFYING INFORMATION:

NAME: Grajdura, Sarah

ORCID iD: https://orcid.org/0000-0003-2317-4305

POSITION TITLE: Assistant Professor

PRIMARY ORGANIZATION AND LOCATION: Utah State University, Logan, Utah, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
University of California, Davis, California, United States	PHD	03/2022	Civil and Environmental Engineering
University of Illinois, Urbana-Champaign, Illinois, United States	PHD	08/2016	Agricultural and Applied Economics
University of Illinois, Urbana-Champagin, Illinois, United States	BS	05/2011	Civil and Environmental Engineering

Appointments and Positions

2024 - present Assistant Professor, Utah State University, Logan, Utah, United States

2022 - 2024 Postdoctoral Associate, University of Vermont, Burlington, Vermont, United States

Products

Products Most Closely Related to the Proposed Project

1. Pezeshknejad P, Damon L, Grajdura S, Rowangould D. Advancing Equitable Electric Vehicle Adoption: Addressing Home Charging Barriers and Costs. [Poster]. 2024 Conference on Advancing Transportation Equity; 2024 July. Available from: https://trb.secure-platform.com/cate/solicitations/165/sessiongallery/2092/application/12226
2. Pezeshknejad P, Damon L, Grajdura S, Rowangould D. Advancing Equitable Electric Vehicle Adoption: Addressing Home Charging Barriers and Costs. Transportation Research Board Annual Meeting; 2025 January; Washington DC, USA. Available from: N/A PMID: N/A
3. Grajdura S, Rowangould D. Understanding Wildfire Evacuees' Perceived Safety on their Evacuation Route: A Study of the 2018 Camp Fire. Transportation research interdisciplinary perspectives. Forthcoming; N/A. Available from: N/A PMID: N/A
4. Grajdura S, Borjigin S, Niemeier D. Fast-Moving Dire Wildfire Evacuation Simulation. Transportation Research Part D: Transport and Environment. 2022 March; 104. Available from: https://www.sciencedirect.com/science/article/abs/pii/S1361920922000219?dgcid=coauthor DOI: 10.1016/j.trd.2022.103190

5. Grajdura S, Qian X, Niemeier D. Awareness, departure, and preparation time in no-notice wildfire evacuations. Safety Science. 2021; 139. Available from: https://www.sciencedirect.com/science/article/abs/pii/S092575352100103X DOI: 10.1016/j.ssci.2021.105258

Other Significant Products, Whether or Not Related to the Proposed Project

1. Espeland S, LanzDuret-Hernandez J, Grajdura S. Evaluation of Rural Travel Constraints and Travel Burdens in the U.S. and in Rural Zero-Car Households. [Internet]. Davis, CA: UC Davis: National Center for Sustainable Transportation; 2024 December. Available from: https://escholarship.org/uc/item/3rc9f2bt DOI: 10.7922/G23F4MZ7
2. Handy S, Grajdura S, Sun R, Barbour E, Barajas J, Jaller M, D'Agostino M, Circella G. Post-Covid Transportation Scenarios: Evaluating the Impact of Policies. [Internet]. Sacramento, CA: California Air Resources Board and California Environmental Protection Agency; 2023 October. N/A. Available from: https://ww2.arb.ca.gov/post-covid-transportation-scenarios-evaluating-impact-policies PMID: N/A
3. Grajdura S, Niemeier D. State of Programming and Data Science Preparation in Civil Engineering Undergraduate Curricula. Journal of Civil Engineering Education. 2023; 149(2). Available from: https://ascelibrary.org/doi/10.1061/%28ASCE%29EI.2643-9115.0000076 DOI: 10.1061/(ASCE)EI.2643-9115.0000076

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Certified by Grajdura, Sarah in SciENcv on 2025-09-10 00:16:43

IDENTIFYING INFORMATION:

NAME: Graul, Antje

POSITION TITLE: Associate Professor

PRIMARY ORGANIZATION AND LOCATION: Utah State University, Logan, Utah, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
Leeds University Business School, Leeds, Not Applicable, N/A, United Kingdom	PHD	09/2017	Business and Marketing

Appointments and Positions

2018 - present Associate Professor, Utah State University, Logan, Utah, United States

Products

Products Most Closely Related to the Proposed Project

1. Li Y, Graul A, Zhu J. Introducing the Concept of Consumer Reflexivity: The Mediating Role of Consumer Reflexivity in Shaping Future Sharing Intention. Journal of the Academy of Marketing Science.. 2023.
2. Brocato D, Graul A, Huff J, Hu A, Harms J. Understanding how Stand- Alone Sustainability Courses are Taught in Marketing: A Global Baseline Analysis. Journal of Marketing Education. 2022.
3. Graul A, Brough A, Isaac M. How Emotional Attachment Influences Lender Participation in Consumer-to-Consumer Rental Platforms. Journal of Business Research. 2021.
4. Stafford E, Graul A. Turning consumers green: From green marketing myopia to our 2020 vision. Sustainability: the Journal of Record. 2019.
5. Graul A, Brough A. Why We Don’t Rent What Others Love: The Role of Product Attachment in Consumer-to-Consumer Transactions. Journal of Consumer Psychology. 2021.

Other Significant Products, Whether or Not Related to the Proposed Project

1. Graul A. Exploring the Philosophical Underpinnings of Quantitative Research and Experimental Designs. Research Paradigm Considerations for Emerging Scholars. Editors: Anja Pabel, Josephine Pryce and Allison Anderson. Channel View Publications.. 2021.

Certification:

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Certified by Graul, Antje in SciENcv on 2025-09-17 14:32:51

IDENTIFYING INFORMATION:

NAME: Groves, Fawn

POSITION TITLE: Education and Community Engagement Specialist

PRIMARY ORGANIZATION AND LOCATION: Utah State University, Logan, Utah, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
University of Utah, Salt Lake City, Utah, United States	Other training	01/2019 - 05/2019	Teaching Endorsement, Multidisclipinary Instruction of English Learners
University of Utah, Logan, Utah, United States	MED	05/2007	Education, Culture, and Society
Utah State University, Logan, Utah, United States	BS	05/1995	Mathematics Education

Appointments and Positions

2022 - present Education and Community Engagement Specialist, Utah State University, Logan, Utah, United States

2017 - 2022 Department Lead and Teacher of English Learners, South Cache Middle School, Hyryum, Utah, United States

2008 - 2017 Lecturer, School of Teacher Education & Leadership, Utah State University, Logan, Utah, United States

2007 - 2008 Adjunct Instructor, Dept. of Secondary Education, Utah State University, Logan, Utah, United States

2006 - 2008 Assistant Director, Office of International Students & Scholars, Utah State University, Logan, Utah, United States

2005 - 2005 Adjunct Instructor, Dept. of Secondary Education, Utah State University, Logan, Utah, United States

2001 - 2006 Academic Programs Coordinator, Office of Multicultural Student Services, Utah State University, Logan, Utah, United States

1997 - 2001 Mathematics Teacher, Logan High School, Logan, Utah, United States

Products

Products Most Closely Related to the Proposed Project

Other Significant Products, Whether or Not Related to the Proposed Project

Certification:

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Certified by Groves, Fawn in SciENcv on 2024-08-02 15:23:54

IDENTIFYING INFORMATION:

NAME: Gunther, Jacob

ORCID iD: https://orcid.org/0000-0003-2334-1601

POSITION TITLE: Professor

PRIMARY ORGANIZATION AND LOCATION: Utah State University, Logan, Not Applicable, N/A, USA

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
Brigham Young University, Provo, Utah, United States	PHD	12/1998	Electrical Engineering
Brigham Young University, Provo, Utah, United States	MS	05/1994	Electrical Engineering
Brigham Young University, Provo, Utah, United States	BS	05/1993	Electrical Engineering

Appointments and Positions

2000 - present Professor, Utah State University, Logan, Not Applicable, N/A, USA
2016 - present Department Head, Utah State University, Logan, Utah, United States
2015 - 2021 Chief Technical Officer, Photorithm, Inc., Smithfield, Utah, United States
1998 - 2000 Research Engineer, Merasoft, Inc., Orem, Utah, United States
1994 - 1994 Systems Engineer, Lockheed Martin, Manassas, Virginia, United States

Products

Products Most Closely Related to the Proposed Project

1. Mortensen D, Gunther J, Droge G. A Bin Packing Approach to Minimize Charging Cost for Electric Bus Fleets. IEEE Transactions on Intelligent Transportation Systems. 2024; 25(7):7818-7831. Available from: https://ieeexplore.ieee.org/document/10423914/ DOI: 10.1109/TITS.2024.3358178
2. Whitaker J, Droge G, Hansen M, Mortensen D, Gunther J. A Network Flow Approach to Battery Electric Bus Scheduling. IEEE Transactions on Intelligent Transportation Systems. 2023; 24(9):9098-9109. Available from: https://ieeexplore.ieee.org/document/10137347/ DOI: 10.1109/TITS.2023.3276269
3. Shekaramiz M, Moon T, Gunther J. Exploration vs. Data Refinement via Multiple Mobile Sensors. Entropy. 2019 June 05; 21(6):568-. Available from: https://www.mdpi.com/1099-4300/21/6/568 DOI: 10.3390/e21060568
4. Shekaramiz M, Moon T, Gunther J. Bayesian Compressive Sensing of Sparse Signals with Unknown Clustering Patterns. Entropy. 2019 March 05; 21(3):247-. Available from: https://www.mdpi.com/1099-4300/21/3/247 DOI: 10.3390/e21030247
5. Shi L, Hu R, Gunther J, Ye Y, Zhang H. Energy Efficiency for RF-Powered Backscatter Networks Using HTT Protocol. IEEE Transactions on Vehicular Technology. 2020 November;

69(11):13932-13936. Available from: https://ieeexplore.ieee.org/document/9159908/ DOI: 10.1109/TVT.2020.3014500

Other Significant Products, Whether or Not Related to the Proposed Project

Certification:

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Certified by Gunther, Jacob in SciENcv on 2024-08-08 14:09:26

IDENTIFYING INFORMATION:

NAME: Haddock, John E

ORCID iD: https://orcid.org/0000-0002-8030-317x

POSITION TITLE: Professor of Civil Engineering

PRIMARY ORGANIZATION AND LOCATION: Purdue University, West Lafayette, Indiana, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
Auburn University, Auburn, Alabama, United States	PHD	05/1998	Civil Engineering
Purdue University, West Lafayette, Indiana, United States	MS	05/1993	Civil Engineering
Purdue University, West Lafayette, Indiana, United States	BS	05/1987	Physics

Appointments and Positions

2014 - present Professor of Civil Engineering, Purdue University, West Lafayette, Indiana, United States

2006 - present Director, Local Technical Assistance Program, Purdue University, West Lafayette, Indiana, United States

2005 - 2014 Associate Professor of Civil Engineering, Purdue University, West Lafayette, Indiana, United States

2000 - 2005 Assistant Professor of Civil Engineering, Purdue University, West Lafayette, Indiana, United States

1998 - 2000 District Engineer, Asphalt Institute, Lexington, Kentucky, United States

1996 - 1998 Section Engineer, Indiana Department of Transportation, West Lafayette, Indiana, United States

1993 - 1996 Senior Research Associate, National Center for Asphalt Technology, Auburn, Alabama, United States

1990 - 1993 Mix Design Engineer, Heritage Research Group, Indianapolis, Indiana, United States

Products

Products Most Closely Related to the Proposed Project

1. Cruz H, Moncada O, Jahangiri B, Tirado C, Nazarian S, Haddock J. Analyzing the Mechanical Response of a Calibrated Finite Element Model for Flexible Pavement with Embedded Dynamic Wireless Power Transfer Technology. Transportation Research Record: Journal of the Transportation Research Board. 2024 April 20; :-. Available from:

https://journals.sagepub.com/doi/10.1177/03611981241242077 DOI: 10.1177/03611981241242077

2. Moncada O, Orosa P, John E. Haddock. Assessment of Static Load Strains in a Flexible Pavement with Embedded Dynamic Wireless Power Transfer (DWPT) Components. Lecture Notes in Civil Engineering [Internet] Cham: Springer Nature Switzerland; 2024. Chapter Chapter 18171-178p. Available from: https://link.springer.com/10.1007/978-3-031-63584-7_18 DOI: 10.1007/978-3-031-63584-7_18
3. Park B, Cho S, Rahbar-Rastegar R, Nantung T, Haddock J. Prediction of critical responses in full-depth asphalt pavements using the falling weight deflectometer deflection basin parameters. Construction and Building Materials. 2022 February; 318:126019-. Available from: https://linkinghub.elsevier.com/retrieve/pii/S095006182103751X DOI: 10.1016/j.conbuildmat.2021.126019
4. Park B, Cho S, Nantung T, Haddock J. Field Validation of Falling Weight Deflectometer Deflection-Based Critical Strain Prediction Models for Full-Depth Asphalt Pavements. Transportation Research Record: Journal of the Transportation Research Board. 2023 March 30; 2677(10):635-645. Available from: http://journals.sagepub.com/doi/10.1177/03611981231162594 DOI: 10.1177/03611981231162594
5. Haddad D, Konstantinou T, Aliprantis D, Gkritza K, Pekarek S, Haddock J. Analysis of the Financial Viability of High-Powered Electric Roadways: A Case Study for the State of Indiana," Energy Policy, Vol. 171, 2022, https://doi.org/10.1016/j.enpol.2022.113275. Energy Policy. 2022 December; 171. Available from: https://doi.org/10.1016/j.enpol.2022.113275

Other Significant Products, Whether or Not Related to the Proposed Project

1. Montoya M, Rahbar-Rastegar R, Haddock J. Incorporating phase change materials in asphalt pavements to melt snow and ice. International Journal of Pavement Engineering. 2022 February 28; 24(2):-. Available from: https://www.tandfonline.com/doi/full/10.1080/10298436.2022.2041195 DOI: 10.1080/10298436.2022.2041195
2. Montoya M, Betancourt D, Rahbar-Rastegar R, Youngblood J, Martinez C, Haddock J. Environmentally Tuning Asphalt Pavements Using Microencapsulated Phase Change Materials. Transportation Research Record: Journal of the Transportation Research Board. 2022 January 22; 2676(5):158-175. Available from: http://journals.sagepub.com/doi/10.1177/03611981211068366 DOI: 10.1177/03611981211068366
3. Burroughs J, Weiss C, Shannon J, Haddock J, Weiss J. Modeling the Influence of Changes in Silica Fume on Concrete Performance. Journal of Materials in Civil Engineering. 2021 March; 33(3):-. Available from: https://ascelibrary.org/doi/10.1061/%28ASCE%29MT.1943-5533.0003580 DOI: 10.1061/(ASCE)MT.1943-5533.0003580

Certification:

I certify that the information provided is current, accurate, and complete. This includes but is not limited to information related to domestic and foreign appointments and positions.

I also certify that, at the time of submission, I am not a party to a malign foreign talent recruitment program.

Misrepresentations and/or omissions may be subject to prosecution and liability pursuant to, but not limited to, 18 U.S.C. §§ 287, 1001, 1031 and 31 U.S.C. §§ 3729-3733 and 3802.

Certified by Haddock, John E in SciENcv on 2025-09-18 13:28:14

IDENTIFYING INFORMATION:

NAME: Halling, Marvin W

ORCID iD: https://orcid.org/0000-0003-1599-8304

POSITION TITLE: Department Head and Professor

PRIMARY ORGANIZATION AND LOCATION: Department of Civil and Environmental Engineering, Utah State University, Logan, Utah, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
California Institute of Technology (CALTECH), Pasadena, California, United States	PHD	06/1995	Applied Mechanics, Geophysics (Minor)
Stanford University, Stanford, California, United States	MS	06/1986	Civil Engineering (Structural Engineering)
Utah State University, Logan, Utah, United States	BS	06/1985	Civil Engineering

Appointments and Positions

2021 - present Department Head and Professor, Department of Civil and Environmental Engineering, Utah State University, Logan, Utah, United States

2020 - present Campus Director, USU, CTIPS Transportation Center, Logan, Utah, United States

2011 - present Professor, Department of Civil and Environmental Engineering, Utah State University, Logan, Utah, United States

2001 - 2021 Program Head, Structures Program, Utah State University, Logan, Utah, United States

2000 - 2011 Associate Professor, Utah State University, Logan, Utah, United States

1994 - 2000 Assistant Professor, Utah State University, Logan, Utah, United States

Products

Products Most Closely Related to the Proposed Project

1. Fray F. Pozo-Lora, Marc Maguire, Andrew D. Sorensen, Marvin W. Halling, Paul J. Barr. Benchmarking the Bond of 19-Wire–28.6-mm-Diameter Prestressing Strands to Normal-Weight Concrete. Journal of Materials in Civil Engineering. 2024 November. DOI: 10.1061/JMCEE7.MTENG-18044

Other Significant Products, Whether or Not Related to the Proposed Project

Certification:

I certify that the information provided is current, accurate, and complete. This includes but is not

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Certified by Halling, Marvin W in SciENcv on 2025-09-19 11:58:03

IDENTIFYING INFORMATION:

NAME: Hannigan, Michael

ORCID iD: https://orcid.org/0000-0002-9877-9459

POSITION TITLE: Professor

PRIMARY ORGANIZATION AND LOCATION: University of Colorado, Boulder, Colorado, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
California Institute of Technology, Pasadena, California, United States	PhD	05/1997	Environmental Engineering Science
Southern Methodist University, Dallas, TX, United States	BS	05/1990	Civil Engineering

Appointments and Positions

2018 - present Professor, University of Colorado, Boulder, Colorado, United States
2018 - present Professor, University of Colorado, Mechanical Engineering, Boulder, Colorado, US
2013 - 2018 Associate Professor, University of Colorado, Mechanical Engineering, Boulder, Colorado, United States
2007 - 2013 Assistant Professor, University of Colorado, Mechanical Engineering, Boulder, Colorado, United States
2001 - 2007 Research Assistant Professor, University of Colorado, Mechanical Engineering, Boulder, Colorado, United States
1999 - 2001 Assistant Research Professor, University of Denver, Chemistry, Denver, Colorado, United States
1998 - 1998 Postdoctoral Researcher, Colorado State University, Atmospheric Sciences, Fort Collins, Colorado, United States

Products

Products Most Closely Related to the Proposed Project

1. Collier-Oxandale A, Wong N, Navarro S, Johnston J, Hannigan M. Using gas-phase air quality sensors to disentangle potential sources in a Los Angeles neighborhood. Atmospheric Environment. 2020 July; 233:117519-. Available from: https://linkinghub.elsevier.com/retrieve/pii/S1352231020302557 DOI: 10.1016/j.atmosenv.2020.117519
2. Shamasunder B, Collier-Oxandale A, Blickley J, Sadd J, Chan M, Navarro S, Hannigan M, Wong NJ. Community-Based Health and Exposure Study around Urban Oil Developments in South Los Angeles. Int J Environ Res Public Health. 2018 Jan 15;15(1) PubMed Central PMCID: PMC5800237.
3. Piedrahita R, Xiang Y, Masson N, Ortega J, Collier A, Jiang Y, Li K, Dick R, Lv Q, Hannigan

M, Shang L. The next generation of low-cost personal air quality sensors for quantitative exposure monitoring. Atmospheric Measurement Techniques. 2014 October 07; 7(10):3325-3336. Available from: https://amt.copernicus.org/articles/7/3325/2014/ DOI: 10.5194/amt-7-3325-2014

4. Piedrahita R, Kanyomse E, Coffey E, Xie M, Hagar Y, Alirigia R, Agyei F, Wiedinmyer C, Dickinson K, Oduro A, Hannigan M. Exposures to and origins of carbonaceous PM2.5 in a cookstove intervention in Northern Ghana. Science of The Total Environment. 2017 January; 576:178-192. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0048969716322355 DOI: 10.1016/j.scitotenv.2016.10.069
5. Casey J, Ortega J, Coffey E, Hannigan M. Low-cost measurement techniques to characterize the influence of home heating fuel on carbon monoxide in Navajo homes. Science of The Total Environment. 2018 June; 625:608-618. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0048969717337452 DOI: 10.1016/j.scitotenv.2017.12.312

Other Significant Products, Whether or Not Related to the Proposed Project

1. Coffey ER, Muvandimwe D, Hagar Y, Wiedinmyer C, Kanyomse E, Piedrahita R, Dickinson KL, Oduro A, Hannigan MP. New Emission Factors and Efficiencies from in-Field Measurements of Traditional and Improved Cookstoves and Their Potential Implications. Environ Sci Technol. 2017 Nov 7;51(21):12508-12517. PubMed PMID: 29058409.
2. Pfotenhauer D, Coffey E, Piedrahita R, Agao D, Alirigia R, Muvandimwe D, Lacey F, Wiedinmyer C, Dickinson K, Dalaba M, Kanyomse E, Oduro A, Hannigan M. Updated Emission Factors from Diffuse Combustion Sources in Sub-Saharan Africa and Their Effect on Regional Emission Estimates. Environmental Science & Technology. 2019 May 09; 53(11):6392-6401. Available from: https://pubs.acs.org/doi/10.1021/acs.est.8b06155 DOI: 10.1021/acs.est.8b06155
3. Dickinson KL, Kanyomse E, Piedrahita R, Coffey E, Rivera IJ, Adoctor J, Alirigia R, Muvandimwe D, Dove M, Dukic V, Hayden MH, Diaz-Sanchez D, Abisiba AV, Anaseba D, Hagar Y, Masson N, Monaghan A, Titiati A, Steinhoff DF, Hsu YY, Kaspar R, Brooks B, Hodgson A, Hannigan M, Oduro AR, Wiedinmyer C. Research on Emissions, Air quality, Climate, and Cooking Technologies in Northern Ghana (REACCTING): study rationale and protocol. BMC Public Health. 2015 Feb 12;15:126. PubMed Central PMCID: PMC4336492.
4. Piedrahita R, Coffey E, Hagar Y, Kanyomse E, Verploeg K, Wiedinmyer C, Dickinson K, Oduro A, Hannigan M. Attributing Air Pollutant Exposure to Emission Sources with Proximity Sensing. Atmosphere. 2019 July 13; 10(7):395-. Available from: https://www.mdpi.com/2073-4433/10/7/395 DOI: 10.3390/atmos10070395
5. Okorn K, Jimenez A, Collier-Oxandale A, Johnston J, Hannigan M. Characterizing methane and total non-methane hydrocarbon levels in Los Angeles communities with oil and gas facilities using air quality monitors. Sci Total Environ. 2021 Jul 10;777 PubMed Central PMCID: PMC8485894.

Certification:

I certify that the information provided is current, accurate, and complete. This includes but is not

limited to current, pending, and other support (both foreign and domestic) as defined in 42 U.S.C. § 6605.

I also certify that, at the time of submission, I am not a party to a malign foreign talent recruitment program.

Misrepresentations and/or omissions may be subject to prosecution and liability pursuant to, but not limited to, 18 U.S.C. §§ 287, 1001, 1031 and 31 U.S.C. §§ 3729-3733 and 3802.

Certified by Hannigan, Michael in SciENcv on 2024-08-05 13:25:48

BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors.
Follow this format for each person. DO NOT EXCEED FIVE PAGES.

NAME: Harper, Mario

eRA COMMONS USER NAME (credential, e.g., agency login):

POSITION TITLE: Assistant Professor

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE (if applicable)	START DATE MM/YYYY	COMPLETION DATE MM/YYYY	FIELD OF STUDY
Utah State University, Logan, Utah	BA		05/2014	Economics
Utah State University, Logan, Utah	BS		05/2014	Physics
Utah State University, Logan, Utah	MS		05/2015	Financial Economics
Florida State University, Tallahassee, Florida	MS		05/2017	Computational Science
Florida State University, Tallahassee, Florida	PHD		12/2018	Computational Science
Microsoft, Tallahassee, Florida	N/A		10/2019	Microsoft Certified: Azure Data Fundamentals
Microsoft, Tallahassee, Florida	N/A		12/2019	Microsoft Certified: Azure Data Scientist Associate
Amazon Web Services (AWS), Logan, Utah	N/A		11/2020	AWS Certified Solutions Architect - Professional

A. Personal Statement

My research agenda integrates artificial intelligence, robotics, and electrified transportation with the goal of advancing sustainable mobility systems and resilient infrastructure. As a faculty member at Utah State University and a lead within the NSF Engineering Research Center for Advancing Sustainability through Powered Infrastructure for Roadway Electrification (ASPIRE), I have built a portfolio at the intersection of AI-driven energy management, transportation electrification, and real-time decision-making. My work combines algorithm development with applied system engineering to ensure that electrified transportation can be deployed reliably, efficiently, and at scale. I direct the Decision-making, Intelligence, Robotics, Electrification, and Transportation (DIRECT) Laboratory, which specializes in developing intelligent algorithms for energy management, control of distributed infrastructure, and autonomous mobility. My group has created digital twins of electrified transportation hubs, advanced optimization models for charger siting and control, and reinforcement learning–based energy management systems that integrate with microgrids and transit operations. These efforts have supported partnerships with major industry and government stakeholders, including the Utah Transit Authority, Honda Research, ABB, Rocky Mountain Power, and the Army Research Laboratory. In ASPIRE, I lead the data and AI portfolio, connecting large-scale data services with applied decision-making tools. This includes deploying real-time telemetry across hundreds of chargers in Utah, creating predictive analytics for electric bus operations, and designing scalable architectures for multi-modal charging hubs.

1. Allred C, Pusey J, Harper M. Cultivating Quadrupedal Robotic Agility: Unveiling Reinforcement Learning Dynamics with the Boosted Tree Motif Classifier. International Journal of Semantic

Computing. 2025; 19(1). issn: 1793-351X

2. Ordonez,Camilo,, Harper,Mario,, Boylan,Jonathan T,, Collins Jr,Emmanuel G,. Trajectory Planning Using Dynamics and Power Models: A Heuristics Based Approach. CRC Press; 2025. isbn: 1040366171
3. Gmeiner R, Harper M. Artificial intelligence and economic planning. AI & SOCIETY. 2024; 39(3):985-1007. issn: 0951-5666
4. Nelson K, Harper M. POSEIDON-SAT: Data Enhancement for Optical Fishing Vessel Detection From Low-Cost Satellites. IEEE Transactions on Intelligent Transportation Systems. 2024. issn: 1524-9050

B. Positions and Honors

Positions and Scientific Appointments

2022 - Data and AI Research Area Lead, NSF ASPIRE Engineering Research Center, Logan, Utah

2020 - Assistant Professor, Utah State University, Computer Science Department, Logan, Utah

C. Contribution to Science

1. a. Maheshwarkar A, Geary B, Harper M, Petruzza S. A Comprehensive and Interactive Visualization Tool to Support Equitable Adoption of Electrified Transportation. 2024 IEEE 27th International Conference on Intelligent Transportation Systems (ITSC). 2024; :3459-3465. isbn: 9798331505929

   b. Bohlourihajar K, Harper M. Catalyzing Urban Health and Sustainability: The Impact of Electric Bus Fleet Electrification in Justice 40 Communities of Salt Lake County. 2024 Forum for Innovative Sustainable Transportation Systems (FISTS). 2024; :1-6. isbn: 9798350370669

   c. Anderson R, Anderson J, Anderson T, Harper M. Charger Reservation Web Application. Software Impacts. 2023; 18:100589. issn: 2665-9638

   d. Anderson R, Harper M. Save Money, Get Charged: Facility-Tied Energy Management with Unknown and Unscheduled EV Charging. 2023 IEEE 26th International Conference on Intelligent Transportation Systems (ITSC). 2023; :986-991. isbn: 9798350399462

2. a. Allred C, Pusey J, Harper M. Cultivating Quadrupedal Robotic Agility: Unveiling Reinforcement Learning Dynamics with the Boosted Tree Motif Classifier. International Journal of Semantic Computing. 2025; 19(1). issn: 1793-351X

   b. Ordonez,Camilo,, Harper,Mario,, Boylan,Jonathan T,, Collins Jr,Emmanuel G,. Trajectory Planning Using Dynamics and Power Models: A Heuristics Based Approach. CRC Press; 2025. isbn: 1040366171

   c. Gmeiner R, Harper M. Artificial intelligence and economic planning. AI & SOCIETY. 2024; 39(3):985-1007. issn: 0951-5666

   d. Nelson K, Harper M. POSEIDON-SAT: Data Enhancement for Optical Fishing Vessel Detection From Low-Cost Satellites. IEEE Transactions on Intelligent Transportation Systems. 2024. issn: 1524-9050

D. Scholastic Performance

Scholastic Performance

YEAR	COURSE TITLE	GRADE
	UTAH STATE UNIVERSITY	
	UTAH STATE UNIVERSITY	

YEAR	COURSE TITLE	GRADE
	UTAH STATE UNIVERSITY	
	FLORIDA STATE UNIVERSITY	
	FLORIDA STATE UNIVERSITY	
	MICROSOFT	
	MICROSOFT	
	AMAZON WEB SERVICES (AWS)	

IDENTIFYING INFORMATION:

NAME: Hodge, Bri-Mathias Scott

ORCID iD: https://orcid.org/0000-0001-8684-0534

POSITION TITLE: Professor

PRIMARY ORGANIZATION AND LOCATION: University of Colorado Boulder, Boulder, Colorado, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
National Renewable Energy Laboratory, Golden, Colorado, United States	Postdoctoral Fellow	09/2010 - 08/2011	Power Systems
Purdue University, West Lafayette, Indiana, United States	PHD	08/2010	Chemical Engineering
Åbo Akademi, Turku, Not Applicable, N/A, Finland	MS	10/2005	Chemical Engineering
Carnegie Mellon University, Pittsburgh, Pennsylvania, United States	BS	05/2004	Chemical Engineering

Appointments and Positions

2018 - present Professor, University of Colorado Boulder, Boulder, Colorado, United States
2018 - 2024 Chief Scientist, National Renewable Energy Laboratory, Golden, Colorado, United States
2016 - 2018 Manager - Power System Design and Studies Group, National Renewable Energy Laboratory, Golden, Colorado, United States
2014 - 2015 Section Supervisor - System Planning and Reliability, National Renewable Energy Laboratory, Golden, Colorado, United States
2013 - 2014 Senior Engineer, National Renewable Energy Laboratory, Golden, Colorado, United States
2011 - 2013 Research Engineer, National Renewable Energy Laboratory, Golden, Colorado, United States

Products

Products Most Closely Related to the Proposed Project

1. Sajadi A, Kenyon R, Hodge BS. Synchronization in electric power networks with inherent heterogeneity up to 100% inverter-based renewable generation. Nature Communications. 2022 May 05; 14. Available from: https://www.nature.com/articles/s41467-022-30164-3
2. Kenyon R, Mather B, Hodge BS. Coupled transmission and distribution simulations to assess distributed generation response to power system faults. Electric Power Systems Research. 2020 December; 189. Available from: https://doi.org/10.1016/j.epsr.2020.106746
3. Kenyon R, Maguire J, Present E, Christensen D, Hodge B. Bulk Electric Power System Risks From Coordinated Edge Devices. IEEE Open Access Journal of Power and Energy. 2021; 8:35-

44. Available from: https://ieeexplore.ieee.org/document/9328163/ DOI: 10.1109/OAJPE.2021.3052433

4. Hodge, B, Shukla, A, Huang, S, Reklaitis, G, Venkatasubramanian, V, Peny, J. Multi-Paradigm Modeling of the Effects of PHEV Adoption on Electric Utility Usage Levels and Emissions. Industrial & Engineering Chemistry Research. 2011. DOI: https://doi.org/10.1021/ie101837w. Multi-Paradigm Modeling of the Effects of PHEV Adoption on Electric Utility Usage Levels and Emissions. Industrial & Engineering Chemistry Research. 2011. DOI: https://doi.org/10.1021/ie101837w
5. Doubleday K, Parker A, Hafiz F, Irwin B, Hancock S, Pless S, Hodge B. Toward a subhourly net zero energy district design through integrated building and distribution system modeling. Journal of Renewable and Sustainable Energy. 2019 May 01; 11(3):-. Available from: https://pubs.aip.org/jrse/article/11/3/036301/284878/Toward-a-subhourly-net-zero-energy-district-design DOI: 10.1063/1.5093917

Other Significant Products, Whether or Not Related to the Proposed Project

1. Omar J. Guerra, Jiazi Zhang, Joshua Eichman, Paul Denholm, Jennifer Kurtz, Bri-Mathias Hodge. The value of seasonal energy storage technologies for the integration of wind and solar power. Energy & Environmental Science. 2020. Available from: https://doi.org/10.1039/D0EE00771D DOI: 10.1039/D0EE00771D
2. Davis SJ, Lewis NS, Shaner M, Aggarwal S, Arent D, Azevedo IL, Benson SM, Bradley T, Brouwer J, Chiang YM, Clack CTM, Cohen A, Doig S, Edmonds J, Fennell P, Field CB, Hannegan B, Hodge BM, Hoffert MI, Ingersoll E, Jaramillo P, Lackner KS, Mach KJ, Mastrandrea M, Ogden J, Peterson PF, Sanchez DL, Sperling D, Stagner J, Trancik JE, Yang CJ, Caldeira K. Net-zero emissions energy systems. Science. 2018 Jun 29;360(6396) PubMed PMID: 29954954.
3. Draxl C, Clifton A, Hodge B, McCaa J. The Wind Integration National Dataset (WIND) Toolkit. Applied Energy. 2015 August; 151:355 - 366. Available from: https://doi.org/10.1016/j.apenergy.2015.03.121
4. Julien S, Sajadi A, Hodge B. Hierarchical Control of Utility-Scale Solar PV Plants for Mitigation of Generation Variability and Ancillary Service Provision. IEEE Transactions on Sustainable Energy. 2022; 13(3):1383-1395. Available from: https://ieeexplore.ieee.org/document/9707870/ DOI: 10.1109/TSTE.2022.3149451
5. Markovic M, Sajadi A, Florita A, Cruickshank III R, Hodge B. Voltage Estimation in Low-Voltage Distribution Grids With Distributed Energy Resources. IEEE Transactions on Sustainable Energy. 2021; 12(3):1640-1650. Available from: https://ieeexplore.ieee.org/document/9359483/ DOI: 10.1109/TSTE.2021.3060546

Certification:

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Misrepresentations and/or omissions may be subject to prosecution and liability pursuant to, but not limited to, 18 U.S.C. §§ 287, 1001, 1031 and 31 U.S.C. §§ 3729-3733 and 3802.

Certified by Hodge, Bri-Mathias Scott in SciENcv on 2024-08-01 13:49:57

IDENTIFYING INFORMATION:

NAME: Katz, Amanda

POSITION TITLE: Assistant Professor

PRIMARY ORGANIZATION AND LOCATION: Utah State University, Logan, Utah, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
Carnegie Mellon University, Pittsburgh, Pennsylvania, United States	PHD	08/2021	History
New York University, New York, New York, United States	MA	08/2014	Humanities and Social Thought
Worcester State University, Worcester, Massachusetts, United States	BA	05/2004	English

Appointments and Positions

2023 - present Assistant Professor, Utah State University, Logan, Utah, United States

Products

Products Most Closely Related to the Proposed Project

Other Significant Products, Whether or Not Related to the Proposed Project

Certification:

I certify that the information provided is current, accurate, and complete. This includes but is not limited to information related to domestic and foreign appointments and positions.

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Misrepresentations and/or omissions may be subject to prosecution and liability pursuant to, but not limited to, 18 U.S.C. §§ 287, 1001, 1031 and 31 U.S.C. §§ 3729-3733 and 3802.

Certified by Katz, Amanda in SciENcv on 2025-09-17 17:29:51

IDENTIFYING INFORMATION:

NAME: Lee, Juhyeong

ORCID iD: https://orcid.org/0000-0001-9383-3869

POSITION TITLE: Assistant Professor

PRIMARY ORGANIZATION AND LOCATION: Utah State University, Logan, Utah, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
Mississippi State University, Mississippi State, MS, US	PhD	08/2017	Aerospace Engineering
Mississippi State University, Mississippi State, MS, US	MS	05/2010	Aerospace Engineering
Chonnam National University, Gwangju, Jeollanam-do, KR	BS	02/2004	Material Science and Engineering

Appointments and Positions

2019 - present Assistant Professor, Utah State University, Logan, Utah, United States

2018 - 2019 Research Associate, University of Bristol, Bristol, Not Applicable, N/A, United Kingdom

2017 - 2018 Postdoctoral Associate, Center for Advanced Vehicular Systems, Starkville, Mississippi, United States

2013 - 2014 Design Relese Engineer, General Motors (South Korea), Incheon, Not Applicable, N/A, Korea South

2010 - 2013 Researcher, OCI Company Ltd, Seongnam, Virtual, Korea South

Products

Products Most Closely Related to the Proposed Project

1. Donghyeon Lee, Junho Park, Min Ji Woo, Juhyeong Lee, Joung-Man Park, Hyung Mi Lim, Tae Kyung Lee, Seong Baek Yang, Sang Yong Nam, Dong-Jun Kwon. Impact of polymer structure in polyurethane topcoats on anti-icing properties. Applied Surface Science. 2024 September. DOI: 10.1016/j.apsusc.2024.160402
2. SZH Shah, Juhyeong Lee, Khurram Altaf, M Mohammad, MZ Hussain, RS Choudhry. Quasi-static indentation characteristics of foam-filled sandwich composite structures with additively manufactured CFRP and GFRP corrugated cores. Journal of Sandwich Structures & Materials. 2025 February. DOI: 10.1177/10996362241303079
3. S.Z.H. Shah, Khurram Altaf, Juhyeong Lee, T. Sharif, R.S. Choudhry, S.M. Hussain. Bending performance and failure mechanisms of hybrid and regular sandwich composite structures with 3D printed corrugated cores. Composite Structures. 2023 December. DOI:

10.1016/j.compstruct.2023.117580

Other Significant Products, Whether or Not Related to the Proposed Project

1. Bin Yang, Yuchen Zhou, Juhyeong Lee, Raj Das, Kunkun Fu, Dongmin Yang. Electrical-thermal response of composite honeycomb sandwiched structures under lightning strike. Composite Structures. 2025 November. DOI: 10.1016/j.compstruct.2025.119460
2. Heejin Kim, Kandasamy Praveen, Min Wook Lee, Juhyeong Lee. Performance-tunable thermal barrier coating for carbon fiber-reinforced plastic composites via flame spraying. Composites Part B: Engineering. 2024 December. DOI: 10.1016/j.compositesb.2024.111842
3. Juhyeong Lee, Thomas E. Lacy Jr., Charles U. Pittman Jr.. Coupled thermal electrical and mechanical lightning damage predictions to carbon/epoxy composites during arc channel shape expansion. Composite Structures. 2021 January; 255:112912. Available from: https://doi.org/10.1016%2Fj.compstruct.2020.112912 DOI: 10.1016/j.compstruct.2020.112912
4. Yang B., Fu K., Lee J., Li Y.. Artificial Neural Network (ANN)-Based Residual Strength Prediction of Carbon Fibre Reinforced Composites (CFRCs) After Impact. Applied Composite Materials. 2021; 28(3):809-833. DOI: 10.1007/s10443-021-09891-1
5. Heejin Kim, Jungwon Kim, Juhyeong Lee, Min Wook Lee. Thermal barrier coating for carbon fiber-reinforced composite materials. Composites Part B: Engineering. 2021 November. DOI: 10.1016/j.compositesb.2021.109308

Certification:

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Certified by Lee, Juhyeong in SciENcv on 2025-09-11 17:48:10

IDENTIFYING INFORMATION:

NAME: Linford, Don G.

POSITION TITLE: Innovation Ecosystem Director

PRIMARY ORGANIZATION AND LOCATION: ASPIRE/Utah State University, Logan, Utah, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
Northeastern University, Boston, Massachusetts, United States	MBA	05/1994	International Finance
University of Utah, Salt Lake City, Utah, United States	BA	08/1988	Political Science - International Development

Appointments and Positions

2022 - present	Innovation Ecosystem Director, ASPIRE/Utah State University, Logan, Utah, United States
2023 - present	Volunteer Board Member, The Center for Creativity, Innovation and Discovery, Providence, Utah, United States
2021 - 2022	Chief Operating Officer, Apex Group, Sao Paulo, Not Applicable, N/A, Brazil
2020 - 2022	Owner/Principal, Quarter Circle A Consulting, Sao Paulo, Not Applicable, N/A, Brazil
2018 - 2020	Chief Operating Officer, Deutsche Bank, Security Services, London, Not Applicable, N/A, United Kingdom
2016 - 2019	Board Member, Deutsche Bank SA, Sao Paulo, Not Applicable, N/A, Brazil
2016 - 2018	Board Member, Deutsche Bank Argentina, Buenos Aires, Not Applicable, N/A, Argentina
2013 - 2018	Director Regional Product Head Latin America,, Deutsche Bank, Security Services,, Sao Paulo, Not Applicable, N/A, Brazil
2007 - 2013	Regional Product Head, Banco Itau Unibanco, Latin America, Sao Paulo, Not Applicable, N/A, Brazil
2000 - 2007	Global Business Manager, JPMorgan Chase, Network Management, New York, New York, United States
1996 - 2007	Vice President Regional Network Manager, JPMorgan Chase, Latin America, New York, New York, United States
1995 - 1996	Assistant Vice President, JPMorgan Chase, Global Network Management, New York, New York, United States
1990 - 1995	Manager, Securities and Cash Transaction Management, The Boston Company, Boston, Massachusetts, United States
1989 - 1990	Country Coordinator, Bank of Boston, Boston, Massachusetts, United States
1988 - 1989	Currency Specialist, Deak International, Boston, Massachusetts, United States

Products

Products Most Closely Related to the Proposed Project

Other Significant Products, Whether or Not Related to the Proposed Project

Certification:

I certify that the information provided is current, accurate, and complete. This includes but is not limited to current, pending, and other support (both foreign and domestic) as defined in 42 U.S.C. § 6605.

I also certify that, at the time of submission, I am not a party to a malign foreign talent recruitment program.

Misrepresentations and/or omissions may be subject to prosecution and liability pursuant to, but not limited to, 18 U.S.C. §§ 287, 1001, 1031 and 31 U.S.C. §§ 3729-3733 and 3802.

Certified by Linford, Don G. in SciENcv on 2024-08-05 16:35:54

IDENTIFYING INFORMATION:

NAME: Lv, Qin

ORCID iD: https://orcid.org/0000-0002-9437-1376

POSITION TITLE: Professor

PRIMARY ORGANIZATION AND LOCATION: University of Colorado Boulder, Department of Computer Science, Boulder, CO, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
Princeton University, Princeton, NJ, USA	PHD	10/2006	Computer Science
Princeton University, Princeton, NJ, USA	MA	05/2002	Computer Science
Tsinghua University, Beijing, Not Applicable, N/A, China	BENG	07/2000	Computer Science and Technology

Appointments and Positions

2021 - present Professor, University of Colorado Boulder, Department of Computer Science, Boulder, CO, United States

2018 - 2023 Co-Associate Chair for Graduate Education, University of Colorado Boulder, Department of Computer Science, Boulder, CO, United States

2015 - 2018 Co-Director of Graduate Program, University of Colorado Boulder, Department of Computer Science, Boulder, CO, United States

2014 - 2021 Associate Professor, University of Colorado Boulder, Department of Computer Science, Boulder, CO, USA

2008 - 2014 Assistant Professor, University of Colorado Boulder, Department of Computer Science, Boulder, CO, United States

2007 - 2008 Assistant Professor, Stony Brook University, Department of Computer Science, Stony Brook, NY, USA

2006 - 2007 Postdoctoral Research Associate, Princeton University, Department of Computer Science, Princeton, NJ, USA

Products

Products Most Closely Related to the Proposed Project

1. Li K, Lu M, Lu F, Lv Q, Shang L, Maksimovic D. Personalized Driving Behavior Monitoring and Analysis for Emerging Hybrid Vehicles. Proceedings of the 10th International Conference on Pervasive Computing (Pervasive '12). 2012; :1-19.
2. Ruan T, Lv Q. Exploring equity perception of electric vehicles from a social media perspective. Transportation Research Interdisciplinary Perspectives. 2024 May 01; 25:101103. Available from: https://www.sciencedirect.com/science/article/pii/S2590198224000897 issn: 2590-1982
3. Priyam T, Ruan T, Lv Q. Demographic-Based Public Perception Analysis of Electric Vehicles on Online Social Networks. Sustainability. 2024; 16(1). DOI: 10.3390/su16010305

4. Ruan T, Lv Q. Public perception of electric vehicles on reddit over the past decade. Communications in Transportation Research. 2022 December 01; 2:100070. Available from: https://www.sciencedirect.com/science/article/pii/S2772424722000208 issn: 2772-4247
5. Zhang Y, Lv Q, Gao D, Shen S, Dick R, Hannigan M, Liu Q. Multi-group Encoder-Decoder Networks to Fuse Heterogeneous Data for Next- day Air Quality Prediction. Proceedings of the 28th International Joint Conference on Artificial Intelligence (IJCAI '19). 2019; :4341-4347.

Other Significant Products, Whether or Not Related to the Proposed Project

1. Y. Zhao, Q. Liu, D. Li, D. Kang, Q. Lv, L. Shang. Hierarchical Anomaly Detection and Multimodal Classification in Large-Scale Photovoltaic Systems. IEEE Transactions on Sustainable Energy. 2019; 10(3):1351-1361. DOI: 10.1109/TSTE.2018.2867009
2. Liu Q, Klucik R, Chen C, Grant G, Gallaher D, Lv Q, Shang L. Unsupervised detection of contextual anomaly in remotely sensed data. Remote Sensing of Environment. 2017 December 01; 202:75-87. PMID: 0034-4257
3. Shi Y, Chen Y, Dong M, Yang X, Li D, Wang Y, Dick R, Lv Q, Zhao Y, Yang F, Lu T, Gu N, Shang L. Train Faster, Perform Better: Modular Adaptive Training in Over-Parameterized Models. Advances in Neural Information Processing Systems (NeurIPS). 2023 December; 36:25712-25730.
4. Ruan T, Lv Q. Public perception of electric vehicles on Reddit and Twitter: A cross-platform analysis. Transportation Research Interdisciplinary Perspectives. 2023 September 01; 21:100872. DOI: 10.1016/j.trip.2023.100872
5. Lu Y, Wang B, Zhao Y, Yang X, Li L, Dong M, Lv Q, Zhou F, Gu N, Shang L. Physics-informed surrogate modeling for hydro-fracture geometry prediction based on deep learning. Energy. 2022 August 15; 253:124139. Available from: https://www.sciencedirect.com/science/article/pii/S0360544222010428 issn: 0360-5442

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Certified by Lv, Qin in SciENcv on 2024-08-05 18:29:58

IDENTIFYING INFORMATION:

NAME: Maksimovic, Dragan

POSITION TITLE: Distinguished Professor

PRIMARY ORGANIZATION AND LOCATION: University of Colorado, Boulder, Colorado, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
California Institute of Technology, Pasadena, California, United States	PHD	06/1989	Electrical Engineering
University of Belgrade, Belgrade, Not Applicable, N/A, Serbia	MS	07/1986	Electrical Engineering
University of Belgrade, Belgrade, Not Applicable, N/A, Serbia	BS	07/1984	Electrical Engineering

Appointments and Positions

2023 - present Distinguished Professor, University of Colorado, Boulder, Colorado, United States
2006 - 2023 Professor, University of Colorado , Boulder, Colorado, United States
1999 - 2006 Associate Professor, University of Colorado, Boulder, Colorado, United States
1992 - 1999 Assistant Professor, University of Colorado, Boulder, Colorado, United States

Products

Products Most Closely Related to the Proposed Project

1. Majmunovic B, Mukherjee S, Martin T, Mallik R, Dutta S, Seo G, Johnson B, Maksimovic D. 1 kV, 10-kW SiC-Based Quadruple Active Bridge DCX Stage in a DC to Three-Phase AC Module for Medium-Voltage Grid Integration. IEEE Transactions on Power Electronics. 2022 December; 37(12):14631-14646. Available from: https://ieeexplore.ieee.org/document/9827483/ DOI: 10.1109/TPEL.2022.3189966
2. Kamel M, Sankaranarayanan V, Zane R, Maksimovic D. State-of-Charge Balancing With Parallel and Series Output Connected Battery Power Modules. IEEE Transactions on Power Electronics. 2022; 37(6):6669-6677. Available from: https://ieeexplore.ieee.org/document/9684985/ DOI: 10.1109/TPEL.2022.3143835
3. Chen H, Kim H, Erickson R, Maksimovic D. Electrified Automotive Powertrain Architecture Using Composite DC–DC Converters. IEEE Transactions on Power Electronics. 2017; 32(1):98-116. Available from: http://ieeexplore.ieee.org/document/7415939/ DOI: 10.1109/TPEL.2016.2533347
4. Evzelman M, Ur Rehman M, Hathaway K, Zane R, Costinett D, Maksimovic D. Active Balancing System for Electric Vehicles With Incorporated Low-Voltage Bus. IEEE Transactions on Power Electronics. 2016 November; 31(11):7887-7895. Available from: http://ieeexplore.ieee.org/document/7368921/ DOI: 10.1109/TPEL.2015.2513432
5. Chen H, Sabi K, Kim H, Harada T, Erickson R, Maksimovic D. A 98.7% Efficient Composite

Converter Architecture With Application-Tailored Efficiency Characteristic. IEEE Transactions on Power Electronics. 2016; 31(1):101-110. Available from: http://ieeexplore.ieee.org/document/7029672/ DOI: 10.1109/TPEL.2015.2398429

Other Significant Products, Whether or Not Related to the Proposed Project

1. Erickson R, Maksimović D. Fundamentals of Power Electronics [Internet] Cham: Springer International Publishing; 2020. -p. Available from: http://link.springer.com/10.1007/978-3-030-43881-4 DOI: 10.1007/978-3-030-43881-4
2. Corradini L, Maksimović D, Mattavelli P, Zane R. 1 ed. Digital Control of High-Frequency Switched-Mode Power Converters [Internet] Wiley; 2015-06-22. -p. Available from: https://onlinelibrary.wiley.com/doi/book/10.1002/9781119025498 DOI: 10.1002/9781119025498
3. Mukherjee S, Gao Y, Maksimovic D. Reduction of AC Winding Losses Due to Fringing-Field Effects in High-Frequency Inductors With Orthogonal Air Gaps. IEEE Transactions on Power Electronics. 2021; 36(1):815-828. Available from: https://ieeexplore.ieee.org/document/9117192/ DOI: 10.1109/TPEL.2020.3002507
4. Dede E, Gao Y, Zhou Y, Sankaranarayanan V, Zhou F, Maksimovic D, Erickson R. Thermal Design, Optimization, and Packaging of Planar Magnetic Components. IEEE Transactions on Components, Packaging and Manufacturing Technology. 2021; 11(9):1480-1488. Available from: https://ieeexplore.ieee.org/document/9514527/ DOI: 10.1109/TCPMT.2021.3105003
5. Sankaranarayanan V, Gao Y, Erickson R, Maksimovic D. Online Efficiency Optimization of a Closed-Loop Controlled SiC-Based Bidirectional Boost Converter. IEEE Transactions on Power Electronics. 2022; 37(4):4008-4021. Available from: https://ieeexplore.ieee.org/document/9599499/ DOI: 10.1109/TPEL.2021.3123965

Certification:

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I also certify that, at the time of submission, I am not a party to a malign foreign talent recruitment program.

Misrepresentations and/or omissions may be subject to prosecution and liability pursuant to, but not limited to, 18 U.S.C. §§ 287, 1001, 1031 and 31 U.S.C. §§ 3729-3733 and 3802.

Certified by Maksimovic, Dragan in SciENcv on 2024-08-05 13:28:48

IDENTIFYING INFORMATION:

NAME: Mallick, Rajib

ORCID iD: https://orcid.org/0000-0001-5043-1595

POSITION TITLE: Professor

PRIMARY ORGANIZATION AND LOCATION: The University of Texas at El Paso, El Paso, TX, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
Auburn University, Auburn, Alabama, United States	PHD	08/1997	Civil Engineering
Auburn University, Auburn, Alabama, United States	MS	12/1993	Civil Engineering
Jadavpur University, Calcutta, Not Applicable, N/A, India	BENG	07/1989	Civil Engineering

Appointments and Positions

2024 - present	Professor, The University of Texas at El Paso, El Paso, TX, United States
2024 - present	Professor, The University of Texas at El Paso, El Paso, TX, United States
2022 - 2023	Visiting Professor, The University of Texas at El Paso, El Paso, TX, United States
2021 - 2022	Professor, Indian Institute of Technology (IIT) Delhi, New Delhi, Not Applicable, N/A, India
2012 - 2021	Ralph White Family Distinguished Professor , Worcester Polytechnic Institute (WPI), Worcester, Massachusetts, United States
2011 - 2012	Professor, Worcester Polytechnic Institute (WPI), Worcester, Alabama, United States
2004 - 2011	Associate Professor, Worcester Polytechnic Institute (WPI), Worcester, Alabama, United States
1998 - 2004	Assistant Professor, Worcester Polytechnic Institute (WPI), Worcester, Alabama, United States
1996 - 1998	Senior Research Associate, Auburn University, Auburn, Alabama, United States
1992 - 1995	Graduate Research Assistant, Auburn University, Auburn, Alabama, United States
1989 - 1991	Graduate Engineer, Ghosh Bose and Associates, Calcutta, Not Applicable, N/A, India

Products

Products Most Closely Related to the Proposed Project

1. Chen Q, Tao M, Mallick R, Zhang Z. Holistic and Practical Approach for Assessing Flood Risks of Low Volume Asphalt Roads. Transportation Research Record: Journal of the Transportation Research Board. 2024 July 30; :-. Available from: https://journals.sagepub.com/doi/10.1177/03611981241252790 DOI: 10.1177/03611981241252790
2. Karimi M, Mallick R. Flexible Pavement Instrumentation: A State-of-the-Art Review. Journal

of Transportation Engineering, Part B: Pavements. 2023 June; 149(2):-. Available from: https://ascelibrary.org/doi/10.1061/JPEODX.PVENG-1175 DOI: 10.1061/JPEODX.PVENG-1175

3. DeCarlo C, Dave E, Sias J, Airey G, Mallick R. Comparative Evaluation of Moisture Susceptibility Test Methods for Routine Usage in Asphalt Mixture Design. Journal of Testing and Evaluation. 2020 January 01; 48(1):88-106. Available from: https://asmedigitalcollection.asme.org/testingevaluation/article/48/1/88/1191188/Comparative-Evaluation-of-Moisture-Susceptibility DOI: 10.1520/JTE20180908

Other Significant Products, Whether or Not Related to the Proposed Project

1. Joshi P, Mallick R. igital Image Color Analysis to Evaluate Moisture Sensitivity of Hot Mix Asphalt (HMA) Mixes. Journal of Infrastructure Asset Management. 2023 August 23.
2. Mallick R, El Korchi T. Pavement Engineering: Principles and Practice. 4 ed. Boca Raton, FL and Abingdon, Oxon: Taylor and Francis/CRC Press; 2022. 790p.
3. Kautz F, Mallick R. Simulation-Based Stochastic Method to Model Microcrack Coalescence in Asphalt Pavements: Concept Paper. Journal of Transportation Engineering, Part B: Pavements. 2021 December.
4. Asadi M. Numerical modeling of post-flooded water flow in pavement structures. Transportation Geotechnics. 2021 March.
5. Mallick R. A Probabilistic Understanding of the Effect of Voids and Layer Thickness on Interconnectivity of Voids in Asphalt Mixes: An Agent-Based Modeling Approach. Journal of Transportation Engineering, Part B: Pavements. 2022 June.

Certification:

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I also certify that, at the time of submission, I am not a party to a malign foreign talent recruitment program.

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Certified by Mallick, Rajib in SciENcv on 2024-08-13 11:30:13

IDENTIFYING INFORMATION:

NAME: Mandal, Paras

POSITION TITLE: Professor

PRIMARY ORGANIZATION AND LOCATION: Department of Electrical and Computer Engineering, University of Texas at El Paso, El Paso, Texas, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
University of New Brunswick, Fredericton, New Brunswick, Canada	Postdoctoral Fellow	01/2011 - 09/2011	Power and Renewable Energy Systems
University of Calgary, Calgary, Alberta, Canada	Postdoctoral Fellow	01/2010 - 01/2011	Power and Renewable Energy System
University of Tasmania, Hobart, Tasmania, Australia	Postdoctoral Fellow	02/2008 - 11/2009	Electric Power Systems
University of the Ryukyus, Okinawa, Okinawa, Japan	Postdoctoral Fellow	11/2005 - 07/2007	Electricity Market
University of the Ryukyus, Okinawa, Okinawa, Japan	PHD	09/2005	Interdisciplinary Intelligent Systems Engineering (Power System)
Asian Institute of Technology, Bangkok, Not Applicable, N/A, Thailand	MENG	08/2002	Energy, Economics, and Planning
Kuvempu University, Chitradurga, Karnataka, India	BENG	08/1998	Electrical and Electronics Engineering

Appointments and Positions

2023 - present Professor, Department of Electrical and Computer Engineering, University of Texas at El Paso, El Paso, Texas, United States

2017 - 2023 Associate Professor, Department of Electrical and Computer Engineering, University of Texas at El paso, El Paso, Texas, United States

2014 - 2017 Assistant Professor, Department of Electrical and Computer Engineering, University of Texas at El Pas, El Paso, Texas, United States

2011 - 2014 Assistant Professor, Department of Industrial, Manufacturing, and Systems Engineering, University of Texas at El Paso, El Paso, Texas, United States

Products

Products Most Closely Related to the Proposed Project

1. Newbolt T, Mandal P, Wang H, Zane R. Sustainability of Dynamic Wireless Power Transfer Roadway for In-Motion Electric Vehicle Charging. IEEE Transactions on Transportation Electrification. 2024 March; 10(1):1347-1362. DOI: 10.1109/TTE.2023.3262202
2. Kiptoo M, Adewuyi O, Furukakoi M, Mandal P, Senjyu T. Integrated Multi-Criteria Planning for Resilient Renewable Energy-Based Microgrid Considering Advanced Demand Response

and Uncertainty. Energies. 2023 September 27; 16(19):6838-. DOI: 10.3390/en16196838

3. Newbolt T, Mandal P, Wang H, Zane R. Diverse Effects of Dynamic Wireless Power Transfer Roadway In-Motion Electric Vehicle Charging. 2023 IEEE Power & Energy Society Innovative Smart Grid Technologies Conference (ISGT); 2023 March 22; Washington, DC, USA. DOI: 10.1109/ISGT51731.2023.10066429
4. Newbolt T, Mandal P, Wang H, Zane R. Priority Load Control for Dynamic WPT Roadway in Electrified Transportation Infrastructure. 2023 IEEE Power & Energy Society General Meeting (PESGM); 2023 September 25; Orlando, FL, USA. DOI: 10.1109/PESGM52003.2023.10252817
5. Akter H, Howlader H, Saber A, Mandal P, Takahashi H, Senjyu T. Optimal Sizing of Hybrid Microgrid in a Remote Island Considering Advanced Direct Load Control for Demand Response and Low Carbon Emission. Energies. 2021 November 13; 14(22):7599-. DOI: 10.3390/en14227599

Other Significant Products, Whether or Not Related to the Proposed Project

1. Simental OQuezada, Mandal P, Galvan E, Kamalasadan S. Resilience Evaluation for Power Distribution Systems Impacted by Winter Storms. 2023 IEEE Industry Applications Society Annual Meeting (IAS); 2024 February 01; Nashville, TN, USA. DOI: 10.1109/IAS54024.2023.10406368
2. Newbolt T, Mandal P, Wang H, Zane R. Meteorological Data-Driven Traffic Flow Forecasting Using Intelligent Algorithms. 2023 IEEE PES Innovative Smart Grid Technologies Latin America (ISGT-LA); 2023 November 28; San Juan, PR, USA. DOI: 10.1109/ISGT-LA56058.2023.10328218
3. Avila A, Mandal P. Impact of Commercial EV Loads on the Power Grid. 2023 IEEE Industry Applications Society Annual Meeting (IAS); 2024 February 01; Nashville, TN, USA. DOI: 10.1109/IAS54024.2023.10406837
4. Chawla M, Zade A, Newbolt T, Mandal P, Kamineni A, Wang H, Zane R. Modeling and Comparative Analysis of Power Distribution Architectures for Large-scale Electric Vehicle In-motion Wireless Charging Infrastructures. 2022 Wireless Power Week (WPW); 2022 September 29; Bordeaux, France. DOI: 10.1109/WPW54272.2022.9901363

Certification:

I certify that the information provided is current, accurate, and complete. This includes but is not limited to current, pending, and other support (both foreign and domestic) as defined in 42 U.S.C. § 6605.

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Misrepresentations and/or omissions may be subject to prosecution and liability pursuant to, but not limited to, 18 U.S.C. §§ 287, 1001, 1031 and 31 U.S.C. §§ 3729-3733 and 3802.

Certified by Mandal, Paras in SciENcv on 2024-08-07 02:07:12

IDENTIFYING INFORMATION:

NAME: Masquelier, Michael

POSITION TITLE: Chief Commercial Officer

PRIMARY ORGANIZATION AND LOCATION: Utah State University/ASPIRE, Logan, Utah, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
Arizona State University, Tempe, Arizona, United States	MS	05/1989	Electrical Engineering
University of Illinois at Urbana-Champaign, Urbana, Illinois, United States	BS	05/1983	Electrical Engineering

Appointments and Positions

2022 - present	Chief Commercial Officer, Utah State University/ASPIRE, Logan, Utah, United States
2012 - 2022	Chief Technology Officer, WAVE, Salt Lake City, Utah, United States
2010 - 2013	Chief Executive Officer & Chief Technology Officer, Livewire, Salt Lake City, Utah, United States
2010 - 2011	Vice President of Operations & Engineering, Vutara, Salt Lake City, Utah, United States
2008 - 2010	Entrepeneur-in-Residence, Envisia, Inc., Salt Lake City, Utah, United States
1997 - 2008	Director of Networked Sensing Systems, Motorola Labs, Schaumburg, Illinois, United States

Products

Products Most Closely Related to the Proposed Project

Other Significant Products, Whether or Not Related to the Proposed Project

Certification:

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Certified by Masquelier, Michael in SciENcv on 2025-04-14 15:11:39

IDENTIFYING INFORMATION:

NAME: Matcovschi, Anca

POSITION TITLE: Chief Communications and Marketing Officer - ASPIRE NSF ERC

PRIMARY ORGANIZATION AND LOCATION: Utah State University, Logan, Utah, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
CITI Program, Logan, Utah, United States	Other training	02/2025 - 02/2025	IRB Human Subjects Research (HSR) Social-Behavioral-Educational (SBE) Foundations Certificate
Utah State University, Logan, Utah, United States	PHD	12/2027	Career and Technical Education
PROSCI Change Management Certification Program, Logan, Utah, United States	Other training	03/2022 - 03/2022	Prosci® Certified Change Practitioner
Utah State University, Logan, Utah, United States	MBA	04/2020	Data Analytics
Al. I. Cuza University, Iasi, Not Applicable, N/A, Romania	MCOMMUN	02/2014	Marketing and Business Communications
Portuguese Institute of Marketing Administration (IPAM), Lisbon, Not Applicable, N/A, Portugal	OTH	07/2011	Erasmus Study Abroad Program - Senior Year of Bachelor's
Al. I. Cuza University, Iasi, Not Applicable, N/A, Romania	BBA	09/2011	Marketing

Appointments and Positions

2024 - present	Chief Communications and Marketing Officer - ASPIRE NSF ERC, Utah State University, Logan, Utah, United States
2024 - present	Part-time Faculty, American Public University System, Charles Town, West Virginia, United States
2022 - 2023	Vice President of Marketing, Education, Lightcast (formerly Emsi BurningGlass), Moscow, Idaho, United States
2020 - 2022	Director of Online and Statewide Recruitment, Utah State University, Logan, Utah, United States
2018 - 2020	USU Online Marketing Manager, Utah State University, Logan, Utah, United States
2017 - 2017	Marketing Manager, HotWax Systems, Salt Lake City, Utah, United States
2016 - 2016	Marketing Automation Consultant, MKTR.cc, Salt Lake City, Utah, United States
2015 - 2016	Production Team Lead / Campaign Program Manager, Harte Hanks, Iasi, Not Applicable, N/A, Romania

2014 - 2014	Marketing Comms Coordinator / Copywriter, Benchmark Labs, Dubai, Not Applicable, N/A, United Arab Emirates
2012 - 2013	Branding & Marketing Comms Specialist, Boomerang Branding & Communication, Iasi, Not Applicable, N/A, Romania
2012 - 2012	Erasmus Student Intern, Naples Regional Tourism Agency, Naples, Not Applicable, N/A, Italy
2010 - 2015	Business Marketing Consultant, Freelance, Iasi, Not Applicable, N/A, Romania
2008 - 2009	Copywriter & Promotional Marketing Associate, Cardiv Marketing, Iasi, Not Applicable, N/A, Romania

Products

Products Most Closely Related to the Proposed Project
Other Significant Products, Whether or Not Related to the Proposed Project

Certification:

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Certified by Matcovschi, Anca in SciENcv on 2025-03-03 23:33:37

IDENTIFYING INFORMATION:

NAME: Maughan, Dustin W

POSITION TITLE: ASPIRE - Director of Operations

PRIMARY ORGANIZATION AND LOCATION: Utah State University, Logan, Utah, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
Project Management Institute, Salt Lake City, Utah, United States	PMP	02/2018	Project Management Professional
Board of Certified Safety Professionals, Logan, Utah, United States	GSP	06/2011	Graduate Safety Professional
Utah State University, Logan, Utah, United States	BS	05/2011	Public Health, Industrial Hygiene

Appointments and Positions

2019 - present	ASPIRE - Director of Operations, Utah State University, Logan, Utah, United States
2013 - present	Safety Manager, Job Industrial Services dBA JEPCO, Salt Lake City, Utah, United States
2018 - 2019	Senior Project Manager, Thermo Fisher Scientific, Logan, Utah, United States
2017 - 2018	Construction Project Manager, Job Industrial Services, Salt Lake City, Utah, United States
2012 - 2013	Special Government Employee, OSHA, Crawfordsville, Indiana, United States
2011 - 2013	Safety Coordinator / Industrial Hygienist, Nucor Steel, Crawfordsville, Indiana, United States

Products

Products Most Closely Related to the Proposed Project

Other Significant Products, Whether or Not Related to the Proposed Project

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Certified by Maughan, Dustin W in SciENcv on 2025-02-06 16:03:50

IDENTIFYING INFORMATION:

NAME: Minichiello, Angela

POSITION TITLE: Associate Professor of Engineering Education

PRIMARY ORGANIZATION AND LOCATION: Utah State University, Logan, Utah, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
Utah State University, Logan, Utah, United States	PHD	07/2016	Engineering Education
Georgia Institute of Technology, Atlanta, Georgia, United States	MS	09/1997	Mechanical Engineering
United States Military Academy, West Point, New York, United States	BS	05/1987	Mechanical Engineering

Appointments and Positions

2022 - present Associate Professor of Engineering Education, Utah State University, Logan, Utah, United States

2005 - present Adjunct Faculty, Mechanical and Aerospace Engineering Department, Utah State University, Logan, Utah, United States

2016 - 2022 Assistant Professor of Engineering Education, Utah State University, Loga, Utah, United States

2009 - 2016 Principal Lecturer of Engineering, Utah State University, Logan, Utah, United States

2004 - 2010 Principal, CastleRock Engineering Inc, Logan, Utah, United States

2002 - 2006 Senior Mechanical/Thermal Engineer, Space Dynamics Laboratory, North Logan, Utah, United States

1998 - 2002 Research and Development Mechanical Engineer, Hewlett Packard Company, Fort Collins, Colorado, United States

1997 - 1998 Manufacturing Engineer, Hewlett Packard Company, San Diego, California, United States

1987 - 1994 Active Duty Commissioned Officer, CH47C/D Pilot, U.S. Army, Various, N/A, United States

Products

Products Most Closely Related to the Proposed Project

1. Kirchner M, Minichiello A. Military Veterans Transitioning to Higher Education and the Civilian Workforce:. Hunter-Johnson Y, Ros T, Alfred M, editors. Little Compton, RI: Adult

Higher Education Alliance (AHEA) Publication Series; 2025. Veteran friendly or veteran ready? Employment organizations that support veteran success.

2. Minichiello A, Lawanto O, Goodridge W, Iqbal A, Asghar M. Flipping the digital switch: Affective responses of STEM undergraduates to Emergency Remote Teaching during the COVID-19 pandemic. Project Leadership and Society. 2022; 3. Available from: https://www.sciencedirect.com/science/article/pii/S2666721522000035
3. Minichiello A, Caldwell L. A narrative review of Design-Based Research in engineering education: Opportunities and challenges. Studies in Engineering Education. 2021; 1(2):31-54.
4. Minichiello A, Hanks E. Becoming engineers in the middle years: Narrative writing as identity work in an undergraduate engineering science course. International Journal of Engineering Education. 2020; 36(5):1-20.
5. Minichiello A. From deficit thinking to counter storying: A narrative inquiry of nontraditional undergraduate experience in engineering education. International Journal of Education in Mathematics, Science and Technology. 2018; 6(3):266-284.

Other Significant Products, Whether or Not Related to the Proposed Project

1. Asghar M, Minichiello A, Ahmed S. Mental health and wellbeing of undergraduate engineering students: A systematic literature review. Journal of Engineering Education. 2024; 113:1046-1075. Available from: https://onlinelibrary.wiley.com/doi/pdfdirect/10.1002/jee.20574
2. Wilson-Lopez A, Minichiello A, Green T, Hartman C, Garlick J. A comparative case study of engineers' literacy practices and implications for Transformative Disciplinary Literacy Pedagogies in engineering education. Reading Research Quarterly. 2022; 57(4):1129-1147.
3. Minichiello A, Armco D, Mukherjee S, Caldwell L, Kulyukin V, Truscott T, Elliott J. Developing a mobile application-based particle image velocimetry tool for enhanced teaching and learning in fluid mechanics: A design-based research approach. Computer Applications in Engineering Education. 2021; 29:517-537.
4. Minichiello A, J H, D H. Bringing user experience design to bear on STEM education: A narrative literature review. Journal for STEM Education Research. 2018; 1(1):7-33.
5. Minichiello A. Studies of equity, access, and innovation. Marx S, editor. New York: Routledge; 2016. Examining academic integrity in the postmodern: Undergraduates' use of solutions to complete textbook-based engineering coursework.

Certification:

I certify that the information provided is current, accurate, and complete. This includes but is not limited to information related to domestic and foreign appointments and positions.

I also certify that, at the time of submission, I am not a party to a malign foreign talent recruitment program.

Misrepresentations and/or omissions may be subject to prosecution and liability pursuant to, but not limited to, 18 U.S.C. §§ 287, 1001, 1031 and 31 U.S.C. §§ 3729-3733 and 3802.

Certified by Minichiello, Angela in SciENcv on 2025-09-08 17:22:43

IDENTIFYING INFORMATION:

NAME: Montoya, Miguel Angel

ORCID iD: https://orcid.org/0000-0002-8989-3268

POSITION TITLE: Assistant Professor of Research

PRIMARY ORGANIZATION AND LOCATION: University of Texas at El Paso, El Paso, Texas, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
Purdue University, West Lafayette, Indiana, United States	PHD	10/2021	Civil Engineering
Purdue University, West Lafayette, Indiana, United States	MCE	12/2016	Civil Engineering
Catholic University of Honduras, Tegucigalpa, Not Applicable, N/A, Honduras	BCE	03/2014	Civil Engineering

Appointments and Positions

2023 - present Assistant Professor of Research, University of Texas at El Paso, El Paso, Texas, United States

2021 - 2023 Postdoctoral Fellow, University of Texas at El Paso, El Paso, Texas, United States

2014 - 2021 Graduate Research Assistant, Purdue University, West Lafayette, Indiana, United States

Products

Products Most Closely Related to the Proposed Project

1. Reddy G, Montoya M, Abdallah I, Nazarian S, Izzo R. Alternative Approaches for Rapid Evaluation of Frictional Resistance of Aggregates. Transportation Research Record: Journal of the Transportation Research Board. 2024 April 09; :-. Available from: https://journals.sagepub.com/doi/10.1177/03611981241239961 DOI: 10.1177/03611981241239961
2. Montoya M, Rahbar-Rastegar R, Haddock J. Incorporating phase change materials in asphalt pavements to melt snow and ice. International Journal of Pavement Engineering. 2022 February 28; 24(2):-. Available from: https://www.tandfonline.com/doi/full/10.1080/10298436.2022.2041195 DOI: 10.1080/10298436.2022.2041195
3. Montoya M, Betancourt D, Rahbar-Rastegar R, Youngblood J, Martinez C, Haddock J. Environmentally Tuning Asphalt Pavements Using Microencapsulated Phase Change Materials. Transportation Research Record: Journal of the Transportation Research Board.

2022 January 22; 2676(5):158-175. Available from: http://journals.sagepub.com/doi/10.1177/03611981211068366 DOI: 10.1177/03611981211068366

4. Montoya M, Haddock J. Estimating asphalt mixture volumetric properties using seemingly unrelated regression equations approaches. Construction and Building Materials. 2019 November; 225:829-837. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0950061819319415 DOI: 10.1016/j.conbuildmat.2019.07.266
5. Quantifying Asphalt Emulsion-Based Chip Seal Curing Times Using Electrical Resistance Measurements. 2017 August. DOI: 10.5703/1288284316389

Other Significant Products, Whether or Not Related to the Proposed Project

1. Afsha S, Vaid S, Montoya M, Abdallah I, Nazarian S. Impact of Clay Contamination on Rutting Performance of Asphalt Mixtures. Transportation Research Record: Journal of the Transportation Research Board. 2024 March 21; :-. Available from: https://journals.sagepub.com/doi/10.1177/03611981241233287 DOI: 10.1177/03611981241233287
2. John E. Haddock, Reyhaneh Rahbar-Rastegar, M. Reza Pouranian, Miguel Montoya, Harsh Patel. Implementing the Superpave 5 Asphalt Mixture Design Method in Indiana. 2020. Available from: https://doi.org/10.5703%2F1288284317127 DOI: 10.5703/1288284317127
3. MONTOYA M, POURANIAN M, HADDOCK J. Increasing Asphalt Pavement Density Through Mixture Design: A Field Project. Asphalt Paving Technology. 2018 March 21; 87:-. Available from: http://dpi-proceedings.com/index.php/aapt2018/article/view/33800 DOI: 10.12783/aapt2018/33800
4. Encapsulation of phase change materials in cellulose imanocrystalsReinforced poly(urea-urethane) microcapsules and their incorporation in asphalt for snow and ice melting. International Conference on Nanotechnology for Renewable Materials 2018; ; c2018. isbn: 978-151087036-9
5. Montoya M, Jason Weiss W, Haddock J. Using electrical resistance to evaluate the chip seal curing process. Road Materials and Pavement Design. 2017 October 23; 18(sup4):98-111. Available from: https://www.tandfonline.com/doi/full/10.1080/14680629.2017.1389090 DOI: 10.1080/14680629.2017.1389090

Certification:

I certify that the information provided is current, accurate, and complete. This includes but is not limited to information related to domestic and foreign appointments and positions.

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Misrepresentations and/or omissions may be subject to prosecution and liability pursuant to, but not limited to, 18 U.S.C. §§ 287, 1001, 1031 and 31 U.S.C. §§ 3729-3733 and 3802.

Certified by Montoya, Miguel Angel in SciENcv on 2025-09-16 18:07:24

IDENTIFYING INFORMATION:

NAME: Moyer, Joanne

POSITION TITLE: Associate Professor of Instruction

PRIMARY ORGANIZATION AND LOCATION: University of Texas at El Paso, El Paso, Texas, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
University of Texas at El Paso, El Paso, Texas, United States	PHD	08/2020	Civil Engineering
University of Texas at El Paso, El Paso, Texas, United States	MS	08/2010	Civil Engineering
University of Texas at El Paso, El Paso, Texas, United States	BS	05/2007	Civil Engineering

Appointments and Positions

2020 - present Associate Professor of Instruction, University of Texas at El Paso, El Paso, Texas, United States

Products

Products Most Closely Related to the Proposed Project

Other Significant Products, Whether or Not Related to the Proposed Project

Certification:

I certify that the information provided is current, accurate, and complete. This includes but is not limited to information related to domestic and foreign appointments and positions.

I also certify that, at the time of submission, I am not a party to a malign foreign talent recruitment program.

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Certified by Moyer, Joanne in SciENcv on 2025-09-17 15:04:26

IDENTIFYING INFORMATION:

NAME: Myers, Beth A

POSITION TITLE: Owner

PRIMARY ORGANIZATION AND LOCATION: Beth Myers Consulting, Lafayette, Colorado, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
University of Colorado Boulder, Boulder, Colorado, United States	PHD	05/2016	Civil Engineering
University of Colorado Boulder, Boulder, Colorado, United States	MENG	12/2011	Engineering Management
University of Colorado Boulder, Boulder, Colorado, United States	BA	12/2006	Biochemistry

Appointments and Positions

2019 - present Owner, Beth Myers Consulting, Lafayette, Colorado, United States

2022 - present Associate Vice Chancellor for Academic Planning and Institutional Effectiveness, Office of the Provost, University of Colorado Denver, Denver, Colorado, United States

2020 - present Assessment and Evaluation Lead, ASPIRE Engineering Research Center, Utah State University, Logan, Utah, United States

2019 - 2022 Assistant Vice Provost for Student Success Initiatives; Assistant Vice Chancellor for Undergraduate Education, Office of Undergraduate Education, University of Colorado Boulder, Boulder, Colorado, United States

2016 - 2019 Director of Analytics, Assessment and Accreditation, College of Engineering and Applied Science, University of Colorado Boulder, Boulder, Colorado, United States

2013 - 2016 Assessment and Program Evaluation - Research Associate, College of Engineering and Applied Science, University of Colorado Boulder, Boulder, Colorado, United States

2010 - 2012 Director of Access and Recruiting, College of Engineering and Applied Science, University of Colorado Boulder, Boulder, Colorado, United States

2008 - 2010 Research Assistant to Associate Dean for Inclusive Excellence, College of Engineering and Applied Science, University of Colorado Boulder, Boulder, Colorado, United States

2007 - 2008 Program Manager, General Internal Medicine, University of Colorado Denver, Anschutz Medical Campus, Aurora, Colorado, United States

Products

Products Most Closely Related to the Proposed Project

1. Cady E., Holloway B.M., Maldonado T.A., Myers B.A., Williams A.B.. Sharing Exemplary Admissions Practices that Promote Diversity in Engineering Panel Discussion. 2022 CoNECD -

Collaborative Network for Engineering and Computing Diversity. 2022 CoNECD - Collaborative Network for Engineering and Computing Diversity; 2022; c2022. eid: 2-s2.0-85137277883

2. Bielefeldt A.R., Tsai J.Y., Myers B.A., Godrick D.A., Sullivan J.F.. Minority Status and Belonging: Engineering Math as a Vehicle to Build Community. CoNECD 2021. CoNECD 2021; 2021; c2021. eid: 2-s2.0-85125171857
3. Riley D.M., Clawson R.A., Maksimovic D., Myers B.A., Santiago I., Stites N.A., Taylor J.L.. Developing Engineering Formation Systems for Sustainability. ASEE Annual Conference and Exposition, Conference Proceedings. ASEE Annual Conference and Exposition, Conference Proceedings; 2021; c2021. eid: 2-s2.0-85124573086
4. Ennis T.D., Myers B.A.. Summer bridge design: Purposely fostering engineering expertise and success with the redshirting in engineering program scholars. CoNECD 2019 - Collaborative Network for Engineering and Computing Diversity. CoNECD 2019 - Collaborative Network for Engineering and Computing Diversity; 2019; c2019. eid: 2-s2.0-85096996506
5. Tsai J.Y., Myers B.A., Sullivan J.F., Anderson K.M.. Intended and unintended consequences of rapidly expanding an engineering mathematics intervention for incoming first-year students. ASEE Annual Conference and Exposition, Conference Proceedings. ASEE Annual Conference and Exposition, Conference Proceedings; 2019; c2019. eid: 2-s2.0-85078779017

Other Significant Products, Whether or Not Related to the Proposed Project

1. Myers B.A., Bielefeldt A.R., Sullivan J.F.. Critical GPA and standardized test score admission thresholds. CoNECD 2019 - Collaborative Network for Engineering and Computing Diversity. CoNECD 2019 - Collaborative Network for Engineering and Computing Diversity; 2019; c2019. eid: 2-s2.0-85096979096
2. Myers B.A., Bielefeldt A.R., Sullivan J.F.. Quantifying the pool of underrepresented minority students for engineering studies. CoNECD 2019 - Collaborative Network for Engineering and Computing Diversity. CoNECD 2019 - Collaborative Network for Engineering and Computing Diversity; 2019; c2019. eid: 2-s2.0-85096956539
3. Tsai J.Y., Myers B.A.. Mandatory but not required: Examining change in the year two implementation of a novel engineering mathematics course. ASEE Annual Conference and Exposition, Conference Proceedings. ASEE Annual Conference and Exposition, Conference Proceedings; 2019; c2019. eid: 2-s2.0-85078725979
4. Myers B.A., Knaphus-Soran E., Llewellyn D.C., Delaney A., Cunningham S., Cosman P., Ennis T.D., Pitts K.. Redshirt in engineering: A model for improving equity and inclusion. CoNECD 2018 - Collaborative Network for Engineering and Computing Diversity Conference. CoNECD 2018 - Collaborative Network for Engineering and Computing Diversity Conference; 2018; c2018. eid: 2-s2.0-85078726829
5. Tsai J.Y., O'Connor K., Myers B.A., Sullivan J.F., Reamon D.T., Anderson K.M.. Examining the replication - Or mutation - Processes of implementing a national model for engineering mathematics education at a new site. ASEE Annual Conference and Exposition, Conference Proceedings. ASEE Annual Conference and Exposition, Conference Proceedings; 2018; c2018. eid: 2-s2.0-85051232579

Certification:

I certify that the information provided is current, accurate, and complete. This includes but is not limited to current, pending, and other support (both foreign and domestic) as defined in 42 U.S.C. § 6605.

I also certify that, at the time of submission, I am not a party to a malign foreign talent recruitment program.

Misrepresentations and/or omissions may be subject to prosecution and liability pursuant to, but not limited to, 18 U.S.C. §§ 287, 1001, 1031 and 31 U.S.C. §§ 3729-3733 and 3802.

Certified by Myers, Beth A in SciENcv on 2025-02-06 22:30:43

IDENTIFYING INFORMATION:

NAME: Nazarian, Soheil

ORCID iD: https://orcid.org/0000-0002-2622-1261

POSITION TITLE: Professor

PRIMARY ORGANIZATION AND LOCATION: The University of Texas at El Paso, El Paso, Texas, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
The University of Texas at Austin, Austin, Texas, United States	PHD	12/1984	Civil Engineering
Tufts University, Medford, Massachusetts, United States	MSCE	12/1981	Geotechnical Engineering
University of Tehran, Tehran, Not Applicable, N/A, Iran	MSCE	06/1979	Structural Engineering

Appointments and Positions

1997 - present	Professor , The University of Texas at El Paso, El Paso, Texas, United States
1992 - 1997	Associate Professor , The University of Texas at El Paso, El Paso , Texas, United States
1988 - 1992	Assistant Professor , The University of Texas at El Paso, El Paso , Texas, United States

Products

Products Most Closely Related to the Proposed Project

1. Cruz H, Moncada O, Jahangiri B, Tirado C, Nazarian S, Haddock J. Analyzing the Mechanical Response of a Calibrated Finite Element Model for Flexible Pavement with Embedded Dynamic Wireless Power Transfer Technology. Transportation Research Record: Journal of the Transportation Research Board. 2024 April 20; :-. Available from: https://journals.sagepub.com/doi/10.1177/03611981241242077 DOI: 10.1177/03611981241242077
2. Beizaei M, Rocha S, Tirado C, Nazarian S, Rada G. Impact of Pavement Stiffness on Performance of Traffic Speed Deflection Measurements. Transportation Research Record: Journal of the Transportation Research Board. 2024 April 11; :-. Available from: https://journals.sagepub.com/doi/10.1177/03611981241238224 DOI: 10.1177/03611981241238224
3. Reddy G, Montoya M, Abdallah I, Nazarian S, Izzo R. Alternative Approaches for Rapid Evaluation of Frictional Resistance of Aggregates. Transportation Research Record: Journal of the Transportation Research Board. 2024 April 09; :-. Available from: https://journals.sagepub.com/doi/10.1177/03611981241239961 DOI: 10.1177/03611981241239961
4. Saghafi M, Nazarian S, Abdallah I, Tirado C, Rodriguez D. Harmonizing Flexible Pavement

Rutting Design with Balanced Mix Design. Transportation Research Record: Journal of the Transportation Research Board. 2022 March 16; 2676(7):823-836. Available from: http://journals.sagepub.com/doi/10.1177/03611981221082557 DOI: 10.1177/03611981221082557

5. Fathi A, Tirado C, Mazari M, Rocha S, Nazarian S. Correlating Continuous Compaction Control Measurements to In Situ Modulus-Based Testing for Quality Assessment of Compacted Geomaterials. Springer Series in Geomechanics and Geoengineering [Internet] Cham: Springer International Publishing; 2020. Chapter Chapter 50585-595p. Available from: http://link.springer.com/10.1007/978-3-030-32029-4_50 DOI: 10.1007/978-3-030-32029-4_50

Other Significant Products, Whether or Not Related to the Proposed Project

1. Alhassan et al. "Nondestructive Evaluation of Highway System Asset Foundational Condition and Capability. NCHRP Research Report 1041, Transportation Research Board. 2023 March 01. Available from: https://dx.doi.org/ 10.17226/27037
2. Misaghi et al. Impact of Pavement Roughness and Suspension Systems on Vehicle Dynamic Loads on Flexible Pavements. Journal of Transportation Engineering. 2021. Available from: https://doi.org/10.1016/j.treng. 2021.100045
3. Bronson et al. Relating Corrosion of Mechanically Stabilized Earth Reinforcements with Fluid Conductivity of Backfill Soils. Journal of Materials in Civil Engineering. 2020. Available from: https://doi.org/10.1061/(ASCE)MT.1943-5533.0003431
4. Mallick et al. Rational Method to Determine Investment Amount for Making Roadways Resilient to a Changing Climate. Journal of Infrastructure Systems. 2018. Available from: https://doi.org/10.1061/(ASCE)IS.1943-555X.0000411
5. Xu et al. The Pioneer of Intelligent Construction—An Overview of Development of Intelligent Compaction. Journal of Road Engineering. 2022 March 01. Available from: https://doi.org/10.1016/j.jreng.2022.12.001

Certification:

I certify that the information provided is current, accurate, and complete. This includes but is not limited to current, pending, and other support (both foreign and domestic) as defined in 42 U.S.C. § 6605.

I also certify that, at the time of submission, I am not a party to a malign foreign talent recruitment program.

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Certified by Nazarian, Soheil in SciENcv on 2024-08-06 09:56:48

IDENTIFYING INFORMATION:

NAME: Ohland, Matthew W.

POSITION TITLE: Dale & Suzi Gallagher Professor of Engineering Education and Associate Head

PRIMARY ORGANIZATION AND LOCATION: Purdue University, West Lafayette, IN, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
University of Florida, Gainesville, FL, United States	Postdoctoral Fellow	07/1998 - 06/2000	NSF Postdoctoral Fellow in Science, Mathematics, Engineering, and Technology Education
University of Florida, Gainesville, FL, United States	PHD	08/1996	Civil Engineering
Rensselaer Polytechnic Institute, Troy, NY, United States	MS	12/1992	Materials Engineering
Rensselaer Polytechnic Institute, Troy, NY, United States	MS	12/1991	Mechanical Engineering
Swarthmore College, Swarthmore, PA, United States	BA	06/1989	Religion
Swarthmore College, Swarthmore, PA, United States	BS	06/1989	Engineering

Appointments and Positions

2006 - present Dale & Suzi Gallagher Professor of Engineering Education and Associate Head, Purdue University, West Lafayette, IN, United States

2014 - 2015 Professorial Research Fellow in Engineering Education, Central Queensland University, School of Engineering and the Built Environment, Rockhampton, QLD, Australia

2000 - 2006 Associate Professor, Clemson University, General Engineering, Clemson, SC, United States

1996 - 2000 Assistant Director , University of Florida, Southeastern University Coalition for Engineering Education, Gainesville, FL, United States

Products

Products Most Closely Related to the Proposed Project

1. Huerta-Manzanilla E, Ohland M, Peniche-Vera R. Co-enrollment density predicts engineering students' persistence and graduation: College networks and logistic regression analysis. Studies in Educational Evaluation. 2021 September; 70:101025-. Available from:

https://linkinghub.elsevier.com/retrieve/pii/S0191491X21000511 DOI: 10.1016/j.stueduc.2021.101025

2. Lord S, Layton R, Ohland M. Multi-Institution Study of Student Demographics and Outcomes in Electrical and Computer Engineering in the USA. IEEE Transactions on Education. 2015; 58(3):141-150. Available from: https://ieeexplore.ieee.org/document/6881755/ DOI: 10.1109/TE.2014.2344622
3. Lord SM, Ohland MW, Camacho MC, Layton RA. Beyond pipeline and pathways: ecosystem metrics. Journal of Engineering Education. 2019 February 26; 108(1):32. Available from: https://onlinelibrary.wiley.com/doi/abs/10.1002/jee.20250 DOI: 10.1002/jee.20250
4. Ohland M.W., Long R.A.. The multiple-institution database for investigating engineering longitudinal development: An experiential case study of data sharing and Reuse. Advances in Engineering Education. 2016; 5(2). eid: 2-s2.0-84976291649
5. Orr MK, Ohland MW, Lord SM, Layton RA. Comparing the Multiple-Institution Database for Investigating Engineering Longitudinal Development with a National Dataset from the United States. International Journal of Engineering Education. 2020 January 28; 36(4):1321. Available from: https://www.ijee.ie/1atestissues/Vol36-4/18_ijee3954.pdf Other: 0949149X

Other Significant Products, Whether or Not Related to the Proposed Project

1. Ohland M, Brawner C, Camacho M, Layton R, Long R, Lord S, Wasburn M. Race, Gender, and Measures of Success in Engineering Education. Journal of Engineering Education. 2013 January 02; 100(2):225-252. Available from: https://onlinelibrary.wiley.com/doi/10.1002/j.2168-9830.2011.tb00012.x DOI: 10.1002/j.2168-9830.2011.tb00012.x
2. Ohland M, Lord S, Layton R. Student Demographics and Outcomes in Civil Engineering in the United States. Journal of Professional Issues in Engineering Education and Practice. 2015 October; 141(4):-. Available from: https://ascelibrary.org/doi/10.1061/%28ASCE%29EI.1943-5541.0000244 DOI: 10.1061/(ASCE)EI.1943-5541.0000244
3. Lundy-Wagner V, Veenstra C, Orr M, Ramirez N, Ohland M, Long R. Gaining Access or Losing Ground?: Socioeconomically Disadvantaged Students in Undergraduate Engineering, 1994–2003. The Journal of Higher Education. 2014; 85(3):339-369. Available from: http://muse.jhu.edu/content/crossref/journals/journal_of_higher_education/v085/85.3.lundy-wagner.html DOI: 10.1353/jhe.2014.0015
4. Orr M, Lord S, Layton R, Ohland M. Student Demographics and Outcomes in Mechanical Engineering in the U.S. International Journal of Mechanical Engineering Education. 2014 July 23; 42(1):48-60. Available from: http://journals.sagepub.com/doi/10.7227/IJMEE.42.1.5 DOI: 10.7227/IJMEE.42.1.5
5. Ohland M.W., Sheppard S.D., Lichtenstein G., Eris O., Chachra D., Layton R.A.. Persistence, engagement, and migration in engineering programs. Journal of Engineering Education. 2008; 97(3):259-278. eid: 2-s2.0-60549103910

Certification:

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Certified by Ohland, Matthew W. in SciENcv on 2024-08-05 15:46:45

IDENTIFYING INFORMATION:

NAME: Parvania, Masood

ORCID iD: https://orcid.org/0000-0002-8891-7010

POSITION TITLE: Roger P. Webb Endowed Professor

PRIMARY ORGANIZATION AND LOCATION: University of Utah, Department of Electrical and Computer Engineering, Salt Lake City, Utah, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
Sharif University of Technology, Tehran, Not Applicable, N/A, Iran	PHD	09/2013	Electrical Engineering
Sharif University of Technology, Tehran, Not Applicable, N/A, Iran	MS	08/2009	Electrical Engineering
Iran University of Science and Technology, Tehran, Not Applicable, N/A, Iran	BS	02/2007	Electrical Engineering

Appointments and Positions

2023 - present Roger P. Webb Endowed Professor, University of Utah, Department of Electrical and Computer Engineering, Salt Lake City, Utah, United States

2020 - present Associate Professor, University of Utah, Salt Lake City, Utah, United States

2020 - present Associate Chair for Research and Advancement, University of Utah, Department of Electrical and Computer Engineering, Salt Lake City, Utah, United States

2020 - present Adjunct Associate Professor, University of Utah, School of Computing, Salt Lake City, Utah, United States

2020 - present Adjunct Associate Professor, University of Utah, Department of Mathematics, Salt Lake City, Utah, United States

2015 - 2020 Assistant Professor, University of Utah, Department of Electrical and Computer Engineering, Salt Lake City, Utah, United States

2015 - 2015 Postdoctoral Scholar, Arizona State University, School of Electrical, Computer and Energy Engineering, Tempe, Arizona, United States

2014 - 2014 Postdoctoral Scholar, University of California, Davis, Department of Electrical and Computer Engineering, Davis, California, United States

2012 - 2013 Research Associate, Illinois Institute of Technology, Department of Electrical and Computer Engineering, Chicago, Illinois, United States

Products

Products Most Closely Related to the Proposed Project

1. Bagherinezhad A, Hosseini M, Parvania M. Real-Time Hierarchical Energy Flexibility Management of Integrated Hybrid Resources. IEEE Transactions on Smart Grid. 2023 November; 14(6):4508-4518. Available from: https://ieeexplore.ieee.org/document/10227086/ DOI: 10.1109/TSG.2023.3308013
2. Hosseini M, Rodriguez-Garcia L, Parvania M. Hierarchical Combination of Deep

Reinforcement Learning and Quadratic Programming for Distribution System Restoration. IEEE Transactions on Sustainable Energy. 2023; 14(2):1088-1098. Available from: https://ieeexplore.ieee.org/document/10051723/ DOI: 10.1109/TSTE.2023.3245090

3. Bagherinezhad A, Hosseini M, Parvania M. Real-Time Coordinated Operation of Power and Autonomous Electric Ride-Hailing Systems. IEEE Transactions on Smart Grid. 2023; 14(3):2214-2225. Available from: https://ieeexplore.ieee.org/document/10050109/ DOI: 10.1109/TSG.2023.3247780
4. Hosseini M, Parvania M. On the Feasibility Guarantees of Deep Reinforcement Learning Solutions for Distribution System Operation. IEEE Transactions on Smart Grid. 2023; 14(2):954-964. Available from: https://ieeexplore.ieee.org/document/10004973/ DOI: 10.1109/TSG.2022.3233709
5. Hosseini M, Umunnakwe A, Parvania M, Tasdizen T. Intelligent Damage Classification and Estimation in Power Distribution Poles Using Unmanned Aerial Vehicles and Convolutional Neural Networks. IEEE Transactions on Smart Grid. 2020; 11(4):3325-3333. Available from: https://ieeexplore.ieee.org/document/8972612/ DOI: 10.1109/TSG.2020.2970156

Other Significant Products, Whether or Not Related to the Proposed Project

1. Hosseini M, Parvania M. Hierarchical Intelligent Operation of Energy Storage Systems in Power Distribution Grids. IEEE Transactions on Sustainable Energy. 2023; 14(2):741-750. Available from: https://ieeexplore.ieee.org/document/9953585/ DOI: 10.1109/TSTE.2022.3222425
2. Ganjkhani M, Gholami A, Giraldo J, Srivastava A, Parvania M. Multi-Source Data Aggregation and Real-Time Anomaly Classification and Localization in Power Distribution Systems. IEEE Transactions on Smart Grid. 2024; 15(2):2191-2202. Available from: https://ieeexplore.ieee.org/document/10253676/ DOI: 10.1109/TSG.2023.3316548
3. Umunnakwe A, Parvania M, Nguyen H, Horel J, Davis K. Data-driven spatio-temporal analysis of wildfire risk to power systems operation. IET Generation, Transmission & Distribution. 2022 May 13; 16(13):2531-2546. Available from: https://onlinelibrary.wiley.com/doi/10.1049/gtd2.12463 DOI: 10.1049/gtd2.12463
4. Hosseini M, Parvania M. Resilient Operation of Distribution Grids Using Deep Reinforcement Learning. IEEE Transactions on Industrial Informatics. 2022; 18(3):2100-2109. Available from: https://ieeexplore.ieee.org/document/9445634/ DOI: 10.1109/TII.2021.3086080
5. Gilanifar M, Parvania M. Clustered multi-node learning of electric vehicle charging flexibility. Applied Energy. 2021 January; 282:116125-. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0306261920315403 DOI: 10.1016/j.apenergy.2020.116125

Certification:

I certify that the information provided is current, accurate, and complete. This includes but is not limited to current, pending, and other support (both foreign and domestic) as defined in 42 U.S.C. § 6605.

I also certify that, at the time of submission, I am not a party to a malign foreign talent recruitment

program.

Misrepresentations and/or omissions may be subject to prosecution and liability pursuant to, but not limited to, 18 U.S.C. §§ 287, 1001, 1031 and 31 U.S.C. §§ 3729-3733 and 3802.

Certified by Parvania, Masood in SciENcv on 2024-08-02 21:11:29

IDENTIFYING INFORMATION:

NAME: Pekarek, Steve Dean

ORCID iD: https://orcid.org/0000-0001-6754-852x

POSITION TITLE: Edmund O. Schweitzer I

PRIMARY ORGANIZATION AND LOCATION: Purdue University, WEST LAFAYETTE, Indiana, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
Purdue University, WEST LAFAYETTE, Indiana, United States	PHD	12/1996	ECE
Purdue University, WEST LAFAYETTE, Indiana, United States	MS	05/1994	ECE
Purdue University, WEST LAFAYETTE, Indiana, United States	BS	12/1991	ECE

Appointments and Positions

2018 - present Edmund O. Schweitzer I, Purdue University, WEST LAFAYETTE, Indiana, United States

2007 - 2018 Professor of Electrical and Computer Engineering, Purdue University, WEST LAFAYETTE, Indiana, United States

2004 - 2007 Associate Professor of Electrical and Computer Engineering, Purdue University, WEST LAFAYETTE, Indiana, United States

2002 - 2004 Associate Professor of Electrical and Computer Engineering, University of Missouri-Rolla, Rolla, Missouri, United States

1997 - 2002 Assistant Professor of Electrical and Computer Engineering, University of Missouri-Rolla, Rolla, Missouri, United States

Products

Products Most Closely Related to the Proposed Project

1. Brovont A, Aliprantis D, Pekarek S, Vickers C, Mehar V. Magnetic Design for Three-Phase Dynamic Wireless Power Transfer With Constant Output Power. IEEE Transactions on Energy Conversion. 2023; 38(2):1481-1484. Available from: https://ieeexplore.ieee.org/document/10041972/ DOI: 10.1109/TEC.2023.3244074
2. Howard R, Horvath D, Pekarek S. Calculating inductance in a 2-D method of moments model. Engineering Analysis with Boundary Elements. 2024 May; 162:258-267. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0955799724000584 DOI: 10.1016/j.enganabound.2024.02.005
3. Donnelly T, Pekarek S, Fudge D, Zarate N. Thévenin Equivalent Circuits for Modeling Coupled Common/Differential-Mode Behavior in Power Electronic Systems. IEEE Open Access Journal of Power and Energy. 2021; 8:377-388. Available from: https://ieeexplore.ieee.org/document/9551296/ DOI: 10.1109/OAJPE.2021.3116099

4. Fahimi B, Lewis L, Miller J, Pekarek S, Boldea I, Ozpineci B, Hameyer K, Schulz S, Ghaderi A, Popescu M, Lehman B, Patel D. Automotive Electric Propulsion Systems: A Technology Outlook. IEEE Transactions on Transportation Electrification. 2023; :1-1. Available from: https://ieeexplore.ieee.org/document/10273420/ DOI: 10.1109/TTE.2023.3321707
5. Horvath D, Howard R, Pekarek S. Lorentz Force/Torque Calculation in 2-D Method of Moments. IEEE Transactions on Magnetics. 2020; 56(8):1-8. Available from: https://ieeexplore.ieee.org/document/9119456/ DOI: 10.1109/TMAG.2020.3002982

Other Significant Products, Whether or Not Related to the Proposed Project

1. Aliprantis D, Pekarek S. The Unsung Hero of the Electric Vehicle Revolution: The role of computational electromagnetics in electric machine design and analysis. IEEE Electrification Magazine. 2023 December; 11(4):64-68. Available from: https://ieeexplore.ieee.org/document/10334429/ DOI: 10.1109/MELE.2023.3320510
2. Hamilton D, Navarro L, Aliprantis D, Pekarek S, Zweigle G. Linearized-Trajectory Model-Predictive Controller for Improving Microgrid Short-Term Stability With Real-Time Implementation. IEEE Transactions on Industry Applications. 2023 November; 59(6):7356-7367. Available from: https://ieeexplore.ieee.org/document/10216372/ DOI: 10.1109/TIA.2023.3304621

Certification:

I certify that the information provided is current, accurate, and complete. This includes but is not limited to current, pending, and other support (both foreign and domestic) as defined in 42 U.S.C. § 6605.

I also certify that, at the time of submission, I am not a party to a malign foreign talent recruitment program.

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Certified by Pekarek, Steve Dean in SciENcv on 2024-08-02 10:27:10

IDENTIFYING INFORMATION:

NAME: Petruzza, Steve

ORCID iD: https://orcid.org/0000-0002-2649-1595

POSITION TITLE: Assistant Professor

PRIMARY ORGANIZATION AND LOCATION: Utah State University, Logan, Utah, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
University of Rome "Tor Vergata", Rome, Not Applicable, N/A, Italy	PHD	04/2018	Computer Science
University of Rome "Tor Vergata", Rome, Not Applicable, N/A, Italy	MENG	04/2013	Computer Engineering
University of Rome "Tor Vergata", Rome, Not Applicable, N/A, Italy	BENG	04/2011	Computer engineering

Appointments and Positions

2020 - present Assistant Professor, Utah State University, Logan, Utah, United States
2020 - present Research Associate, University of Utah, Salt Lake City, Utah, United States
2019 - present President, Data Intensive Science (non profit 305c), Logan, Utah, United States
2017 - 2020 PostDoctoral Fellow, University of Utah, Salt Lake City, Utah, United States
2016 - 2016 Research Assistant, University of Utah, Salt Lake City, Utah, United States
2013 - 2015 System Analyst, Elettronica SpA, Rome, Not Applicable, N/A, Italy
2012 - 2013 Software Engineer, Capgemini SpA, Rome, Not Applicable, N/A, Italy

Products

Products Most Closely Related to the Proposed Project

1. Shudler S, Petruzza S, Pascucci V, Bremer P. Portable and Composable Flow Graphs for In Situ Analytics. 2021 IEEE 11th Symposium on Large Data Analysis and Visualization (LDAV); 2021; IEEE; c2021. Available from: https://ieeexplore.ieee.org/abstract/document/9623191/
2. Petruzza S, Treichler S, Pascucci V, Bremer P. Babelflow: An embedded domain specific language for parallel analysis and visualization. 2018 IEEE International Parallel and Distributed Processing Symposium (IPDPS); 2018; IEEE; c2018.
3. Sewell A, Fan K, Shovon A, Dyken L, Kumar S, Petruzza S. Bruck Algorithm Performance Analysis for Multi-GPU All-to-All Communication. International Conference on High Performance Computing in Asia-Pacific Region; 2024.
4. Humphrey A, Peterson B, Schmidt J, Berzins M, Harris D, Isaac B, Thornock J, Harman T, Kumar S, Petruzza S. An Integrated Approach to Scaling Task-Based Runtime Systems for Next Generation Engineering Problems. International Conference for High Performance

Computing, Networking, Storage and Analysis; 2017; ACM; c2017. Available from: https://www.osti.gov/biblio/1755953

5. Sewell A, Fytanidis D, Mateevitsi V, Harrison C, Marsaglia N, Marrinan T, Rizzi S, Insley J, Papka M, Petruzza S. Bridging Gaps in Simulation Analysis through a General Purpose, Bidirectional Steering Interface with Ascent. SC24-W: Workshops of the International Conference for High Performance Computing, Networking, Storage and Analysis. 2024; :841-846. PMID: 9798350355543

Other Significant Products, Whether or Not Related to the Proposed Project

1. Huang X, Klacansky P, Petruzza S, Gyulassy A, Bremer P, Pascucci V. Distributed merge forest: a new fast and scalable approach for topological analysis at scale. International Conference on Supercomputing; 2021; ACM; c2021. Available from: https://dl.acm.org/doi/10.1145/3447818.3460358 DOI: 10.1145/3447818.3460358
2. Usher W, Huang X, Petruzza S, Kumar S, Slattery S, Reeve S, Wang F, Johnson C, Pascucci V. Adaptive spatially aware i/o for multiresolution particle data layouts. IEEE International Parallel and Distributed Processing Symposium (IPDPS); 2021; IEEE; c2021. Available from: https://ieeexplore.ieee.org/abstract/document/9460496/
3. Fan K, Hoang D, Petruzza S, Gilray T, Pascucci V, Kumar S. Load-balancing Parallel I/O of Compressed Hierarchical Layouts. IEEE 28th International Conference on High Performance Computing, Data, and Analytics (HiPC); 2021; IEEE; c2021. Available from: https://ieeexplore.ieee.org/abstract/document/9680353/
4. Han M, Li J, Sane S, Gupta S, Wang B, Petruzza S, Johnson C. Interactive visualization of time-varying flow fields using particle tracing neural networks. 2024 IEEE 17th Pacific Visualization Conference (PacificVis). 2024; :52-61. isbn: 9798350393804
5. Fan K, Petruzza S, Gilray T, Kumar S. Configurable algorithms for all-to-all collectives. ISC High Performance 2024 Research Paper Proceedings (39th International Conference). 2024; :1-12. isbn: 3982633605

Certification:

I certify that the information provided is current, accurate, and complete. This includes but is not limited to information related to domestic and foreign appointments and positions.

I also certify that, at the time of submission, I am not a party to a malign foreign talent recruitment program.

Misrepresentations and/or omissions may be subject to prosecution and liability pursuant to, but not limited to, 18 U.S.C. §§ 287, 1001, 1031 and 31 U.S.C. §§ 3729-3733 and 3802.

Certified by Petruzza, Steve in SciENcv on 2025-09-08 15:45:56

IDENTIFYING INFORMATION:

NAME: Plett, Gregory

ORCID iD: https://orcid.org/0000-0002-4868-7863

POSITION TITLE: Professor

PRIMARY ORGANIZATION AND LOCATION: University of Colorado Colorado Springs, Colorado Springs, Colorado, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
Stanford University, Stanford, California, United States	PHD	05/1998	Electrical Engineering
Stanford University, Stanford, California, United States	MS	09/1992	Electrical Engineering
Carleton University, Ottawa, Ontario, Canada	BENG	05/1990	Computer Systems Engineering

Appointments and Positions

2011 - present Professor, University of Colorado Colorado Springs, Colorado Springs, Colorado, United States

2005 - 2011 Associate Professor, University of Colorado Colorado Springs, Colorado Springs, Colorado, United States

1998 - 2005 Assistant Professor, University of Colorado Colorado Springs, Colorado Springs, Colorado, United States

Products

Products Most Closely Related to the Proposed Project

1. Lu D, Trimboli M, Wang Y, Plett G. Modeling Voltage Decay During Calendar-Life Aging. Journal of The Electrochemical Society. 2022 December 20; 169(12):120515-. Available from: https://iopscience.iop.org/article/10.1149/1945-7111/acaa5d DOI: 10.1149/1945-7111/acaa5d
2. Lu D, Scott Trimboli M, Fan G, Wang Y, Plett G. Nondestructive EIS Testing to Estimate a Subset of Physics-based-model Parameter Values for Lithium-ion Cells. Journal of The Electrochemical Society. 2022 August 05; 169(8):080504-. Available from: https://iopscience.iop.org/article/10.1149/1945-7111/ac824a DOI: 10.1149/1945-7111/ac824a
3. Lu D, Scott Trimboli M, Fan G, Zhang R, Plett G. Nondestructive Pulse Testing to Estimate a Subset of Physics-Based-Model Parameter Values for Lithium-Ion Cells. Journal of The Electrochemical Society. 2021 August 24; 168(8):080533-. Available from: https://iopscience.iop.org/article/10.1149/1945-7111/ac1cfa DOI: 10.1149/1945-7111/ac1cfa
4. Rodríguez A, Plett G, Trimboli M. Comparing four model-order reduction techniques, applied to lithium-ion battery-cell internal electrochemical transfer functions. eTransportation.

2019 August; 1:100009-. Available from: https://linkinghub.elsevier.com/retrieve/pii/S2590116819300098 DOI: 10.1016/j.etran.2019.100009

5. Plett G. Algebraic Solution for Modeling SEI Layer Growth. ECS Electrochemistry Letters. 2013 April 18; 2(7):A63-A65. Available from: https://iopscience.iop.org/article/10.1149/1.004307eel DOI: 10.1149/1.004307eel

Other Significant Products, Whether or Not Related to the Proposed Project

1. Gregory L. Plett and M. Scott Trimboli. Battery Management Systems, Volume III: Physics-Based Methods. 2023. isbn: 9781630819040
2. Gregory L. Plett. Battery Management Systems, Volume I: Battery Modeling. 2015. isbn: 978-1-63081-023-8
3. Gregory L. Plett. Battery Management Systems, Volume II: Equivalent-Circuit Methods. 2015. isbn: 978-1-63081-027-6
4. Plett G. Reduced-Order multi-modal model of SEI layer growth for management and control of lithium-ion batteries. 2017 IEEE Conference on Control Technology and Applications (CCTA). 2017 IEEE Conference on Control Technology and Applications (CCTA); ; Mauna Lani Resort, HI, USA. IEEE; c2017. Available from: http://ieeexplore.ieee.org/document/8062493/ DOI: 10.1109/CCTA.2017.8062493
5. Fan G, Lu D, Trimboli M, Plett G, Zhu C, Zhang X. Nondestructive diagnostics and quantification of battery aging under different degradation paths. Journal of Power Sources. 2023 February; 557:232555-. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0378775322015324 DOI: 10.1016/j.jpowsour.2022.232555

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Certified by Plett, Gregory in SciENcv on 2025-09-09 07:11:57

IDENTIFYING INFORMATION:

NAME: Qin, Junjie

POSITION TITLE: Assistant Professor

PRIMARY ORGANIZATION AND LOCATION: Elmore Family School of Electrical and Computer Engineering, Purdue University, West Lafayette, Indiana, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
University of California, Berkeley, Berkeley, California, United States	Postdoctoral Fellow	01/2018 - 12/2020	Mechanical Engineering
Lawrence Berkeley National Laboratory, Berkeley, California, United States	Postdoctoral Fellow	01/2018 - 09/2019	Grid Integration Group
Stanford University, Stanford, California, United States	PHD	01/2018	Computational and Mathematical Engineering
Stanford University, Stanford, California, United States	MS	06/2017	Statistics
Stanford University, Stanford, California, United States	MS	08/2011	Civil and Environmental Engineering
Tsinghua University, Beijing, Not Applicable, N/A, China	BOTH	08/2010	Economics
Tsinghua University, Beijing, Not Applicable, N/A, China	BENG	08/2010	Hydraulic Engineering

Appointments and Positions

2021 - present Assistant Professor, Elmore Family School of Electrical and Computer Engineering, Purdue University, West Lafayette, Indiana, United States

Products

Products Most Closely Related to the Proposed Project

1. J. Qin, I. Yang, R. Rajagopal. Submodularity of Storage Placement Optimization in Power Networks. IEEE Transactions on Automatic Control. 2019; 64(8):3268-3283. DOI: 10.1109/TAC.2018.2882489
2. Jain R, Qin J, Rajagopal R. Data-driven planning of distributed energy resources amidst socio-technical complexities. Nature Energy. 2017 July 17; 2(8):17112. Available from: https://doi.org/10.1038/nenergy.2017.112 DOI: 10.1038/nenergy.2017.112
3. Chen G, Qin J. On the Choice of Loss Function in Learning-based Optimal Power Flow. in Proc. IEEE Power and Energy Society General Meeting. Forthcoming. Available from: https://arxiv.org/abs/2402.00773
4. Chen G, Qin J. Neural Risk Limiting Dispatch in Power Networks: Formulation and

Generalization Guarantees. Submitted to IEEE Transactions on Power Systems. 2024 January. Available from: https://arxiv.org//2402.00772

5. J. Qin, Y. Chow, J. Yang, R. Rajagopal. Distributed Online Modified Greedy Algorithm for Networked Storage Operation Under Uncertainty. IEEE Transactions on Smart Grid. 2016; 7(2):1106-1118. DOI: 10.1109/TSG.2015.2422780

Other Significant Products, Whether or Not Related to the Proposed Project

1. J. Qin, R. Rajagopal, P. Varaiya. Flexible Market for Smart Grid: Coordinated Trading of Contingent Contracts. IEEE Transactions on Control of Network Systems. 2018; 5(4):1657-1667. DOI: 10.1109/TCNS.2017.2746347
2. J. Qin, Y. Chow, J. Yang, R. Rajagopal. Online Modified Greedy Algorithm for Storage Control Under Uncertainty. IEEE Transactions on Power Systems. 2016; 31(3):1729-1743. DOI: 10.1109/TPWRS.2015.2440355
3. J. Wang, J. Qin, H. Zhong, R. Rajagopal, Q. Xia, C. Kang. Reliability Value of Distributed Solar+Storage Systems Amidst Rare Weather Events. IEEE Transactions on Smart Grid. 2019; 10(4):4476-4486. DOI: 10.1109/TSG.2018.2861227
4. H. Chen, Z. Hu, H. Luo, J. Qin, R. Rajagopal, H. Zhang. Design and Planning of a Multiple-Charger Multiple-Port Charging System for PEV Charging Station. IEEE Transactions on Smart Grid. 2019; 10(1):173-183. DOI: 10.1109/TSG.2017.2735636
5. Y. Zhao, J. Qin, R. Rajagopal, A. Goldsmith, H. V. Poor. Wind Aggregation Via Risky Power Markets. IEEE Transactions on Power Systems. 2015; 30(3):1571-1581. DOI: 10.1109/TPWRS.2014.2359671

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Certified by Qin, Junjie in SciENcv on 2024-05-21 16:18:22

IDENTIFYING INFORMATION:

NAME: Quinn, Jason

ORCID iD: https://orcid.org/0000-0003-0157-5642

POSITION TITLE: Professor

PRIMARY ORGANIZATION AND LOCATION: Mechanical Engineering, Colorado State University, Fort Collins, Colorado, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
Colorado State University, Fort Collins, Colorado, United States	Other training	10/2011 - 05/2012	Research Scientist
Colorado State University , Fort Collins, Colorado, United States	PHD	09/2011	Mechanical Engineering
University of Wisconsin, Madison, Wisconsin, United States	MS	05/2004	Nuclear Engineering & Engineering Physics
Colorado State University , Fort Collins, Colorado, United States	BS	05/2002	Mechanical Engineering

Appointments and Positions

2023 - present	Professor, Mechanical Engineering, Colorado State University, Fort Collins, Colorado, United States
2023 - present	Operating Director, Energy Institute , Colorado State University , Fort Collins, Colorado, United States
2023 - present	CEO, Optimized Kinetics, Steamboat Springs, Colorado, United States
2018 - present	CEO, Sustainability Science LLC, Steamboat Springs, Colorado, United States
2019 - 2023	Associate Professor, Mechanical Engineering, Colorado State University, Fort Collins, Colorado, United States
2016 - 2018	Assistant Professor, Mechanical Engineering, Colorado State University , Fort Collins, Colorado, United States
2012 - 2016	Assistant Professor, Mechanical & Aerospace Engineering, Utah State University , Logan, Utah, United States

Products

Products Most Closely Related to the Proposed Project

1. Horesh N, Trinko D, Quinn J. Comparing costs and climate impacts of various electric vehicle charging systems across the United States. Nature Communications. 2024 June 01; 15(1):-. Available from: https://www.nature.com/articles/s41467-024-49157-5 DOI: 10.1038/s41467-024-49157-5
2. Limb B, Quinn J, Johnson A, Sowby R, Thomas E. The potential of carbon markets to accelerate green infrastructure based water quality trading. Communications Earth & Environment. 2024 April 15; 5(1):-. Available from: https://www.nature.com/articles/s43247-

024-01359-x DOI: 10.1038/s43247-024-01359-x

3. Cole G, Robbins C, Grauberger B, Garland S, Tong T, Bandhauer T, Quinn J. Optimization of mobile oil and gas produced water treatment unit deployment logistics to achieve economic feasibility. Resources, Conservation and Recycling. 2022 June; 181:106249-. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0921344922000970 DOI: 10.1016/j.resconrec.2022.106249
4. Sproul E, Barlow J, Quinn J. Time Value of Greenhouse Gas Emissions in Life Cycle Assessment and Techno-Economic Analysis. Environmental Science & Technology. 2019 April 23; 53(10):6073-6080. Available from: https://pubs.acs.org/doi/10.1021/acs.est.9b00514 DOI: 10.1021/acs.est.9b00514
5. Greene JM, Wallace J, Williams RB, Leytem AB, Bock BR, McCully M, Kaffka SR, Rotz CA, Quinn JC. National Greenhouse Gas Emission Reduction Potential from Adopting Anaerobic Digestion on Large-Scale Dairy Farms in the United States. Environ Sci Technol. 2024 Jul 16;58(28):12409-12419. PubMed PMID: 38953529.

Other Significant Products, Whether or Not Related to the Proposed Project

1. Quiroz D, Greene J, Limb B, Quinn J. Global Life Cycle and Techno-Economic Assessment of Algal-Based Biofuels. Environmental Science & Technology. 2023 July 27; 57(31):11541-11551. Available from: https://pubs.acs.org/doi/10.1021/acs.est.3c02892 DOI: 10.1021/acs.est.3c02892
2. Smith J, Limb B, Beal C, Banta K, Field J, Simske S, Quinn J. Evaluating the sustainability of the 2017 US biofuel industry with an integrated techno-economic analysis and life cycle assessment. Journal of Cleaner Production. 2023 August; 413:137364-. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0959652623015226 DOI: 10.1016/j.jclepro.2023.137364
3. Summers H, Quinn J. Improving water scarcity footprint capabilities in arid regions through expansion of characterization factor methods. Science of The Total Environment. 2021 December; 801:149586-. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0048969721046611 DOI: 10.1016/j.scitotenv.2021.149586
4. Antonanzas J, Quinn J. Net environmental impact of the PV industry from 2000-2025. Journal of Cleaner Production. 2021 August; 311:127791-. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0959652621020096 DOI: 10.1016/j.jclepro.2021.127791
5. Horesh N, Trinko D, Quinn J. Author Correction: Comparing costs and climate impacts of various electric vehicle charging systems across the United States. Nature Communications. 2024 June 18; 15(1):-. Available from: https://www.nature.com/articles/s41467-024-49525-1 DOI: 10.1038/s41467-024-49525-1

Certification:

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I also certify that, at the time of submission, I am not a party to a malign foreign talent recruitment program.

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Certified by Quinn, Jason in SciENcv on 2025-03-04 22:13:15

IDENTIFYING INFORMATION:

NAME: Raheem, Adeeba

ORCID iD: https://orcid.org/0000-0002-2226-5582

POSITION TITLE: Associate Professor

PRIMARY ORGANIZATION AND LOCATION: The University of Texas at El Paso , Department of Civil Engineering, El Paso, Texas, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
University of Florida, Gainesville, Florida, United States	PHD	07/2014	Construction Management
University of Florida, Gainesville, Florida, United States	MS	12/2013	Construction Engineering
University of Florida, Gainesville, Florida, United States	MS	12/2012	Environmental Engineering
University of Florida, Gainesville, Florida, United States	MS	06/2010	Building Construction
University of Engineering and Technology, Lahore, Punjab, Pakistan	BS	12/2005	Architectural Engineering and Design

Appointments and Positions

2022 - present Associate Professor, The University of Texas at El Paso , Department of Civil Engineering, El Paso, Texas, United States

2018 - 2022 Assistant Professor-Tenure Track, The University of Texas at El Paso, El Paso, Texas, United States

2014 - 2018 Clinical Assistant Professor, The University of Texas at El Paso, El Paso, Texas, United States

Products

Products Most Closely Related to the Proposed Project

1. Luis Lugo J, Gallegos Reyes J, Weidner J, Raheem A, Cheu R. Evaluation of 3D Reconstruction Methods from Terrestrial LiDAR Point Cloud Data to Create Digital Twins of Civil Infrastructure Projects. International Conference on Transportation and Development 2022. International Conference on Transportation and Development 2022; May un; Seattle, Washington. Reston, VA: American Society of Civil Engineers; c2022. Available from: https://ascelibrary.org/doi/10.1061/9780784484319.008 DOI: 10.1061/9780784484319.008
2. Brown L, Weidner J, Raheem A, Long Cheu R. Vision-Based Methodology to Create a Highway Asset Inventory for Integration in a Digital Twin Model. International Conference on

Transportation and Development 2022. International Conference on Transportation and Development 2022; May un; Seattle, Washington. Reston, VA: American Society of Civil Engineers; c2022. Available from: https://ascelibrary.org/doi/10.1061/9780784484364.003 DOI: 10.1061/9780784484364.003

3. Cruz H, Raheem A, Nazarian S. Digital Twin Technology Applications for Transportation Infrastructure—A Survey-Based Study. Computing in Civil Engineering 2021. ASCE International Conference on Computing in Civil Engineering 2021; Sept r ; Orlando, Florida. Reston, VA: American Society of Civil Engineers; c2022. Available from: http://ascelibrary.org/doi/10.1061/9780784483893.044 DOI: 10.1061/9780784483893.044
4. Azfar T, Wang C, Ke R, Raheem A, Weidner J, Cheu R. Incorporating Vehicle Detection Algorithms via Edge Computing on a Campus Digital Twin Model. International Conference on Transportation and Development 2023. International Conference on Transportation and Development 2023; June 17; Austin, Texas. Reston, VA: American Society of Civil Engineers; c2023. Available from: https://ascelibrary.org/doi/10.1061/9780784484876.035 DOI: 10.1061/9780784484876.035
5. Chang C, Makahaube J, Raheem A, Smith E, Mahnaz S. Using System Dynamics Method to Measure Project Management Performance of Local Government Agencies. Businesses. 2022 September 23; 2(4):376-395. Available from: https://www.mdpi.com/2673-7116/2/4/24 DOI: 10.3390/businesses2040024

Other Significant Products, Whether or Not Related to the Proposed Project

1. Azfar T, Weidner J, Raheem A, Ke R, Cheu R. Efficient Procedure of Building University Campus Models for Digital Twin Simulation. IEEE Journal of Radio Frequency Identification. 2022; 6:769-773. Available from: https://ieeexplore.ieee.org/document/9913679/ DOI: 10.1109/JRFID.2022.3212957
2. Salcido J, Raheem A, Ravi S. Comparison of embodied energy and environmental impact of alternative materials used in reticulated dome construction. Building and Environment. 2016 February; 96:22-34. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0360132315301736 DOI: 10.1016/j.buildenv.2015.11.010

Certification:

I certify that the information provided is current, accurate, and complete. This includes but is not limited to information related to domestic and foreign appointments and positions.

I also certify that, at the time of submission, I am not a party to a malign foreign talent recruitment program.

Misrepresentations and/or omissions may be subject to prosecution and liability pursuant to, but not limited to, 18 U.S.C. §§ 287, 1001, 1031 and 31 U.S.C. §§ 3729-3733 and 3802.

Certified by Raheem, Adeeba in SciENcv on 2025-09-11 23:09:00

IDENTIFYING INFORMATION:

NAME: Reid, Colleen

ORCID iD: https://orcid.org/0000-0001-8572-1162

POSITION TITLE: Associate Professor

PRIMARY ORGANIZATION AND LOCATION: University of Colorado Boulder, Boulder, Colorado, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
University of California Berkeley, Berkeley, CA, US	PhD	07/2014	Environmental Health Sciences
University of California Berkeley, Berkeley, CA, US	MPH	05/2007	Environmental Health Sciences
Brown University, Providence, RI, US	ScB	05/2000	Environmental Science

Appointments and Positions

2023 - present Associate Professor, University of Colorado Boulder, Boulder, Colorado, United States

2016 - 2023 Assistant Professor, University of Colorado Boulder, Geography, Boulder, CO, US

2014 - 2016 Robert Wood Johnson Health and Society Scholar, Harvard School of Public Health, Center for Population and Development Studies, Boston, MA, US

2007 - 2009 ASPH Environmental Health Fellow, U.S. Environmental Protection Agency, National Center for Environmental Assessment, Washington, DC, US

Products

Products Most Closely Related to the Proposed Project

1. Koplitz S, Jacob D, Sulprizio M, Myllyvirta L, Reid C. Burden of Disease from Rising Coal-Fired Power Plant Emissions in Southeast Asia. Environmental Science & Technology. 2017 January 12; 51(3):1467-1476. Available from: https://pubs.acs.org/doi/10.1021/acs.est.6b03731 DOI: 10.1021/acs.est.6b03731
2. Silberstein J, Mael L, Frischmon C, Rieves E, Coffey E, Das T, Dresser W, Hatch A, Nath J, Pliszka H, Reid C, Vance M, Wiedinmyer C, De Gouw J, Hannigan M. Residual impacts of a wildland urban interface fire on urban particulate matter and dust: a study from the Marshall Fire. Air Quality, Atmosphere & Health. 2023 May 20; 16(9):1839-1850. Available from: https://link.springer.com/10.1007/s11869-023-01376-3 DOI: 10.1007/s11869-023-01376-3
3. Reid CE, Considine EM, Maestas MM, Li G. Daily PM(2.5) concentration estimates by county, ZIP code, and census tract in 11 western states 2008-2018. Sci Data. 2021 Apr 19;8(1):112. PubMed Central PMCID: PMC8055869.
4. Considine EM, Reid CE, Ogletree MR, Dye T. Improving accuracy of air pollution exposure measurements: Statistical correction of a municipal low-cost airborne particulate matter sensor network. Environ Pollut. 2021 Jan 1;268(Pt B):115833. PubMed PMID: 33120139.

5. Reid CE, Considine EM, Watson GL, Telesca D, Pfister GG, Jerrett M. Associations between respiratory health and ozone and fine particulate matter during a wildfire event. Environ Int. 2019 Aug;129:291-298. PubMed PMID: 31146163.

Other Significant Products, Whether or Not Related to the Proposed Project

1. Reid CE, O'Neill MS, Gronlund CJ, Brines SJ, Brown DG, Diez-Roux AV, Schwartz J. Mapping community determinants of heat vulnerability. Environ Health Perspect. 2009 Nov;117(11):1730-6. PubMed Central PMCID: PMC2801183.
2. Considine EM, Hao J, deSouza P, Braun D, Reid CE, Nethery RC. Evaluation of Model-Based PM(2.5) Estimates for Exposure Assessment during Wildfire Smoke Episodes in the Western U.S. Environ Sci Technol. 2023 Feb 7;57(5):2031-2041. PubMed Central PMCID: PMC10288567.
3. Reid CE, Brauer M, Johnston FH, Jerrett M, Balmes JR, Elliott CT. Critical Review of Health Impacts of Wildfire Smoke Exposure. Environ Health Perspect. 2016 Sep;124(9):1334-43. PubMed Central PMCID: PMC5010409.
4. Reid CE, Jerrett M, Petersen ML, Pfister GG, Morefield PE, Tager IB, Raffuse SM, Balmes JR. Spatiotemporal prediction of fine particulate matter during the 2008 northern California wildfires using machine learning. Environ Sci Technol. 2015 Mar 17;49(6):3887-96. PubMed PMID: 25648639.
5. Reid C, O'Neill M, Gronlund C, Brines S, Brown D, Diez-Roux A, Schwartz J. Mapping Community Determinants of Heat Vulnerability. Environmental Health Perspectives. 2009 November; 117(11):1730-1736. Available from: https://ehp.niehs.nih.gov/doi/10.1289/ehp.0900683 DOI: 10.1289/ehp.0900683

Certification:

I certify that the information provided is current, accurate, and complete. This includes but is not limited to current, pending, and other support (both foreign and domestic) as defined in 42 U.S.C. § 6605.

I also certify that, at the time of submission, I am not a party to a malign foreign talent recruitment program.

Misrepresentations and/or omissions may be subject to prosecution and liability pursuant to, but not limited to, 18 U.S.C. §§ 287, 1001, 1031 and 31 U.S.C. §§ 3729-3733 and 3802.

Certified by Reid, Colleen in SciENcv on 2024-08-01 19:19:35

IDENTIFYING INFORMATION:

NAME: Roberts, Nicholas A

POSITION TITLE: Associate Professor

PRIMARY ORGANIZATION AND LOCATION: Utah State University, Mechanical and Aerospace Engineering, Logan, Utah, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
Vanderbilt University, Nashville, Tennessee, United States	PHD	07/2010	Mechanical Engineering
Georgia Institute of Technology, Atlanta, Georgia, United States	BS	05/2006	Mechanical Engineering

Appointments and Positions

2019 - present Associate Professor, Utah State University, Mechanical and Aerospace Engineering, Logan, Utah, United States

2013 - 2019 Assistant Professor, Utah State University, Mechanical and Aerospace Engineering, Logan, Utah, United States

2010 - 2013 Postdoctoral Research Associate, University of Tennessee/Oak Ridge National Laboratory, Knoxville, Tennessee, United States

Products

Products Most Closely Related to the Proposed Project

1. Ghorbani M, Wang H, Roberts NA. Numerical Study of Thermal Management Systems Using Phase Change Materials Integrated with Heat Sink for Wireless Super-Fast Charging Stations of EVs in Constant Heat Flux Condition. ASME Summer Heat Transfer Conference; 2023 July 10; Washington DC, US. Available from: https://asmedigitalcollection.asme.org/HT/proceedings-abstract/HT2023/87165/1167605
2. Ziegenfelder P, Roberts NA, Wang H. Novel Gerber File-based Numerical Modeling and Simulation for Thermal Analysis of Printed Circuit Boards. IEEE Applied Power Electronics Conference and Exposition. 2023; :103-109.
3. Roberts NA, Mullen J, Zane RA, Kamineni A, Varghese BJ, Halling M., inventors. Static heat exchanger for wireless power transfer pad. US 11521780. 2022 December 06.
4. Larsen JB, Kamineni A, Roberts NA, Halling M, Vaikasi P, Barnes A. Test Platform to Evaluate Pavement Embedded Wireless Charging Pads. Wireless Power Week; 2022 July 05; Bordeaux, France. Available from: https://ieeexplore.ieee.org/abstract/document/9901325
5. Varghese BJ, Kamineni A, Roberts NA, Halling M, Thrimawithana DJ, Zane RA. Design considerations for 50 kW dynamic wireless charging with concrete-embedded coils. IEEE PELS Workshop on Emerging Technologies: Wireless Power Transfer; 2020 November 15; Seoul,

South Korea. Available from: https://ieeexplore.ieee.org/abstract/document/9291275

Other Significant Products, Whether or Not Related to the Proposed Project

1. Behbahanian A, Roberts NA. Phonon wave-packet simulations using the quantized definition of energy and a temperature-dependent phonon dispersion relation and phonon density of states. Physical Review E. 2021 April 29; 103(4):043311. Available from: https://journals.aps.org/pre/abstract/10.1103/PhysRevE.103.043311
2. Cutler RA, Hui C, Knudson L, Behbahanian A, Beatty S, Risbud S, Babcock R, Roberts NA, Prebys E. Effect of ionizing radiation on thermal and mechanical properties of filled-epoxy adhesives. International Journal of Adhesion and Adhesives. 2023 October 01; 127:103496. Available from: https://www.sciencedirect.com/science/article/pii/S0143749623001768
3. Fowlkes JD, Roberts NA, Wu Y, Diez JA, González AG, Hartnett C, Mahady K, Afkhami S, Kondic L, Rack PD. Hierarchical nanoparticle ensembles synthesized by liquid phase directed self-assembly. Nano Lett. 2014 Feb 12;14(2):774-82. PubMed PMID: 24372258.
4. Roberts NA, Fowlkes JD, Mahady K, Afkhami S, Kondic L, Rack PD. Directed assembly of one- and two-dimensional nanoparticle arrays from pulsed laser induced dewetting of square waveforms. ACS Appl Mater Interfaces. 2013 May 22;5(10):4450-6. PubMed PMID: 23607517.
5. Behbahanian A, Roberts NA. Large Area Substrate-Based Nanofabrication of Controllable and Customizable Gold Nanoparticles Via Capped Dewetting. J Vis Exp. 2019 Feb 26; PubMed PMID: 30882780.

Certification:

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Certified by Roberts, Nicholas A in SciENcv on 2025-09-11 10:51:14

IDENTIFYING INFORMATION:

NAME: Sajadi, Amir

ORCID iD: https://orcid.org/0000-0002-6144-9800

POSITION TITLE: Senior Research Associate

PRIMARY ORGANIZATION AND LOCATION: University of Colorado Boulder, Boulder, Colorado, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
University of Manchester, Manchester, Not Applicable, N/A, England	Postdoctoral Fellow	11/2016 - 10/2018	Future Power Systems
Case Western Reserve University, Cleveland, Ohio, United States	PHD	05/2016	Systems and Control Engineering
Warsaw University of Technology, Warsaw, Masovian, Poland	MS	07/2012	Electrical Engineering
Azad University, Saveh, Markazi, Iran	BS	07/2009	Electrical Engineering

Appointments and Positions

2023 - present Senior Research Associate, University of Colorado Boulder, Boulder, Colorado, United States

2022 - 2023 Power System Team Load/Senior Manager of Controls, Span.io, San Francisco, California, United States

2021 - 2022 Senior Reliability Planning Engineer, Western Electricity Coordinating Council (WECC), Salt Lake City, Utah, United States

2020 - 2021 Research Associate, University of Colorado Boulder, Boulder, Colorado, United States

2019 - 2020 Senior Engineer, Public Utility Commission of Wisconsin, Madison, Wisconsin, United States

Products

Products Most Closely Related to the Proposed Project

1. Sajadi A, Kenyon R, Hodge B. Synchronization in electric power networks with inherent heterogeneity up to 100% inverter-based renewable generation. Nature Communications. 2022 May 05; 13(1):-. Available from: https://www.nature.com/articles/s41467-022-30164-3 DOI: 10.1038/s41467-022-30164-3
2. Sajadi A, Zhao S, Clark K, Loparo K. Small-Signal Stability Analysis of Large-Scale Power Systems in Response to Variability of Offshore Wind Power Plants. IEEE Systems Journal. 2019; 13(3):3070-3079. Available from: https://ieeexplore.ieee.org/document/8584053/ DOI: 10.1109/JSYST.2018.2885302
3. Sajadi A, Kolacinski R, Clark K, Loparo K. Transient Stability Analysis for Offshore Wind Power Plant Integration Planning Studies—Part II: Long-Term Faults. IEEE Transactions on

Industry Applications. 2019; 55(1):193-202. Available from: https://ieeexplore.ieee.org/document/8454301/ DOI: 10.1109/TIA.2018.2868540

4. Sajadi A, Kolacinski R, Clark K, Loparo K. Transient Stability Analysis for Offshore Wind Power Plant Integration Planning Studies—Part I: Short-Term Faults. IEEE Transactions on Industry Applications. 2019; 55(1):182-192. Available from: https://ieeexplore.ieee.org/document/8454303/ DOI: 10.1109/TIA.2018.2868550
5. Julien S, Sajadi A, Hodge B. Hierarchical Control of Utility-Scale Solar PV Plants for Mitigation of Generation Variability and Ancillary Service Provision. IEEE Transactions on Sustainable Energy. 2022; 13(3):1383-1395. Available from: https://ieeexplore.ieee.org/document/9707870/ DOI: 10.1109/TSTE.2022.3149451

Other Significant Products, Whether or Not Related to the Proposed Project

Certification:

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Certified by Sajadi, Amir in SciENcv on 2024-08-05 21:46:13

IDENTIFYING INFORMATION:

NAME: Santiago, Ivonne

ORCID iD: https://orcid.org/0000-0001-7989-0656

POSITION TITLE: Associate Professor Civil, Environmental, and Construction Engineering

PRIMARY ORGANIZATION AND LOCATION: The University of Texas at El Paso, El Paso, TX, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
New Mexico State University, Las Cruces, NM, USA	DPHIL	12/1995	Civil Engineering (Environmental Engineering)
Clemson University, Clemson, South Carolina, USA	MENG	08/1988	Environmental Systems Engineering
University of Puerto Rico, Mayaguez, Puerto Rico, USA	BS	05/1986	Civil Engineering

Appointments and Positions

2021 - present Associate Professor Civil, Environmental, and Construction Engineering, The University of Texas at El Paso, El Paso, TX, United States
2020 - 2021 Provost Faculty Fellow, The University of Texas at El Paso, El Paso, TX, USA
2013 - 2021 Clinical Professor Civil Engineering, The University of Texas at El Paso, EL Paso, TX, USA
2012 - 2013 Special Faculty Associate Center For Excellence in Teaching and Learning, The University of Texas at El Paso, El Paso, TX, USA
2009 - 2013 Lecturer Civil Engineering, The University of Texas at El Paso, El Paso, TX, USA
2004 - 2006 Professor Civil Engineering, University of Puerto Rico, Mayaguez, PR, USA
2002 - 2003 Associate Director for Academic Affairs Civil Engineering Department, University of Puerto Rico, Mayaguez, PR, USA
2001 - 2002 Director Water Quality Area, Puerto Rico Environmental Quality Board, San Juan, PR, USA
1999 - 2004 Associate Professor Civil Engineering, University of Puerto Rico, Mayaguez, PR, USA
1995 - 1999 Assistant Professor, University of Puerto Rico , Mayaguez, PR, USA

Products

Products Most Closely Related to the Proposed Project

1. Amy Wilson-Lopez, Jennifer Taylor, Ivonne Santiago. Principles for Designing Engineering Curricula Grounded in Environmental Justice. 2022 ASEE Annual Conference & Exposition; 2022; c2022.
2. Lozada . Increasing Equity in Access to Electric vehicles and Electrified infrastructure through Per-ceptions, Opinions and Knowledge of Underrepresented Communities in the Paso del Norte Region. 2023 ASEE Conference; 2023; Baltimore, MD, US. c2023. DOI: doi:10.18260/1-2--43664
3. Lopez . How Active Rainwater Harvesting may help Reduce Nuisance Flooding: Flood Analysis and Social Barriers to Adoption. In:Ivonne Santiago, editor. 2023 ASEE Annual Conference and Exposition; 2023; Baltimore, MD, US. c2023. DOI: doi: 10.18260/1-2--43846
4. Parkinson P, Mecham E, Groves F, Santiago I. Designing Electric Vehicle Infrastructures and Opportunities to Benefit All Residents. 2025 Annual Conference American Society of Engineering Education. 2023 June. DOI: 10.18260/1-2—43247
5. Wilson-Lopez . Community Perceptions of Procedural and Distributive Justice in Engineered Systems: A Case Study of Community-Engaged Vehicular Electrification.. In:Ivonne Santiago, Parkinson , Groves , Mecham , Chavez , editors. 2023 ASEE Conference; 2023 June; Minneapolis, MN. c2023. DOI: 10.18260/1-2—41283

Other Significant Products, Whether or Not Related to the Proposed Project

1. Amy Wilson-Lopez, Jennifer Taylor, Ivonne Santiago. Principles for Designing Engineering Curricula Grounded in Environmental Justice. 2022 ASEE Annual Conference & Exposition; 2022; c2022.
2. Oddonetto T, Lugo A, Abdusalam A, Senanayake P, Walker W, Wang H, Xu P, Santiago I. Salt-free electrodialysis metathesis for brackish water desalination brine management: Pilot evaluation of operational configuration and hydraulic recovery. Avai; :119342. Available from: https://www.sciencedirect.com/science/article/pii/S0011916425008185 DOI: 10.1016/j.desal.2025.119342
3. Oddonetto T, Deemer E, Lugo A, Cappelle M, Xu P, Santiago I, Walker W. Assessment of salt-free electrodialysis metathesis: A novel process for brine management in brackish water desalination using monovalent selective ion exchange membranes. Desalination. 2024; 592:118160. DOI: doi:10.18260/1-2—43247
4. Chavez J, Santiago I. Evie and her Electric Adventure. 2025. Available from: Teachengineering.org
5. Riley D, Clawson R, Maksimovic D, Myers B, Santiago I, Stites N, Taylor J. Developing engineering formation systems for sustainability. ; c2021.

Certification:

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Certified by Santiago, Ivonne in SciENcv on 2025-09-20 11:51:06

IDENTIFYING INFORMATION:

NAME: Seelig, Jennifer

POSITION TITLE: Director of Community Partnerships/Director of the Institute of Government & Politics

PRIMARY ORGANIZATION AND LOCATION: Utah State University, Logan, Utah, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
University of Utah, Salt Lake City, Utah, United States	Other training	05/2020 - 05/2020	Conflict Resolution
University of Utah, Salt Lake City, Utah, United States	PHD	05/2018	Political Science
University of Utah, Salt Lake City, Utah, United States	MPA	05/2001	Public Administration
University of Louisville, Louisville, Kentucky, United States	AB	05/1991	English

Appointments and Positions

2020 - present Director of Community Partnerships/Director of the Institute of Government & Politics, Utah State University, Logan, Utah, United States

2020 - present Instructor, University of Utah, Salt Lake City, Utah, United States

2016 - 2020 Director of Community Empowerment and Senior Advisor to the Mayor, Salt Lake City Corporation, Salt Lake City, Utah, United States

2014 - 2018 CPPA Fellow, University of Utah, Salt Lake City, Utah, United States

2006 - 2014 House Minority Leader/Representative, Utah House of Representatives, Salt Lake City, Utah, United States

2005 - 2005 Research Assistant, University of Utah, Salt Lake City, Utah, United States

2002 - 2014 Associate Director Federal/State Legislative Policy and Research, 1-800 Contacts, Draper, Utah, United States

2001 - 2002 Communication and Legislative Policy Analyst, Utah League of Cities and Towns,, Salt Lake City, Utah, United States

2000 - 2001 Policy and Research Analyst, Salt Lake City Corporation, Salt Lake City, Utah, United States

1995 - 2000 Policy and Research Analyst/Senior Constituent Liaison, Salt Lake City Corporation, Salt Lake City, Utah, United States

Products

Products Most Closely Related to the Proposed Project

Other Significant Products, Whether or Not Related to the Proposed Project

Certification:

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Certified by Seelig, Jennifer in SciENcv on 2025-04-11 13:55:34

IDENTIFYING INFORMATION:

NAME: Seetharaman, Sivaranjani

ORCID iD: https://orcid.org/0000-0001-7585-7816

POSITION TITLE: Assistant Professor

PRIMARY ORGANIZATION AND LOCATION: Purdue University, School of Industrial Engineering, West Lafayette, IN, USA

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
Texas A&M University, College Station, Texas, USA	Postdoctoral Fellow	10/2019 - 02/2022	Electrical and Computer Engineering
University of Notre Dame, Notre Dame, Indiana, USA	PHD	12/2019	Electrical Engineering
Indian Institute of Science, Bangalore, Karnataka, India	MS	12/2013	Electrical Engineering
PES Institute of Technology, Bangalore, Karnataka, India	BENG	06/2011	Electrical and Electronics Engineering

Appointments and Positions

2022 - present Assistant Professor, Purdue University, School of Industrial Engineering, West Lafayette, IN, USA

2020 - 2022 Postdoctoral Researcher, Texas A&M University, Department of Electrical and Computer Engineering, Texas A&M Research Institute for Foundations of Interdisciplinary Data Science (FIDS), College Station, TX, USA

2019 - 2020 Research Associate, Texas A&M University, Department of Electrical and Computer Engineering, College Station, TX, USA

2019 - 2019 Assistant Lecturer/Course Instructor, Texas A&M University, Department of Electrical and Computer Engineering, College Station, TX, USA

Products

Products Most Closely Related to the Proposed Project

1. Helou RE, Sivaranjani S, Kalathil D, Schaper A, Xie L. The Impact of Heavy-Duty Vehicle Electrification on Large Power Grids: a Synthetic Texas Case Study. arXiv [Preprint]. 2022 March 08. Available from: https://arxiv.org/abs/2203.04430
2. Zheng X, Xu N, Trinh L, Wu D, Huang T, Sivaranjani S, Liu Y, Xie L. A multi-scale time-series dataset with benchmark for machine learning in decarbonized energy grids. Sci Data. 2022 Jun 22;9(1):359. PubMed Central PMCID: PMC9214688.
3. Sivaranjani S, Kumar PR, Xie L. A Privacy Preserving Model-Free Optimization and Control Framework for Demand Response from Residential Thermal Loads. IEEE Conference on Decision and Control (CDC); 2020 December.
4. Lee K, Geng X, Sivaranjani S, Xia B, Ming H, Shakkottai S, Xie L. Targeted demand response

for mitigating price volatility and enhancing grid reliability in synthetic Texas electricity markets. iScience. 2022 Feb 18;25(2):103723. PubMed Central PMCID: PMC8816673.

5. Ruan G, Wu D, Zheng X, Zhong H, Kang C, Dahleh MA, Sivaranjani S, Xie L. A Cross-Domain Approach to Analyzing the Short-Run Impact of COVID-19 on the US Electricity Sector. Joule. 2020 Nov 18;4(11):2322-2337. PubMed Central PMCID: PMC7523140.

Other Significant Products, Whether or Not Related to the Proposed Project

1. Ruan G, Qiu D, Sivaranjani S, Awad ASA, Strbac G. Data-driven energy management of virtual power plants: A review. Advances in Applied Energy. 2024 July; 14(100170).
2. Sivaranjani S, Agarwal E, Gupta V, Antsaklis P, Xie L. Distributed mixed voltage angle and frequency droop control of microgrid interconnections with loss of distribution-PMU measurements. IEEE Open Access Journal of Power and Energy. 2020 December; 8:45-56.
3. Kosaraju KC, Sivaranjani S, Gupta V. Safety During Transient Response in Direct Current Microgrids Using Control Barrier Functions. IEEE Control Systems Letters. 2021 April 20.
4. Jena A, Huang T, Sivaranjani S, Kalathil D, Xie L. Distributed Learning-based Stability Assessment for Large Scale Networks of Dissipative Systems. IEEE Conference on Decision and Control (CDC); 2021 December.
5. Suttle W, Sharma V, Kosaraju KC, Sivaranjani S, Liu J, Gupta V, Sadler B. Sampling-based Safe Reinforcement Learning for Nonlinear Dynamical Systems. 27th International Conference on Artificial Intelligence and Statistics (AISTATS). 2024 May. Available from: https://arxiv.org/abs/2403.04007

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Certified by Seetharaman, Sivaranjani in SciENcv on 2024-08-01 02:28:52

IDENTIFYING INFORMATION:

NAME: Singleton, Patrick

ORCID iD: https://orcid.org/0000-0002-9319-2333

POSITION TITLE: Associate Professor

PRIMARY ORGANIZATION AND LOCATION: Utah State University, Logan, Utah, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
Portland State University, Portland, Oregon, United States	PHD	08/2017	Civil & Environmental Engineering
Portland State University, Portland, Oregon, United States	MS	12/2013	Civil & Environmental Engineering
University of Pittsburgh, Pittsburgh, Pennsylvania, United States	BS	12/2008	Civil & Environmental Engineering

Appointments and Positions

2023 - present Associate Professor, Utah State University, Logan, Utah, United States
2023 - present Co-Lead, Integrated Systems Project, National Science Foundation Engineering Research Center ASPIRE, Logan, Utah, United States
2021 - 2023 Co-Lead, Adoption Research Thrust, National Science Foundation Engineering Research Center ASPIRE, Utah State University, Logan, Utah, United States
2017 - 2023 Assistant Professor, Utah State University, Logan, Utah, United States
2011 - 2017 Graduate Research Assistant, Portland State University, Portland, Oregon, United States
2009 - 2011 Civil Engineering Associate, Michael Baker Jr., Pittsbugh, Pennsylvania, United States

Products

Products Most Closely Related to the Proposed Project

1. Soltani Mandolakani F, Singleton P. Electric vehicle charging infrastructure deployment: A discussion of equity and justice theories and accessibility measurement. Transportation Research Interdisciplinary Perspectives. 2024 March; 24:101072-. Available from: https://linkinghub.elsevier.com/retrieve/pii/S2590198224000587 DOI: 10.1016/j.trip.2024.101072
2. Flaris K, Gkritza K, Singleton P, Graul A, Song Z. Riders' perceptions towards transit bus

electrification: Evidence from Salt Lake City, Utah. Transportation Research Part D: Transport and Environment. 2023 April; 117:103642-. Available from: https://linkinghub.elsevier.com/retrieve/pii/S1361920923000391 DOI: 10.1016/j.trd.2023.103642

3. Singleton PA, Fritz-Mauer J, Grunwald B, Sergeant I, Campbell J. Key findings from the WestSmart Gig Driver EV Study. Forth; 2024 October. Available from: https://www.youtube.com/watch?v=abErNm4zEU4
4. Bouck W, Singleton PA. Exploring gig driver electrification: Comparisons, charging behaviors, & issues. Utah Conference on Undergraduate Research; 2025 February; Cedar City, UT.
5. Atul Subedi, Patrick A. Singleton. Mode choice modeling of electric air taxis for long-distance airport trips. Transportation Research Interdisciplinary Perspectives. 2025 May. DOI: 10.1016/j.trip.2025.101421

Other Significant Products, Whether or Not Related to the Proposed Project

1. Singleton PA. Exploring the Positive Utility of Travel and mode choice: Subjective well-being and travel-based multitasking during the commute. In: Goulias KG, Davis AW, editors. Mapping the Travel Behavior Genome [Internet] Cambridge, MA: Elsevier; 2020. Chapter 14p.259-277. Available from: https://doi.org/10.1016/B978-0-12-817340-4.00014-0 DOI: 10.1016/B978-0-12-817340-4.00014-0
2. Singleton PA. Walking (and cycling) to well-being: Modal and other determinants of subjective well-being during the commute. Travel Behaviour and Society. 2019; 16:249-261. Available from: https://doi.org/10.1016/j.tbs.2018.02.005 DOI: 10.1016/j.tbs.2018.02.005
3. De Vos J, Singleton PA. Travel and cognitive dissonance. Transportation Research Part A: Policy and Practice. 2020; 138:525-536. Available from: https://doi.org/10.1016/j.tra.2020.06.014 DOI: 10.1016/j.tra.2020.06.014
4. Singleton PA. Discussing the "positive utilities" of autonomous vehicles: Will travellers really use their time productively?. Transport Reviews. 2019; 39(1):50-65. Available from: https://doi.org/10.1080/01441647.2018.1470584 DOI: 10.1080/01441647.2018.1470584
5. De Vos J, Singleton PA, Gärling T. From attitude to satisfaction: Introducing the travel mode choice cycle. Transport Reviews. 2022; 42(2):204-211. Available from: https://doi.org/10.1080/01441647.2021.1958952 DOI: 10.1080/01441647.2021.1958952

Certification:

I certify that the information provided is current, accurate, and complete. This includes but is not limited to information related to domestic and foreign appointments and positions.

I also certify that, at the time of submission, I am not a party to a malign foreign talent recruitment program.

Misrepresentations and/or omissions may be subject to prosecution and liability pursuant to, but not limited to, 18 U.S.C. §§ 287, 1001, 1031 and 31 U.S.C. §§ 3729-3733 and 3802.

Certified by Singleton, Patrick in SciENcv on 2025-09-08 20:34:48

IDENTIFYING INFORMATION:

NAME: Sleipness, Ole Russell

POSITION TITLE: Associate Professor

PRIMARY ORGANIZATION AND LOCATION: Utah State University, Logan, Utah, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
Clemson University, Clemson, South Carolina, United States	PHD	08/2009	Environmental Design and Planning
Clemson University, Clemson, South Carolina, United States	MCP	05/2005	City and Regional Planning
Washington State University, Pullman, Washington, United States	Bachelor of Landscape Architecture (BLA)	05/2003	Landscape Architecture
Edmonds Community College, Lynnwood, Washington, United States	Associates of Technical Arts (ATA)	06/1999	Ornamental Horticulture

Appointments and Positions

2021 - present Associate Professor, Utah State University, Logan, Utah, United States
2014 - 2021 Assistant Professor, Utah State University, Logan, Utah, United States
2009 - 2014 Clinical Assistant Professor, Washington State University, Pullman, Washington, United States

Products

Products Most Closely Related to the Proposed Project

1. Sleipness O, Singleton P. EV Charging Stations: Urban Design Implications for Dispersed Communities in the Intermountain West. Council of Educators in Landscape Architecture; 2025 March 27; Portland, OR, USA. Available from: https://virtual.oxfordabstracts.com/event/73664/program
2. Chen S, Sleipness O, Christensen K, Yang B, Wang H. Developing and testing a protocol to systematically assess social interaction with urban outdoor environment. J Environ Psychol. 2023 Jun;88:102008. PubMed Central PMCID: PMC10082984.
3. Sleipness O, Evans D, Powell J, Anderson D. Rural Resiliency in the Public Realm: A Collective Case Study Analysis of Land-Grant Design Impacts on Rural Main Streets. Environmental Design Research Association (EDRA); 2022 June; Greenville, SC, USA.

Available from: https://cdn.ymaws.com/www.edra.org/resource/resmgr/proceedings/fullproceedings/edra53_sub-proceedings.pdf

4. Sleipness O, Evans D. Main Street Resiliency: Impacts of DOT Jurisdiction on Rural Adaptation in the Intermountain West. Council of Educators in Landscape Architecture; 2022 March; Santa Ana Pueblo, NM, USA. Available from: https://thecela.org/wp-content/uploads/2022-Proceedings-FINAL-2.pdf
5. Sleipness O, Powell J, Curtis K. Public-Private Partnerships: A Framework for National Park Gateway Community Development. In: Slocum S, Wiltshire, Read, editors. Tourism Transformations in Protected Area Gateway Communities [Internet] Wallingford, UK: CAB International; 2022. Chapter 10p.137-154. Available from: https://doi.org/10.1079/9781789249033.0010

Other Significant Products, Whether or Not Related to the Proposed Project

1. Wang H, Gholami S, Xu W, Samavatekbatan A, Sleipness O, Tassinary LG. Where and how to invest in greenspace for optimal health benefits: a systematic review of greenspace morphology and human health relationships. Lancet Planet Health. 2024 Aug;8(8):e574-e587. PubMed PMID: 39122326.
2. Chen S, Sleipness O, Christensen K, Yang B, Park K, Knowles R, Yang Z, Wang H. Exploring Associations between Social Interaction and Urban Park Attributes: Design Guideline for Both Overall and Separate Park Quality Enhancement. Cities: The International Journal of Urban Policy and Planning. 2024 February; 145. Available from: https://www.sciencedirect.com/science/article/abs/pii/S0264275123005267?via%3Dihub
3. Sleipness O, Christensen K, Michael S. Impacts of Collaboration on Scholarly Production Among Recently Tenured Landscape Architecture Faculty: A Longitudinal Study. Landscape Research Record. 2024; 13. Available from: https://thecela.org/wp-content/uploads/LRR_13_v4-1_reprint_CORRECTION.pdf
4. Park H, Licon C, Givens J, Sleipness O. Implementation of Sustainability Principles in Landscape Architecture Education: An Examination of Faculty Attitudes and Course Syllabi. International Journal of Sustainability in Higher Education. 2024; 25(8). Available from: https://www.emerald.com/ijshe/article-abstract/25/8/1995/1231921/Implementation-of-sustainability-principles-in?redirectedFrom=fulltext
5. Chen S, Sleipness O, Xu Y, Park K, Christensen K. A Systematic Review of Alternative Protocols for Evaluating Non-Spatial Dimensions of Urban Parks. Urban Forestry and Urban Greening. 2020; 53. Available from: https://doi.org/10.1016/j.ufug.2020.126718

Certification:

I certify that the information provided is current, accurate, and complete. This includes but is not limited to information related to domestic and foreign appointments and positions.

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limited to, 18 U.S.C. §§ 287, 1001, 1031 and 31 U.S.C. §§ 3729-3733 and 3802.

Certified by Sleipness, Ole Russell in SciENcv on 2025-09-11 16:15:52

IDENTIFYING INFORMATION:

NAME: Stites, Nick

ORCID iD: https://orcid.org/0000-0001-6981-3745

POSITION TITLE: Director

PRIMARY ORGANIZATION AND LOCATION: University of Colorado Boulder, Integrated Teaching & Learning Program, Boulder, CO, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
Purdue University, West Lafayette, IN, USA	DPHIL	12/2018	Engineering Education
Purdue University, West Lafayette, IN, USA	MS	05/2007	Mechanical Engineering
Colorado State University, Fort Collins, CO, USA	BS	05/2005	Mechanical Engineering

Appointments and Positions

2019 - present Director, University of Colorado Boulder, Integrated Teaching & Learning Program, Boulder, CO, United States

2019 - present Instructor/Assistant Professor Adjoint, University of Colorado Boulder, Integrated Teaching & Learning Program, Boulder, CO, United States

2017 - 2018 Instructional Assistant/Curriculum Designer, Purdue University, West Lafayette, IN, USA

2015 - 2018 Research Assistant, Purdue University, School of Education, West Lafayette, IN, USA

2012 - 2015 Adjunct Instructor, University of Colorado Boulder, Boulder, CO, USA

2008 - 2015 Mechanical/Module Engineer, University of Colorado Boulder, Integrated Teaching & Learning Program, Boulder, CO, USA

2008 - 2009 Adjunct Instructor, Red Rocks Community College, Arvada, CO, USA

2007 - 2007 Mechanical Engineer, Pioneer Engineering, Fort Collins, CO, USA

2005 - 2007 Research Assistant, Purdue University, School of Mechanical Engineering, West Lafayette, IN, USA

Products

Products Most Closely Related to the Proposed Project

1. Stites N, Douglas K, Evenhouse D, Berger E, DeBoer J, Rhoads J. A validation and differential item functioning (DIF) study of an Abbreviated Dynamics Concept Inventory. International Journal of Engineering Education. 2019; 35(2):491-509.
2. Stites N, Berger E, DeBoer J, Rhoads J. A cluster-based approach to understanding students' resource-usage patterns in an active, blended, and collaborative learning environment. International Journal of Engineering Education. 2019; 35(6):1738-1757.

3. Coutinho G, Stites N, Magana A. Understanding faculty decisions about the integration of laboratories into engineering education. ASEE/IEEE Frontiers in Education Conference; 2017; Indianapolis, IN.
4. Stites N, Berger E, DeBoer J, Rhoads J. Are resource-usage patterns related to achievement? A study of an active, blended, and collaborative learning environment for undergraduate engineering courses. European Journal of Engineering Education. 2021; 46(3):416-440. DOI: 10.1080/03043797.2020.1783208
5. Stites N, Yowell J, Anderson C. Pathways to develop "college capital" for underrepresented community college students: The Denver-Metro Engineering Consortium. ASEE Rocky Mountain Section Conference; 2023; Golden, CO.

Other Significant Products, Whether or Not Related to the Proposed Project

1. Stites N, Zywicki C, Berger E, Krousgrill C, Rhoads J, DeBoer J. The impact of instructor experience on student success for a blended, undergraduate engineering class. AERA Annual Meeting; 2017; San Antonio, TX.
2. Sharpe R, Loshbaugh HG, Amey K, Crouch KC, Yowell J, Stites N. Work-in Progress: Aligning an engineering hands-on learning program to college strategy: Reducing implementation barriers to support faculty, students, and their success. ASEE Annual Conference and Exposition; 2024; Portland, OR.
3. Yowell J, Loshbaugh HG, Stites N, Anderson C. Work in Progress: Studying how engineering research internships affect community college students' interest in and intent to complete engineering bachelor's degrees. ASEE Annual Conference and Exposition; 2024; Portland, OR.
4. Stites NA, Yowell JL, Hoenigman R, Kuskin W, Rose AB. Democratizing engineering education: An online Bachelor of Science in Engineering degree. ASEE/IEEE Frontiers in Education Conference; 2023; College Station, TX.
5. Stites NA, Bara M. Redesigning a multi-disciplinary measurement lab and statistics course: An approach for navigating competing priorities. ASEE Annual Conference and Exposition; 2023; Baltimore, MD.

Certification:

I certify that the information provided is current, accurate, and complete. This includes but is not limited to current, pending, and other support (both foreign and domestic) as defined in 42 U.S.C. § 6605.

I also certify that, at the time of submission, I am not a party to a malign foreign talent recruitment program.

Misrepresentations and/or omissions may be subject to prosecution and liability pursuant to, but not limited to, 18 U.S.C. §§ 287, 1001, 1031 and 31 U.S.C. §§ 3729-3733 and 3802.

Certified by Stites, Nick in SciENcv on 2024-08-09 21:03:17

IDENTIFYING INFORMATION:

NAME: Swanson, Hillary

ORCID iD: https://orcid.org/0000-0001-5953-6780

POSITION TITLE: Assistant Professor

PRIMARY ORGANIZATION AND LOCATION: Utah State University, Logan, Utah, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
University of California, Berkeley, Berkeley, California, United States	PHD	05/2015	Science and Mathematics Education
Colorado College, Colorado Springs, Colorado, United States	BA	05/2002	Physics

Appointments and Positions

2020 - present Assistant Professor, Utah State University, Logan, Utah, United States
2019 - 2020 Research Assistant Professor, Northwestern University, Evanston, Illinois, United States
2016 - 2019 Postdoctoral Fellow, Northwestern University, Evanston, Illinois, United States

Products

Products Most Closely Related to the Proposed Project

1. Sinha R, Solola I, Nguyen H, Swanson H, Lawrence L. The role of generative AI in qualitative research: GPT-4's contributions to a grounded theory analysis. Proceedings of the ACM Symposium on Learning, Design and Technology. 2024 June. Available from: https://doi.org/10.1145/3663433.3663456
2. Matthews J, Nguyen H, Swanson H. Shall we play a game? Distributed design games with a generative artificial intelligence player. Proceedings of the International Conference on Computer-Supported Collaborative Learning. 2024 June.
3. Swanson H, Wilensky U. Meta-theoretic competence for computational agent-based modeling. Proceedings of the ACM Symposium on Learning, Design and Technology,. 2024 June.
4. Barth-Cohen L, Swanson H, Arnell J. Methods of research design and analysis for identifying knowledge resources. Physical Review of Physics Education Research Focused Collection in Qualitative Methods in PER: A Critical Examination. 2023. Available from: https://doi.org/10.1103/PhysRevPhysEducRes.19.020119
5. Swanson H. Epistemic systems: A knowledge-level characterization of epistemic games. Proceedings of the International Conference of the Learning Sciences. ICLS; 2023 June 12; Montreal, Quebec, Canada.

Other Significant Products, Whether or Not Related to the Proposed Project

1. Swanson H, Lawrence L, Arnell J, Jones B, Sherin B, Wilensky U. Computational models as

tools for supporting responsive teaching. Behaviour and Information Technology. 2024 July 30. Available from: https://doi.org/10.1080/0144929X.2024.2377385

2. Swanson H, Clarke-Midura J. Integrating formative assessment and feedback into scientific theory-building practices and instruction. Assessment in Education: Principles, Policy, & Practice. 2021; 28(2):118-134. DOI: 10.1080/0969594X.2021.1929830
3. Swanson H. Deeper Learning, Dialogic Learning, and Critical Thinking: Research-Based Strategies for the Classroom. Manalo E, editor. Abingdon-on-Thames: Routledge; 2019. Chapter 4, Refining student thinking through scientific theory building; p.67-83. DOI: https://doi.org/10.4324/9780429323058-5
4. Swanson H, Anton G, Bain C, Horn M, Wilensky U. Computational Thinking Education. Kong S, Abelson H, editors. Singapore: Springer; 2019. Introducing and assessing computational thinking in the secondary science classroom; p.99-117. DOI: https://doi.org/10.1007/978-981-13-6528-7_7
5. Swanson H, Collins A. How failure is productive in the creative process: Refining student explanations through theory-building discussion. Thinking Skills and Creativity. 2018; 30:54-63. DOI: 10.1016/j.tsc.2018.03.005

Certification:

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Certified by Swanson, Hillary in SciENcv on 2025-07-13 23:03:31

IDENTIFYING INFORMATION:

NAME: Tirado, Cesar

ORCID iD: https://orcid.org/0000-0002-8784-3347

POSITION TITLE: Associate Professor of Research

PRIMARY ORGANIZATION AND LOCATION: Center for Transportation Infrastructure Systems, The University of Texas at El Paso, El Paso, Texas, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
The University of Texas at El Paso, El Paso, Texas, United States	PHD	12/2009	Civil Engineering
The University of Texas at El Paso, El Paso, Texas, United States	MS	05/1999	Civil Engineering
The University of Texas at El Paso, El Pas, Texas, United States	BS	12/1996	Civil Engineering

Appointments and Positions

2024 - present Associate Professor of Research, Center for Transportation Infrastructure Systems, The University of Texas at El Paso, El Paso, Texas, United States

2010 - present Research Scientist, Center for Transportation Infrastructure Systems, The University of Texas at El Paso, El Paso, Texas, United States

2017 - 2024 Research Scientist, Center for Transportation Infrastructure Systems, The University of Texas at El Paso, El Paso, Texas, United States

2010 - 2017 Research Associate, Center for Transportation Infrastructure Systems, The University of Texas at El Paso, El Paso, Texas, United States

Products

Products Most Closely Related to the Proposed Project

1. Cruz H, Moncada O, Jahangiri B, Tirado C, Nazarian S, Haddock J. Analyzing the Mechanical Response of a Calibrated Finite Element Model for Flexible Pavement with Embedded Dynamic Wireless Power Transfer Technology. Transportation Research Record: Journal of the Transportation Research Board. 2024 April 20; :-. Available from: https://journals.sagepub.com/doi/10.1177/03611981241242077 DOI: 10.1177/03611981241242077
2. Beizaei M, Rocha S, Tirado C, Nazarian S, Rada G. Impact of Pavement Stiffness on Performance of Traffic Speed Deflection Measurements. Transportation Research Record: Journal of the Transportation Research Board. 2024 April 11; :-. Available from: https://journals.sagepub.com/doi/10.1177/03611981241238224 DOI: 10.1177/03611981241238224

3. Fathi A, Tirado C, Rocha S, Mazari M, Nazarian S. A Machine-Learning Approach for Extracting Modulus of Compacted Unbound Aggregate Base and Subgrade Materials Using Intelligent Compaction Technology. Infrastructures. 2021 October 08; 6(10):142-. Available from: https://www.mdpi.com/2412-3811/6/10/142 DOI: 10.3390/infrastructures6100142
4. Tirado C, Fathi A, Rocha S, Mazari M, Nazarian S. Integrating intelligent compaction technology and modulus-based testing for design verification. Proceedings of the Institution of Civil Engineers - Geotechnical Engineering. 2020 August; 173(4):327-338. Available from: https://www.icevirtuallibrary.com/doi/10.1680/jgeen.19.00199 DOI: 10.1680/jgeen.19.00199
5. Zokaei-Ashtiani M, Tirado C, Carrasco C, Nazarian S, Bendaña J. Modeling of Slab–Foundation Friction in Jointed Concrete Pavements under Nonlinear Thermal Gradient or Traffic Loads. Transportation Research Record: Journal of the Transportation Research Board. 2013 January 01; 2367(1):123-131. Available from: http://journals.sagepub.com/doi/10.3141/2367-13 DOI: 10.3141/2367-13

Other Significant Products, Whether or Not Related to the Proposed Project

1. Tirado C, Mazari M, Carrasco C, Nazarian S. Evaluating Influence Depth of Light Weight Deflectometer through Finite Element Modeling. Airfield and Highway Pavements 2015. Airfield and Highway Pavements 2015; June 0,; Miami, Florida. Reston, VA: American Society of Civil Engineers; c2015. Available from: http://ascelibrary.org/doi/10.1061/9780784479216.070 DOI: 10.1061/9780784479216.070
2. Zokaei-Ashtiani A, Tirado C, Carrasco C, Nazarian S. Impact of different approaches to modelling rigid pavement base layers on slab curling stresses. International Journal of Pavement Engineering. 2015 March 12; 17(10):861-869. Available from: http://www.tandfonline.com/doi/full/10.1080/10298436.2015.1019505 DOI: 10.1080/10298436.2015.1019505
3. Carrasco C, Limouee M, Tirado C, Nazarian S, Bendaña J. Development of NYSLAB. Transportation Research Record: Journal of the Transportation Research Board. 2011 January 01; 2227(1):107-115. Available from: http://journals.sagepub.com/doi/10.3141/2227-12 DOI: 10.3141/2227-12
4. Tirado C, Carrasco C, Mares J, Gharaibeh N, Nazarian S, Bendaña J. Process to Estimate Permit Costs for Movement of Heavy Trucks on Flexible Pavements. Transportation Research Record: Journal of the Transportation Research Board. 2010 January 01; 2154(1):187-196. Available from: http://journals.sagepub.com/doi/10.3141/2154-19 DOI: 10.3141/2154-19
5. Ramos E, Gutierrez A, Tirado C, Stewart C, Abdallah I, Nazarian S. Explaining Overlay Tester Results with Digital Image Correlation and Finite Element Analysis. International Conference on Transportation and Development 2016. International Conference on Transportation and Development 2016; June 29; Houston, Texas. Reston, VA: American Society of Civil Engineers; c2016. Available from: http://ascelibrary.org/doi/10.1061/9780784479926.080 DOI: 10.1061/9780784479926.080

Certification:

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Certified by Tirado, Cesar in SciENcv on 2025-09-11 21:37:19

IDENTIFYING INFORMATION:

NAME: Torres-Machi, Cristina

ORCID iD: https://orcid.org/0000-0002-4334-4474

POSITION TITLE: Assistant Professor

PRIMARY ORGANIZATION AND LOCATION: University of Colorado Boulder, Boulder, CO, US

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
Universitat Politècnica de València, Valencia, Valencia, Spain	PHD	03/2015	Civil Eng.
Universitat Politècnica de València, Valencia, Valencia, Spain	MS	10/2012	Civil Eng.
Universitat Politècnica de València, Valencia, Valencia, Spain	BS	04/2008	Civil Eng.
Pontificia Universidad Catolica de Chile, Santiago, Region Metropolitana, Chile	PHD	03/2015	Civil Eng.

Appointments and Positions

2017 - present	Assistant Professor, University of Colorado Boulder, Boulder, CO, US
2016 - 2017	Research Associate, University of Waterloo, Waterloo, Ontario, Canada
2012 - 2015	Research Assistant, Pontificia Universidad Catolica de Chile, Santiago, Not Applicable, N/A, Chile
2011 - 2016	Assistant Professor, Universitat Politècnica de València, Valencia, Not Applicable, N/A, Spain
2009 - 2011	Structural Engineer, CMD Domingo y Lazaro Ingenieros, Valencia, Not Applicable, N/A, Spain
2007 - 2009	Assistant Site Manager, Dragados SA, Valencia, Not Applicable, N/A, Spain

Products

Products Most Closely Related to the Proposed Project

1. Curtis S, Montagu J, Crozier C, Torres-Machi C, Baker K. Trends in Equitable Electric Vehicle Adoption and Impacts on Pavement Condition and Electric Power Infrastructure. Construction Research Congress 2024. Construction Research Congress 2024; Marc –2; Des Moines, Iowa. Reston, VA: American Society of Civil Engineers; c2024. Available from: https://ascelibrary.org/doi/10.1061/9780784485279.081 DOI: 10.1061/9780784485279.081
2. Contreras F, Torres-Machi C. Impacts of Flooding on Traffic Functionality from Crowdsourced Location Data. Computing in Civil Engineering 2023. ASCE International Conference on Computing in Civil Engineering 2023; June 28; Corvallis, Oregon. Reston, VA: American Society of Civil Engineers; c2024. Available from: https://ascelibrary.org/doi/10.1061/9780784485248.015 DOI: 10.1061/9780784485248.015
3. Evers E, Torres-Machi C. Impacts of Increased Prediction Accuracy in Management Decisions:

A Study of Full-Depth Reclamation Pavements. Journal of Infrastructure Systems. 2024 March; 30(1):-. Available from: https://ascelibrary.org/doi/10.1061/JITSE4.ISENG-2400 DOI: 10.1061/JITSE4.ISENG-2400

4. Bashar M, Torres-Machi C. Deep learning for estimating pavement roughness using synthetic aperture radar data. Automation in Construction. 2022 October; 142:104504-. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0926580522003776 DOI: 10.1016/j.autcon.2022.104504
5. Vallès-Vallès D, Torres-Machi C. Deterioration of Flexible Pavements Induced by Flooding: Case Study Using Stochastic Monte Carlo Simulations in Discrete-Time Markov Chains. Journal of Infrastructure Systems. 2023 March; 29(1):-. Available from: https://ascelibrary.org/doi/10.1061/JITSE4.ISENG-2109 DOI: 10.1061/JITSE4.ISENG-2109

Other Significant Products, Whether or Not Related to the Proposed Project

1. Frey M, Williams S, Torres-Machi C, Srubar W. Biobased Alternative Binders from Agar for Civil Engineering Applications: Thermal, Biodeterioration, and Moisture Sorption Properties. RILEM Bookseries [Internet] Cham: Springer Nature Switzerland; 2023. Chapter Chapter 51665-675p. Available from: https://link.springer.com/10.1007/978-3-031-33465-8_51 DOI: 10.1007/978-3-031-33465-8_51
2. Bashar M, Torres-Machi C. Performance of Machine Learning Algorithms in Predicting the Pavement International Roughness Index. Transportation Research Record: Journal of the Transportation Research Board. 2021 January 19; 2675(5):226-237. Available from: http://journals.sagepub.com/doi/10.1177/0361198120986171 DOI: 10.1177/0361198120986171
3. Bashar M, Torres-Machi C. Machine learning to enhance the management of highway pavements and bridges. Infrastructure Asset Management. 2023 May 02; :1-9. Available from: https://www.icevirtuallibrary.com/doi/10.1680/jinam.22.00031 DOI: 10.1680/jinam.22.00031
4. Beesam V, Torres-Machi C. Input Parameters for the Mechanistic-Empirical Design of Full-Depth Reclamation Projects. Transportation Research Record: Journal of the Transportation Research Board. 2021 July 12; 2675(11):384-396. Available from: http://journals.sagepub.com/doi/10.1177/03611981211017916 DOI: 10.1177/03611981211017916
5. Bashar Mohammad Z, Torres-Machi Cristina. Performance of Machine Learning Algorithms in Predicting the Pavement International Roughness Index. Transportation Research Record. 2021; :0361198120986171.

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Certified by Torres-Machi, Cristina in SciENcv on 2024-07-24 08:32:16

IDENTIFYING INFORMATION:

NAME: Trimboli, Michael Scott

ORCID iD: https://orcid.org/0000-0001-7991-024X

POSITION TITLE: Associate Professor

PRIMARY ORGANIZATION AND LOCATION: University of Colorado Colorado Springs, Colorado Springs, Colorado, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
University of Oxford, Oxford, Oxfordshire, GB	Ph.D.	07/1989	Control Engineering
Columbia University, New York, NY, United States	M.S.	05/1981	Mechanical Engineering
United States Air Force Academy, Colorado Springs, Colorado, United States	B.S. Engineering Science	05/1980	Engineering Science

Appointments and Positions

2018 - present Associate Professor, University of Colorado Colorado Springs, Colorado Springs, Colorado, United States

2011 - 2018 Assistant Professor, University of Colorado Colorado Springs, Colorado Springs, Colorado, United States

1989 - 1991 Associate Professor, Department of Astronautics, United States Air Force Academy, Colorado Springs, Colorado, United States

1983 - 1986 Assistant Professor, Department of Astronautics, United States Air Force Academy, Colorado Springs, Colorado, United States

Products

Products Most Closely Related to the Proposed Project

1. Kawakita de Souza A, Hileman W, Trimboli M, Plett G. A Control-Oriented Reduced-Order Model for Lithium-Metal Batteries. IEEE Control Systems Letters. 2023; 7:1165-1170. Available from: https://ieeexplore.ieee.org/document/9999023/ DOI: 10.1109/LCSYS.2022.3232066
2. Lu D, Trimboli M, Wang Y, Plett G. Modeling Voltage Decay During Calendar-Life Aging. Journal of The Electrochemical Society. 2022 December 20; 169(12):120515-. Available from: https://iopscience.iop.org/article/10.1149/1945-7111/acaa5d DOI: 10.1149/1945-7111/acaa5d
3. Lu D, Trimboli M, Plett G. Cell Discharge Testing to Calibrate a Positive-Electrode Open-Circuit-Potential Model for Lithium-Ion Cells. Journal of The Electrochemical Society. 2022 July 27; 169(7):070524-. Available from: https://iopscience.iop.org/article/10.1149/1945-7111/ac8249 DOI: 10.1149/1945-7111/ac8249
4. Xavier M, de Souza A, Karami K, Plett G, Trimboli M. A Computational Framework for Lithium Ion Cell-Level Model Predictive Control Using a Physics-Based Reduced-Order Model. IEEE Control Systems Letters. 2021 October; 5(4):1387-1392. Available from:

https://ieeexplore.ieee.org/document/9259035/ DOI: 10.1109/LCSYS.2020.3038131

5. Xavier M, Trimboli M. Lithium-ion battery cell-level control using constrained model predictive control and equivalent circuit models. Journal of Power Sources. 2015 July; 285:374-384. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0378775315004905 DOI: 10.1016/j.jpowsour.2015.03.074

Other Significant Products, Whether or Not Related to the Proposed Project

1. Lopetegi I, Plett G, Trimboli M, Kawakita de Souza A, Oca L, Miguel E, Iraola U. A New Battery SOC/SOH/eSOH Estimation Method Using a PBM and Interconnected SPKFs: Part I. SOC and Internal Variable Estimation. Journal of The Electrochemical Society. 2024 March 15; 171(3):030519-. Available from: https://iopscience.iop.org/article/10.1149/1945-7111/ad30d4 DOI: 10.1149/1945-7111/ad30d4
2. Lopetegi I, Plett G, Trimboli M, Oca L, Miguel E, Iraola U. A New Battery SOC/SOH/eSOH Estimation Method Using a PBM and Interconnected SPKFs: Part II. SOH and eSOH Estimation. Journal of The Electrochemical Society. 2024 March 15; 171(3):030518-. Available from: https://iopscience.iop.org/article/10.1149/1945-7111/ad30d5 DOI: 10.1149/1945-7111/ad30d5
3. Lu D, Scott Trimboli M, Fan G, Wang Y, Plett G. Nondestructive EIS Testing to Estimate a Subset of Physics-based-model Parameter Values for Lithium-ion Cells. Journal of The Electrochemical Society. 2022 August 05; 169(8):080504-. Available from: https://iopscience.iop.org/article/10.1149/1945-7111/ac824a DOI: 10.1149/1945-7111/ac824a
4. Trimboli M, de Souza A, Xavier M. Stability and Control Analysis for Series-Input/Parallel-Output Cell Balancing System for Electric Vehicle Battery Packs. IEEE Control Systems Letters. 2022; 6:1388-1393. Available from: https://ieeexplore.ieee.org/document/9488286/ DOI: 10.1109/LCSYS.2021.3097875
5. Lu D, Scott Trimboli M, Fan G, Zhang R, Plett G. Nondestructive Pulse Testing to Estimate a Subset of Physics-Based-Model Parameter Values for Lithium-Ion Cells. Journal of The Electrochemical Society. 2021 August 24; 168(8):080533-. Available from: https://iopscience.iop.org/article/10.1149/1945-7111/ac1cfa DOI: 10.1149/1945-7111/ac1cfa

Certification:

I certify that the information provided is current, accurate, and complete. This includes but is not limited to current, pending, and other support (both foreign and domestic) as defined in 42 U.S.C. § 6605.

I also certify that, at the time of submission, I am not a party to a malign foreign talent recruitment program.

Misrepresentations and/or omissions may be subject to prosecution and liability pursuant to, but not limited to, 18 U.S.C. §§ 287, 1001, 1031 and 31 U.S.C. §§ 3729-3733 and 3802.

Certified by Trimboli, Michael Scott in SciENcv on 2024-08-16 14:28:59

IDENTIFYING INFORMATION:

NAME: Tseng, Tzu-Liang Bill

POSITION TITLE: Professor and Chair

PRIMARY ORGANIZATION AND LOCATION: The University of Texas at El Paso, Department of Industrial, Manufacturing, and Systems Engineering , El Paso, Texas, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
University of Iowa, Iowa City, Iowa, United States	Ph.D.	07/1999	Industrial & Systems Engineering
University of Wisconsin, Madison, Wisconsin, United States	MSIE	08/1995	IE (Decision Sciences)
University of Wisconsin, Madison, Wisconsin, United States	MSIE	05/1993	IE (Manufacturing Systems)
Tunghai University, Taichung, Not Applicable, N/A, Taiwan	BSIE	06/1987	Industrial Engineering

Appointments and Positions

2014 - present Professor and Chair, The University of Texas at El Paso, Department of Industrial, Manufacturing, and Systems Engineering , El Paso, Texas, United States

2009 - 2014 Associate Professor, The University of Texas at El Paso, Department of Industrial, Manufacturing, and Systems Engineering , El Paso, Texas, United States

2004 - 2009 Assistant Professor, The University of Texas at El Paso, Department of Industrial, Manufacturing, and Systems Engineering , El Paso, Texas, United States

Products

Products Most Closely Related to the Proposed Project

1. Chin-Yi Lin, Tzu-Liang Tseng, Solayman Hossain Emon, Tsung-Han Tsai. Large Pre-Trained Models and Few-Shot Fine-Tuning for Virtual Metrology: A Framework for Uncertainty-Driven Adaptive Process Control in Semiconductor Manufacturing. IEEE Transactions on Automation Science and Engineering. 2025. DOI: 10.1109/tase.2025.3568010
2. Chin-Yi Lin, Tzu-Liang Tseng, Solayman Hossain Emon, Tsung-Han Tsai. Generative AI-Driven Data Augmentation for Robust Virtual Metrology: GANs, VAEs, and Diffusion Models. IEEE Transactions on Semiconductor Manufacturing. 2025 August. DOI:

10.1109/tsm.2025.3569229

3. Chin-Yi Lin, Tsung-Han Tsai, Tzu-Liang Tseng. Generative AI for Intelligent Manufacturing Virtual Assistants in the Semiconductor Industry. IEEE Robotics and Automation Letters. 2025 April. DOI: 10.1109/lra.2025.3544506
4. Christopher Lee Colaw, Garrett Madison, Bill Tseng, Grayson Michael Griser, Gage Truelson, Adam Gallo, Yildirim Hurmuzlu. Methodology for Enablement of Human Digital Twins for Quality Assurance in the Aerospace Manufacturing Domain. Sensors. 2025 May. DOI: 10.3390/s25113362
5. Chin-Yi Lin, Tzu-Liang Tseng, Honglun Xu. GPT-Augmented Bayesian Reinforcement Learning Framework for Multi-Objective Supplier Selection. IEEE Transactions on Engineering Management. 2025. DOI: 10.1109/tem.2025.3603183

Other Significant Products, Whether or Not Related to the Proposed Project

1. Huang Y, Fang C, Lu C, (Bill) Tseng T. Optimal Warranty Policy for Consumer Electronics with Dependent Competing Failure Processes. Reliability Engineering & System Safety. 2022 June; 222:108418-. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0951832022000898 DOI: 10.1016/j.ress.2022.108418
2. Habibur Rahman M, Fashiar Rahman M, Tseng T. Estimation of fuel consumption and selection of the most carbon-efficient route for cold-chain logistics. International Journal of Systems Science: Operations & Logistics. 2022 May 29; 10(1):-. Available from: https://www.tandfonline.com/doi/full/10.1080/23302674.2022.2075043 DOI: 10.1080/23302674.2022.2075043
3. Rahman M, Wu J, Tseng T. Automatic morphological extraction of fibers from SEM images for quality control of short fiber-reinforced composites manufacturing. CIRP Journal of Manufacturing Science and Technology. 2021 May; 33:176-187. Available from: https://linkinghub.elsevier.com/retrieve/pii/S1755581721000493 DOI: 10.1016/j.cirpj.2021.03.010
4. Huang C, Liang W, Chuang H, Tseng T, Shen Y. Incremental Green Investment Rule Induction Using Intelligent Rough Sets from an Energy Perspective. Sustainability. 2024 April 26; 16(9):3655-. Available from: https://www.mdpi.com/2071-1050/16/9/3655 DOI: 10.3390/su16093655
5. Rahman M, Tseng T, Pokojovy M, McCaffrey P, Walser E, Moen S, Vo A, Ho J. Machine-Learning-Enabled Diagnostics with Improved Visualization of Disease Lesions in Chest X-ray Images. Diagnostics. 2024 August 06; 14(16):1699-. Available from: https://www.mdpi.com/2075-4418/14/16/1699 DOI: 10.3390/diagnostics14161699

Certification:

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I also certify that, at the time of submission, I am not a party to a malign foreign talent recruitment program.

Misrepresentations and/or omissions may be subject to prosecution and liability pursuant to, but not limited to, 18 U.S.C. §§ 287, 1001, 1031 and 31 U.S.C. §§ 3729-3733 and 3802.

Certified by Tseng, Tzu-Liang Bill in SciENcv on 2025-09-18 13:51:05

IDENTIFYING INFORMATION:

NAME: Wang, Hailei

ORCID iD: https://orcid.org/0000-0002-3037-1342

POSITION TITLE: Associate Professor

PRIMARY ORGANIZATION AND LOCATION: Utah State University, Mechanical & Aerospace Engineering, Logan, UT, Utah, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
Oregon State University, Corvallis, OR, US	PhD	06/2006	Mechanical, Industrial & Manufacturing Engineering
Texas Tech University, Lubbock, TX, US	MS	07/2002	Mechanical Engineering
Southwest Petroleum University, Nanchong, Sichuan, CN	BS	06/1992	Mechanical Engineering

Appointments and Positions

2024 - present Associate Professor, Utah State University, Mechanical & Aerospace Engineering, Logan, UT, Utah, United States

2018 - 2024 Assistant Professor, Utah State University, Logan, Utah, United States

2014 - 2018 Research Assistant Professor, Oregon State University, School of Mechanical, Industrial & Manufacturing Engineering, Corvallis, OR, US

2011 - 2014 Senior Investigator, Oregon State University, Mechanical, Industrial & Manufacturing Engineering, Corvallis, OR, US

2006 - 2010 Research Associate, Oregon State University, Mechanical, Industrial & Manufacturing Engineering, Corvallis, OR, US

2002 - 2006 Graduate Research Assistant, Oregon State University, Mechanical, Industrial & Manufacturing Engineering, Corvallis, OR, US

2000 - 2002 Graduate Research Assistant, Texas Tech University, Mechanical Engineering, Lubbock, TX, US

Products

Products Most Closely Related to the Proposed Project

1. Zhang Y, Bryan J, Richards G, Wang H. Development of surrogate-optimization models for a novel transcritical power cycle integrated with a small modular reactor. Energy and AI. 2024 January; 15:100311-. Available from: https://linkinghub.elsevier.com/retrieve/pii/S2666546823000836 DOI:

10.1016/j.egyai.2023.100311

2. Ghorbani M, Wang H. Computational modeling and experiment validation of a microchannel cross-flow heat exchanger. International Communications in Heat and Mass Transfer. 2023 December; 149:107116-. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0735193323005055 DOI: 10.1016/j.icheatmasstransfer.2023.107116
3. Bryan J, Meek A, Dana S, Islam Sakir M, Wang H. Modeling and design optimization of carbon-free hybrid energy systems with thermal and hydrogen storage. International Journal of Hydrogen Energy. 2023 December; 48(99):39097-39111. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0360319923011527 DOI: 10.1016/j.ijhydene.2023.03.135
4. Bryan J, Meek A, Wang H. Multi-Objective Optimization of a Bi-Metal High-Temperature Recuperator for Application in Concentrating Solar Power. Journal of Energy Resources Technology. 2023 October 01; 145(10):-. Available from: https://asmedigitalcollection.asme.org/energyresources/article/145/10/100902/1163381/Multi-Objective-Optimization-of-a-Bi-Metal-High DOI: 10.1115/1.4062522
5. Bryan J, Zhang Y, Wang H, Richards G. Multi-objective design optimization of an integrated regenerative transcritical cycle considering sensitivity in Pareto-optimal solutions. Energy Conversion and Management: X. 2023 April; 18:100364-. Available from: https://linkinghub.elsevier.com/retrieve/pii/S259017452300020X DOI: 10.1016/j.ecmx.2023.100364

Other Significant Products, Whether or Not Related to the Proposed Project

1. Mokarram N, Wang H. Design and modeling of novel two-phase heat exchangers for a home cooling system with ice energy storage. Applied Thermal Engineering. 2022 May; 207:118175-. Available from: https://linkinghub.elsevier.com/retrieve/pii/S1359431122001387 DOI: 10.1016/j.applthermaleng.2022.118175
2. Zhang Y, Bryan J, Richards G, Wang H. Development and comparative selection of surrogate models using artificial neural network for an integrated regenerative transcritical cycle. Applied Energy. 2022 July; 317:119146-. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0306261922005207 DOI: 10.1016/j.apenergy.2022.119146
3. Kissick S, Wang H. Techno-Economic analysis of alternative power cycles for Light-Water small modular reactors. International Journal of Energy Research. 2022 August 13; 46(14):19467-19479. Available from: https://onlinelibrary.wiley.com/doi/10.1002/er.8516 DOI: 10.1002/er.8516
4. Cummings C, Wang H, Smith M. Transient thermal modeling of bioprocess equipment. International Journal of Heat and Mass Transfer. 2022 March; 184:122064-. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0017931021011704 DOI: 10.1016/j.ijheatmasstransfer.2021.122064
5. Kissick S, Wang H. A comparative study of alternative power cycles for small modular reactors. Energy Conversion and Management. 2021 November; 247:114734-. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0196890421009109 DOI:

10.1016/j.enconman.2021.114734

Certification:

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I also certify that, at the time of submission, I am not a party to a malign foreign talent recruitment program.

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Certified by Wang, Hailei in SciENcv on 2025-09-17 16:18:06

IDENTIFYING INFORMATION:

NAME: Wang, Hongjie

ORCID iD: https://orcid.org/0000-0002-0162-7812

POSITION TITLE: Associate Professor

PRIMARY ORGANIZATION AND LOCATION: Utah State University, Electrical and Computer Engineering, Logan, Utah, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
Utah State University, Logan, Utah, United States	Ph.D.	05/2018	Electrical and Computer Engineering
Shanghai Jiao Tong University, Shanghai, Shanghai, China	M.S.	04/2012	Electrical and Computer Engineering
University of Shanghai for Science and Technology, Shanghai, Shanghai, China	BS	06/2009	Electrical and Computer Engineering

Appointments and Positions

2025 - present Associate Professor, Utah State University, Electrical and Computer Engineering, Logan, Utah, United States

2019 - 2025 Assistant Professor, Utah State University, Electrical and Computer Engineering, Logan, Utah, United States

2018 - 2019 Postdoctoral Researcher, Utah State University, Electrical and Computer Engineering, Logan, Utah, United States

2012 - 2014 Senior Research Scientist, China Electric Power Research Institute, Beijing, Beijing, China

Products

Products Most Closely Related to the Proposed Project

1. Gurudiwan S, Zade A, Wang H, Zane R. Optimized Timing Control for Leading-Edge Aligned Modulation of a T-Type Bridge in Unfolding-Based AC–DC Converters. IEEE Transactions on Power Electronics. 2025; 40(4):4716-4721. Available from: https://ieeexplore.ieee.org/document/10787264/ DOI: 10.1109/TPEL.2024.3514819
2. Newbolt T, Mandal P, Wang H, Zane R. Sustainability of Dynamic Wireless Power Transfer Roadway for In-Motion Electric Vehicle Charging. IEEE Transactions on Transportation Electrification. 2024; 10(1):1347-1362. Available from: https://ieeexplore.ieee.org/document/10081503/ DOI: 10.1109/TTE.2023.3262202

3. Rasheed M, Hassan R, Kamel M, Wang H, Zane R, Tong S, Smith K. Active Reconditioning of Retired Lithium-Ion Battery Packs From Electric Vehicles for Second-Life Applications. IEEE Journal of Emerging and Selected Topics in Power Electronics. 2024; 12(1):388-404. Available from: https://ieeexplore.ieee.org/document/10286848/ DOI: 10.1109/JESTPE.2023.3325251
4. Zade A, Teeneti C, Mansour M, Gurudiwan S, Hesterman B, Wang H, Zane R. A 21-kW Unfolding-Based Single-Stage AC–DC Converter for Wireless Charging Applications. IEEE Journal of Emerging and Selected Topics in Power Electronics. 2024; 12(1):8-27. Available from: https://ieeexplore.ieee.org/document/10236447/ DOI: 10.1109/JESTPE.2023.3309588
5. Newbolt T, Waite M, Mandal P, Wang H, Zane R. Load Demand Modeling of Large-Scale Charging Infrastructure for Electric Vehicles In-Motion. IEEE Access. 2024; 12:175550-175562. Available from: https://ieeexplore.ieee.org/document/10750800/ DOI: 10.1109/ACCESS.2024.3496656

Other Significant Products, Whether or Not Related to the Proposed Project

1. Serrano R, Sultana A, Kavanaugh D, Wang H. Increasing Electric Vehicle Charger Availability with a Mobile, Self-Contained Charging Station. Sustainability. 2025 March 20; 17(6):2767-. Available from: https://www.mdpi.com/2071-1050/17/6/2767 DOI: 10.3390/su17062767
2. Nguyen T, Sun H, Wang H, Hu R. Authentication and PHY-Security Schemes for Electric Vehicle Dynamic Wireless Charging. IEEE Transactions on Vehicular Technology. 2024; 73(2):1698-1712. Available from: https://ieeexplore.ieee.org/document/10261276/ DOI: 10.1109/TVT.2023.3318472
3. GURUDIWAN S, Zade A, Wang H, Zane R. Accurate ZVS Analysis of a Full-Bridge T-Type Resonant Converter for a 20-kW Unfolding-Based AC-DC Topology. IEEE Open Journal of Power Electronics. 2024; 5:692-708. Available from: https://ieeexplore.ieee.org/document/10530476/ DOI: 10.1109/OJPEL.2024.3400256
4. Hassan R, Wang H, Zane R. A New Online Continuous Stability Monitoring Method for DC Microgrids. IEEE Transactions on Power Electronics. 2023; 38(9):10739-10749. Available from: https://ieeexplore.ieee.org/document/10147367/ DOI: 10.1109/TPEL.2023.3284512
5. Wang H, Rasheed M, Hassan R, Kamel M, Tong S, Zane R. Life-Extended Active Battery Control for Energy Storage Using Electric Vehicle Retired Batteries. IEEE Transactions on Power Electronics. 2023; 38(6):6801-6805. Available from: https://ieeexplore.ieee.org/document/10058580/ DOI: 10.1109/TPEL.2023.3252362

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Certified by Wang, Hongjie in SciENcv on 2025-09-09 15:23:25

IDENTIFYING INFORMATION:

NAME: ZANE, REGAN A

ORCID iD: https://orcid.org/0000-0003-1742-9949

POSITION TITLE: Full Professor, David G. and Diann L. Sant Endowed Professor (Since 2018)

PRIMARY ORGANIZATION AND LOCATION: Utah State University, Department of Electrical and Computer Engineering, Logan, Utah, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
University of Colorado, Boulder, Colorado, United States	PHD	12/1999	Electrical Engineering
University of Colorado, Boulder, Colorado, United States	MS	05/1998	Electrical Engineering
University of Colorado, Boulder, Colorado, United States	BS	12/1996	Electrical Engineering

Appointments and Positions

2012 - present Full Professor, David G. and Diann L. Sant Endowed Professor (Since 2018), Utah State University, Department of Electrical and Computer Engineering, Logan, Utah, United States

2020 - present Director, Advancing Sustainability through Powered Infrastructure for Roadway Electrification (ASPIRE) NSF Engineering Research Center, Utah State University, Logan, Utah, United States

2008 - 2016 Associate Professor, University of Colorado at Boulder, Department of Electrical and Computer Engineering, Boulder, Colorado, United States

2001 - 2008 Assistant Professor, University of Colorado at Boulder, Department of Electrical and Computer Engineering, Boulder, Colorado, United States

1999 - 2001 Senior Research Scientist, General Electric, Electronic Power Conversion, Corporate Research & Development Center, Niskayuna, New York, United States

Products

Products Most Closely Related to the Proposed Project

1. Hassan R, Wang H, Zane R. A New Online Continuous Stability Monitoring Method for DC Microgrids. IEEE Transactions on Power Electronics. 2023; 38(9):10739-10749. Available from: https://ieeexplore.ieee.org/document/10147367/ DOI: 10.1109/TPEL.2023.3284512
2. Wang H, Rasheed M, Hassan R, Kamel M, Tong S, Zane R. Life-Extended Active Battery Control for Energy Storage Using Electric Vehicle Retired Batteries. IEEE Transactions on Power Electronics. 2023; 38(6):6801-6805. Available from: https://ieeexplore.ieee.org/document/10058580/ DOI: 10.1109/TPEL.2023.3252362
3. Zade A, Teeneti C, Mansour M, Gurudiwan S, Hesterman B, Wang H, Zane R. A 21 kW Unfolding-Based Single-Stage AC-DC Converter for Wireless Charging Applications. IEEE Journal of Emerging and Selected Topics in Power Electronics. 2023; :1-1. Available from:

https://ieeexplore.ieee.org/document/10236447/ DOI: 10.1109/JESTPE.2023.3309588

4. Rasheed M, Hassan R, Kamel M, Wang H, Zane R, Tong S, Smith K. Active Reconditioning of Retired Lithium-ion Battery Packs from Electric Vehicles for Second Life Applications. IEEE Journal of Emerging and Selected Topics in Power Electronics. 2023; :1-1. Available from: https://ieeexplore.ieee.org/document/10286848/ DOI: 10.1109/JESTPE.2023.3325251
5. Newbolt T, Mandal P, Wang H, Zane R. Sustainability of Dynamic Wireless Power Transfer Roadway for In-motion Electric Vehicle Charging. IEEE Transactions on Transportation Electrification. 2023; :1-1. Available from: https://ieeexplore.ieee.org/document/10081503/ DOI: 10.1109/TTE.2023.3262202

Other Significant Products, Whether or Not Related to the Proposed Project

1. Saha T, Bagchi A, Wang H, Zane R. Bidirectional *LCL* -T Resonant DC–DC Converter for Priority Loads in Undersea Distribution Networks. IEEE Transactions on Power Electronics. 2022 December; 37(12):14874-14887. Available from: https://ieeexplore.ieee.org/document/9810550/ DOI: 10.1109/TPEL.2022.3187133
2. Kamel M, Sankaranarayanan V, Zane R, Maksimovic D. State-of-Charge Balancing With Parallel and Series Output Connected Battery Power Modules. IEEE Transactions on Power Electronics. 2022; 37(6):6669-6677. Available from: https://ieeexplore.ieee.org/document/9684985/ DOI: 10.1109/TPEL.2022.3143835
3. Inoue S, Goodrich D, Saha S, Nimri R, Kamineni A, Flann N, Zane R. Fast Design Optimization Method Utilizing a Combination of Artificial Neural Networks and Genetic Algorithms for Dynamic Inductive Power Transfer Systems. IEEE Open Journal of Power Electronics. 2022; 3:915-929. Available from: https://ieeexplore.ieee.org/document/9963685/ DOI: 10.1109/OJPEL.2022.3224422
4. Kamel M, Ur Rehman M, Zhang F, Zane R, Maksimovic D. Differential Input Current Regulation in Parallel Output Connected Battery Power Modules. IEEE Transactions on Power Electronics. 2022; 37(4):3854-3864. Available from: https://ieeexplore.ieee.org/document/9573292/ DOI: 10.1109/TPEL.2021.3120365
5. Alan Mantooth H, Zane R, Manjrekar M. Guest Editorial Special Section on Cybersecurity of Power Electronics Through Hardware Hardening. IEEE Journal of Emerging and Selected Topics in Power Electronics. 2022; 10(1):1255-1257. Available from: https://ieeexplore.ieee.org/document/9701604/ DOI: 10.1109/JESTPE.2021.3133857

Certification:

I certify that the information provided is current, accurate, and complete. This includes but is not limited to current, pending, and other support (both foreign and domestic) as defined in 42 U.S.C. § 6605.

I also certify that, at the time of submission, I am not a party to a malign foreign talent recruitment program.

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Certified by ZANE, REGAN A in SciENcv on 2024-08-02 15:26:39

Appendix XIV - Assessment and Evaluation Year 5 Report and Appendix

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ASSESSMENT AND EVALUATION SUMMARY

A continuous improvement cycle for assessing and evaluating the ASPIRE Engineering Research Center is fundamental to the Center operations. The first step in the continuous improvement cycle is planning, which includes creating the Assessment and Evaluation Plan.

In year 1, training and guidance on the use of logic models and the SMART goal framework was provided to Center participants. The objective was to help the ASPIRE team create logic models of their proposed work and include specific, measurable, achievable, realistic, and timely goals. The appropriate milestones from the proposal were included in the Center-wide logic model. Center-wide inputs, activities, outputs, outcomes, and impacts were identified. Additionally, logic models were created for each project and the Pillar area. In year 2, there was a shift away from using the online software Dylomo for creating and tracking logic models. However, the same information is now tracked with ClickUp. In year 3 the logic models were reevaluated as part of the Center-wide goal realignment process. In year 4, the assessment team assisted with the creation of ClickUp dashboards aimed at measuring and evaluating the progress of the center-wide goals as well as the individual tasks and project milestones which link directly to the center-wide goals. Similarly, the center-wide logic model was revisited to more accurately demonstrate the decision process the Center follows to reach its strategic goals. In year 5, thanks to the maturity of the center and increased capacity of the team, the assessment team was able to not only continue already established assessment processes but also expand efforts to strategically target area of growth identified in previous years. Areas assessed include onboarding, student engagement, communication, and outreach.



As part of the project development and approval process, project leadership defines task and project milestones that are aligned with Center goals. Those are required to be SMART — smart, measurable, achievable, realistic, and timely. The Assessment and Evaluation team works with the project teams to create quantitative, qualitative, and mixed assessment methods and tools, based on what is most appropriate for the specific project. This process is repeated as new projects are developed. To close the loop, project teams report quarterly to the Research Project coordinator and on ClickUp. These reports are reviewed at the Pillar leaders and project leaders' meetings. The Pillar leaders and project leaders help strategize with project teams to implement necessary course correction or strategic project changes.

The Assessment and Evaluation Plan includes formative process and summative outcomes evaluation of all the work in the Center. Unique assessment metrics have been identified and used to evaluate effectiveness and allow for continuous improvement. Quantitative, qualitative and mixed-method, programmatic short-term and center-wide longitudinal approaches have

been employed — including surveys, interviews, focus groups, data-tracking, and statistical analysis. The ASPIRE Assessment and Evaluation Plan provides annual feedback on progress toward meeting the Center goals.

Existing assessment of educational programs has been used and supplemented to ensure the Center can report program outcomes that capture the broader impact of educational and outreach activities specific to these programs. Evaluating each education program allows the identification of program strengths and weaknesses and improve logistics and design.

ERC assessment activities

	Assessment Activity	Frequency	Year 5 Status
Research Projects	Creation of logic models — these are now tracked in ClickUp. SMART metrics are mapped to task and project milestones that are aligned with Center goals.	Ongoing as projects are approved yearly. Checking of milestones and goals at least annually (or more often as appropriate).	Continued project tracking in ClickUp. Projects provide quarterly updates to the Pillar leaders. The progress tracked in the quarterly updates and project meetings now feeds into the task, project milestone, and center goal dashboards.
Educational Activities	Administer MERCII survey; assesses understanding of the ERC, research & communication skills, culture of inclusion, mentorship experiences, STEM-related future plans, and program satisfaction.	Annually or associated with participation in program (i.e. REU).	MERCII administered Center-wide in March 2025, 182 responses. A multi-year analysis completed with four years of survey responses.
Informal Education	Create and administer feedback form for webinars, tech talks, trainings, etc.	As offered.	Administered in 34 sessions across the last three years, 192 responses, results disseminated to session presenters.
Cohort Trips	Created survey for feedback and evaluation of cohort trips	Administered after each cohort trip.	Administered for 7 cohort trips across the last three years, with the latest in March 2025.
Leadership Retreat Evaluation	Created survey for feedback and evaluation of ASPIRE Leadership Retreat, interviewed leaders on value of ASPIRE	Once per year, May 2025.	Administered and results presented to center director and codirector, 19 respondents to survey and 22 leaders interviewed during the event.
SWOT Training for CoP	Assessment and Evaluation Lead created and provided a training on SWOT analyses best practices for the Council of Presidents (CoP, formerly the SLC)	Once per year, October 2025	Presented to the Council of Presidents (previously the Student Leadership Council), it was recorded for future reference.
Annual Report Process	Conducted interviews with the annual report writing team to determine strengths and opportunities for growth in the report creation process	Completed in October 2025 (one time project)	Held multiple interviews with the technical writer, program coordinator, and program

			manager, presented results to leadership.
Onboarding Assessment	Conducted an in-depth onboarding survey to determine how to improve the onboarding process and develop a baseline. Another survey was created to be administered yearly to measure impact of implemented changes.	Initial completed October 2025, to be administered yearly	38 survey responses received from those onboarded during year 4. Results presented to the center leadership.
Onboarding Development	As a follow-up to the onboarding assessment, conducted interviews to determine what topics should be included in an onboarding program	Completed February 2025 (one time project)	Interviewed 13 participants across different areas of ASPIRE. Presented the list of recommended topics to center leadership.
CERV Conference	Created a survey to be administered at the CERV Conference to evaluate the conference for improvements. Additional industry interviews conducted around EWD.	Administered biennially in conjunction with CERV Conference, last in February 2025	Administered and results presented to center director and codirector, 90 respondents to survey and 27 industry members interviewed during the event.
Student Internship Engagement	Conducted an in-depth assessment investigating student internship engagement and the barriers encountered obtaining internships	Conducted in March 2025	Combination of interviews and focus groups conducted with 30 students, 3 faculty, 4 staff, and 27 prospective employers.
Student Engagement *Assessment Plan*	In collaboration with center leadership, an assessment plan was created to assess student engagement with the center. Objectives were created, and a mixed methodology planned.	Plan created in November 2024. Assessment tools were created, and data has been collected throughout Year 5	A combination of surveys, interviews, focus groups, attendance records, and form submission will be used. The data will be analyzed once a year and presented to leadership, starting at the beginning of Year 6.
Offboarding Survey	An offboarding interview (with an online survey alternative) was created to be administered as ASPIRE participants are offboarded.	Survey created in April 2025, used as participants are offboarded	12 offboarding interviews completed thus far
ASPIRE Newsletter	Analyzed ASPIRE newsletter data to assess ASPIRE participant engagement. Newsletter was created in response to assessment feedback around communication.	Analyzed data for the last year in July 2025, will be analyzed annually	A total of 1444 newsletter emails were sent to center participants. Assessment results were presented to leadership.
Open House Assessment	Conducted an assessment of the ASPIRE USU 2025 Open House using paper surveys for the public (adults and children) as well as an electronic survey for internal participants.	Administered in conjunction with each Open House.	164 external adult surveys, 42 external children surveys, and 29 internal participant surveys were analyzed and results presented to the center.

Roles and responsibilities

The entire leadership team has been engaged in the design and review of the Center and project-specific logic models, and in the dissemination and administration of assessment tools.

The Assessment and Evaluation Lead is responsible for guiding the assessment process and leading an assessment and evaluation team that is responsible for designing assessment tools and analysis. The Assessment and Evaluation Team has subject matter expertise in qualitative methods (such as conducting ethnography, interviewing, and focus groups), survey methodology, statistical analysis, and data visualization that allows us to effectively disseminate results. The Assessment and Evaluation Team feeds formative results and recommendations for improvements to the ERC leadership team on an annual basis (or more often as needed), allowing evidence-based decisions to be made in time to change activities for future years. In this way, attainment of goals tied to task and project milestones is ensured, facilitating the anticipated breakthroughs and impacts. The Assessment and Evaluation Team also coordinates any evaluation activities required by NSF with Center leadership. ERC team members administer assessments and implement changes based on evaluation, and the Council of Presidents (formerly the Student Leadership Council) performs the SWOT analysis annually.

In May 2024, the Center hired a full-time assessment coordinator to assist and enhance assessment and evaluation efforts in the Center. The new assessment coordinator earned a master's degree in data analytics and has extensive experience working with engineering students as an academic advisor. ASPIRE has grown significantly and there is acknowledgement that a full-time position is warranted. The role is rostered at USU but works closely with the assessment and evaluation lead, a consultant, with the day-to-day activities addressed by the assessment coordinator but the lead still provides strategic guidance and external evaluative review of the center outcomes and impact. Over the last year, the additional team capacity and focus of a full-time employee has enhanced already existing assessments processes and has enabled the creation of additional assessment plans, tools, and analyses around topics such as onboarding, student engagement, and multi-year comparisons.

In year 5, we were also able to enhance our systematic processes that demonstrate the interactions between qualitative and quantitative approaches. A good example of this is in the multi-year analysis of annual MERCII survey. Both quantitative and qualitative interactions were documented in the full report and communicated to leadership in regular assessment meetings and center leadership meetings. Additionally, the topic of onboarding is a good example of how we have implemented follow-up evaluation to assess how the feedback was implemented and measure effects from implementations. An in-depth onboarding assessment was completed in October, and a survey was created that will be administered annually to measure the impact and effectiveness of any changes the Center made in response to the feedback received.

YEAR 1-5 RESULTS TO DATE

During year 1, the ASPIRE ERC concentrated on the assessment planning process. Logic models were developed — including outputs and outcomes related to tasks, and a mapping of how

those tasks contribute to the longer-term impacts of ASPIRE. Those artifacts are living documents that change over time with inputs from all ASPIRE participants and regular updates from the leadership team. At the end of the first year, the ASPIRE project leads each reevaluated the activities associated with their projects to make sure what was listed was indeed what was proceeding. This allowed time for reflecting on associated outputs, outcomes, and metrics for assessing progress. The ASPIRE team started systematic review of project progress toward the outputs and outcomes, which has continued throughout year 2-5. In year 2, the project proposal process and project structure were adjusted based on feedback from the first annual review. There was also a decision to move away from using the Master Spreadsheet for project and task tracking as the result of feedback from the year 1 review. These changes show one way ASPIRE closed the loop between year 1 and years 2 and 3. In years 3, 4 and 5, results were tracked using the ClickUp project management tool. As mentioned in the previous section, year 5 was a year of enhancing and growing the assessment and analytic capabilities of ASPIRE with additional capacity. Since the theme of onboarding has been a growth area each year, there was intentional focus on additional qualitative assessment with explicit recommendations for operationalizing changes that will be assessed for effectiveness yearly. A new student engagement assessment plan was also created and implemented in year 5 with tools and metrics for assessing the effectiveness of various student engagement initiatives and activities.

YEAR 5 HIGHLIGHTS

ClickUp Dashboards

With the adoption of ClickUp, a project management software, the assessment and evaluation team assisted with the creation of multiple dashboards. The task-focused dashboards measure the individual task progress *(activities)* along with the task convergence with other tasks and projects. The project milestone dashboards measure the project milestones' *(outputs)* progression which ties directly into the center goals. The center goal dashboard measures the progress towards the center goals based on the progress reported for the dependent milestones. The data used to calculate the progress on these dashboards comes from the milestone progress field in ClickUp that is updated as task leads report progress both in meetings and through the quarterly reports. The leads have access to update the progress at any time and the dashboards update in real time. These dashboards give the Project, Pillar, and center leaders the ability to track the progression of tasks, projects, and center goals across the center in real time. These dashboards are updated at regularly scheduled meetings as well as through the quarterly reports.

Annual Survey

ASPIRE has participated in the Multi-ERC Instrument Inventory (MERCII) survey administration, which is a common quantitative survey developed for use by all ERCs and similar, large scale engineering centers to evaluate educational programming. The MERCII quantitative survey assesses understanding of the ERC, research and communication skills, culture of inclusion, mentorship experiences, STEM-related future plans, and program satisfaction. ASPIRE also chose to add some specific questions addressing communication within ASPIRE.

The MERCII survey was administered via individualized links from Qualtrics that were emailed to ASPIRE ERC students, staff, faculty and other personnel in March 2025.

As the survey has been administered over four consecutive years, multi-year analyses were completed in year 4 and 5. Not only was survey engagement investigated, but focus was also placed on question response changes from the first year. The percentage of positive responses and percentage point change from 2022 were used to categorize all the questions into two watchlists and then into six categories: successes, above average – small change, areas to monitor, areas of growth, below average – small change, and needs review. The detailed analysis report was presented to center leadership. Details of this analysis can be found in the assessment section of the *annual report appendix.*

Opportunities for Growth*:* The themes that emerged as opportunities for growth for ASPIRE from the survey administration include leadership, onboarding and training, professional development, engagement and retention, collaboration, communication, and networking and career development. Recommended actions were suggested by the assessment team for each theme. The two open response questions were analyzed and common themes identified. When asked to describe successful aspects of the ASPIRE experience, respondents identified the following strengths: growth of skills & knowledge; people at ASPIRE; network formed; and leadership's recent efforts towards improvement. When asked for recommendations for improvement, respondents identified the following themes: leadership; personnel management; climate (USU only); onboarding and training; employee professional development, engagement, & retention; collaboration; communication; and networking and career development (student specific). These themes were observed across all participant role types and across multiple organizations (unless otherwise specified). The assessment team created recommendations related to each theme, detailed recommendations can be found in the assessment section of the *annual report appendix.*

Onboarding

The need to improve onboarding has been a growth area identified by the annual MERCII survey consistently each year. In response, the assessment team created and administered a survey to gain greater insight and feedback around the onboarding experience. The survey was administered in October 2024 to all ASPIRE participants who had been onboarded in the last year. The survey identified onboarding strengths which included the welcoming nature of the center, excitement for the mission of ASPIRE, and the opportunity to grow through their experience. Growth opportunities were also identified including a need for a formal onboarding process, clearly defined processes and procedures, clear goals and direction, and need to improve communication. Additionally, student-specific strengths and opportunities as well as staff-specific strengths and opportunities were identified. The results from this analysis were presented to center leadership. An adjusted version of the survey was then created to be administered yearly to measure, by comparing to the 2024 results, the impact of adjustments or initiatives implemented in response to the feedback provided. Details of this analysis can be found in the assessment section of the *annual report appendix*.

Student Engagement

During the Year 4 NSF Annual Site Visit, the need to more fully assess student engagement within the center was identified. In response to this feedback, the Assessment and Evaluation team, worked with the Student Engagement Coordinator and center leadership to develop and implement an assessment plan. First, student engagement objectives and outcomes were developed. Next, opportunities for these outcomes were identified, measures were determined, and data instruments were created to measure the impact of these opportunities. This work is designed to be conducted on a yearly cycle with an overall report being produced once a year. Additional feedback will be provided to the leadership throughout the year as deemed appropriate. Throughout year 5, the data from the varying assessment tools has been gathered and the summarized results will be presented to leadership at the beginning of year 6. Details of this assessment plan can be found in the assessment section of the *annual report appendix*.

Additional educational assessments

Tools were created and administered to evaluate the following:

- ✓ Webinar and tech talk seminars
- ✓ ASPIRE Open House
- ✓ Internship Evaluation and Feedback
- ✓ Student Leadership Council (SLC) Cohort Trip
- ✓ CERV Conference Evaluation
- ✓ Offboarding interviews
- ✓ ASPIRE Leadership Retreat
- ✓ ASPIRE Annual Meeting

A template feedback form that can be used to evaluate all webinar and Tech Talk sessions has been created and used to assess 34 sessions. This years' SLC cohort trips were taken in June 2024 and March 2025 and an evaluation survey was administered following each trip.

Examples of some assessment survey tools can be found in the assessment section of the annual report appendix. We have included more in-depth information for the student engagement assessment plan, onboarding assessment, CERV conference assessment, student internship assessment, SLC cohort trip report, leadership retreat assessment, center newsletter engagement, and the annual survey report.

Conclusions & Recommendations

During year 1 of the ASPIRE ERC, the Assessment and Evaluation team worked mostly with leadership team during the planning phase of the assessment continuous improvement cycle. During years 2-5 there were many more chances to close the loop and evaluate progress and outcomes across the project teams. The Center leadership and broader project teams have created the processes necessary to evaluate progress toward task and project milestone completion that is tied to Center-defined goals. These are now systematically tracked using ClickUp and regularly reviewed by the Pillar Directors, Project Leaders, and ASPIRE leadership. In year 4 there was significantly more focus on entering timely information into ClickUp so that

formative evaluation of progress could be assessed by Center and project leadership. With newly created dashboards, there is even more transparency and ability to disseminate progress reporting broadly in the Center. Year 5 was a year of enhancing and growing the assessment and analytic capabilities of ASPIRE with additional capacity after hiring a full-time assessment coordinator at the end of year 4. This allowed the team to enhance our systematic processes that demonstrate the interactions between qualitative and quantitative approaches using the annual survey, leadership retreat interviews, onboarding and student engagement assessments and analyses.

The Assessment and Evaluation Team participated in all Center-wide meetings, the annual and semi-annual meetings, annual leadership retreats, twice monthly Pillar Directors and EWD meetings, and monthly Project leaders' meetings, and also met with the Center Director and co-Director at least monthly.

This ongoing cycle of assessment allows real-time formative feedback and opportunity for adjustment throughout the year, while annual summative feedback from the annual MERCII survey provides opportunity to triangulate in on suggested changes and create a baseline for the overall Center functioning. Many changes have been made in ASPIRE as a result of feedback from various constituents. Examples of a few of those include changing the project structure, the project proposal process, and operationalizing ClickUp to track task and project milestones, and center goals. In year 2 there was acknowledgement that more communication was needed across the Center. As a result, additional Director updates were added, and there is a plan for more holistic onboarding and offboarding procedures. In year 3 there was a focus on aligning all project work with reevaluated Center-wide goals. Additionally, based on feedback from the Center constituents, leadership streamlined meeting offerings and communicated more clearly about who should attend each meeting. They also hired a new project manager to help take on some of the project administration tasks. In year 4 there were fewer, but more targeted, center-wide meetings and ClickUp dashboards were created to better facilitate tracking of milestone progress.

In year 5, there were even more examples of how the results of assessment influenced the actions taken in ASPIRE. With the added capacity of the reorganized assessment team, additional focus on reporting themes that were consistent across the various assessment tools and reports was possible, so actions were created by triangulating from many different sources. As discussed above, onboarding has been an area for growth each year and this year the activities were more targeted and resulted in changes in center-wide processes for onboarding students, faculty and staff. Additionally, the assessment team recommended utilizing change management. The assessment coordinator then completed training and has begun to apply change management to center initiatives. Another example from year 5 was adjustments to the annual project review and report processes based on feedback from center participants. In year 5 planning began for an added hackathon opportunity at the annual meeting to enhance the entrepreneurial experience for students which has been lower than most other skills assessed in ASPIRE. We look forward to reporting on the impact of these changes as they are assessed in year 6.

Student Engagement Assessment Plan

Melanie Conrad and Katherine Grover

Assessment Overview and Objectives:

During the Year 4 NSF Annual Site Visit, the need to more fully assess student engagement within the center was identified. In response to this feedback, the Assessment and Evaluation team, with the direction of the center leadership, is working with the Student Engagement Coordinator to develop and implement an assessment plan surrounding the center's efforts. The assessment is designed to be ongoing and results will be distributed to the center leadership regularly to further direct the center's resources and work with students. Any changes made in response to the results will continue to be assessed.

Outline of Student Engagement Purpose and Results

In order to effectively assess the work with student engagement, the leadership team has identified the following student engagement purposes and results.

Purpose for Student Engagement with the ASPIRE Center:

1. Provide opportunities for students to further their career progression
2. Provide a space for students to connect, collaborate, and strengthen their professional identity
3. Provide opportunities for students to forge connections with industry

Result of Engagement (categorized by purpose):

1. Provide opportunities for students to further their career progression
    a. Students will develop professional skills (such as leadership, communication, etc.)
    b. Students will enhance their skills through work and educational experience (internships, research, employment etc.)
2. Provide a space for students to connect, collaborate, and strengthen their professional identity
    a. Students will form connections with ASPIRE members (such as mentoring, working in interdisciplinary, diverse, global teams etc.)
    b. Students will strengthen their professional identity
3. Provide opportunities for students to forge connections with industry

a. Students will gain exposure to industry and/or industry perspectives
b. Students will network with industry professionals

Assessment Mapping & Methodology

The following table shows how the work of the center is mapped to the purpose and results identified above and how this work will be assessed. A mixed methodology approach will be used including tools such as the annual MERCII survey, post-event surveys, student focus groups, onboarding and offboarding interviews, and online reporting forms.

Table 1: Student Engagement Purpose and Result Mapping by Opportunities

Purpose	Result	Opportunity	When	What is being Measured?	Data Instrument	Lead
Provide opportunities for students to further their career progression	Students will develop professional skills (such as leadership, communication, etc.)	Participation with the center generally	Ongoing	• Growth in EWD Competencies	• MERCII Survey	Katherine & EWD
		ASA and SLC Professional Development Events	Once a semester	• Participation in events	• Zoom Attendee Numbers • Post Event Surveys – Do we still need?	Katherine
		ASA and SLC Leadership Opportunities	Elections yearly, positions have a one-year appointment	• Growth of leadership skills	• Focus Groups each semester with the leadership teams	Melanie Conrad

		Presentation & Publication Opportunities (Annual Meeting, Tech Talks, Conferences)	Ongoing	• Participation in presentations and publications	• Online NSF Reporting Form	Melanie Conrad
	Students will enhance their skills through work and educational experience (internships, research, employment etc.)	Research and Employment within the Center	Ongoing	• Participation in research and student employment • Growth of skills through this participation	• Online NSF Reporting Form • MERCII	Melanie Conrad
		Internships	Ongoing	• Participation in internships • Growth of skills through participation	• Online NSF Reporting Form • MERCII	Melanie Conrad
		Employment outside the center	Ongoing, after graduation	• Employment after graduation	• Online NSF Reporting Form • Offboarding Interview • LinkedIn Tracking? (Idea)	Melanie Conrad
Provide a space for students to connect, collaborate, and strengthen their	Students will form connections with ASPIRE members (such as mentoring, working in interdisciplinary, diverse, global teams etc.)	Participation with the center generally	Ongoing	• Connection with ASPIRE members	• MERCII Survey • Offboarding Interviews	Katherine & Melanie

professional identity						
		ASA and SLC Organization	Ongoing	• Connection with ASPIRE members	• Focus Groups with ASA/SLC membership and leadership	Katherine & Melanie
	Students will strengthen their professional identity	Participation with the center generally	Ongoing	• Students' professional identity	• Offboarding Interviews	Katherine & Melanie
		ASA and SLC Organization	Ongoing	• Students' professional identity	• Focus Groups with ASA/SLC membership and leadership	Katherine & Melanie
Provide opportunities for students to forge connections with industry	Students will gain exposure to industry and/or industry perspectives	ASA Industry Visits	Once a semester	• Participation in the industry Visits	• Registration and Attendance Numbers	Melanie
		SLC Cohort Trips	2-3 times a year	• Participation in the industry visits in the SLC Cohort Trip • Understanding of importance of gaining industry perspectives	• Post Trip Survey	Katherine
	Students will network with industry professionals	Tech Talks (Is this a good opportunity?	Monthly	• Participation in the Tech Talks	• Zoom Attendance	Melanie & Don

		Maybe don't count all)				
		SLC Cohort Trips	2-3 times a year	• Participation in the industry visits in the SLC Cohort Trip • Identification of industry professional connection	• Post Trip Survey	Katherine
		Annual Meeting Technology Showcase & IIB Day & Networking Reception	Annually	• Participation in: • Technology Showcase • IIB Day • Networking Reception	• Conference Registration • Other Participation Measurement? • Annual Meeting Survey	Melanie & Katherine
		Internships	Ongoing	• Participation in internship • Connections formed during internship	• Online NSF Reporting Form	Melanie

Timeline of Analysis and Distribution of Results

This work will be conducted on a yearly cycle with an overall report being produced once a year. Throughout the year, the feedback from the varying assessment tools will be continually gathered and evaluated frequently with themes/results being shared with the center leadership.

December 2024

ASPIRE Onboarding Analysis

Katherine Grover & Beth Myers

Introduction

The ASPIRE Assessment and Evaluation team has administered the Multi-ERC Instrument Inventory (MERCII) survey to all ASPIRE participants for the last three years. This survey includes qualitative open response questions to allow participants to share feedback to the center. A need to improve onboarding has been a main theme observed each year. In response, the assessment team created and administered a survey to gain greater insight and feedback around the onboarding experience.

Survey Format and Administration

Survey Format

To gain in-depth information, the team created an onboarding survey with five sections (Pre-Screening, Hiring, Role Training and Resources, Value within the Organization, and Future in the Organization). Three versions were created with slight word variations to ensure the survey felt accurate for all groups surveyed: students, staff/post-docs, and faculty. The Pre-Screening section gathered general participant information and made sure the respondent had truly been onboarded in the last year. If the respondent hadn't been onboarded in the last year, the majority of the survey was skipped and a set of general satisfaction questions were presented. The Hiring section contained question regarding the interviewing and hiring process. The Role Training and Resources section contained questions regarding the participant's understanding, satisfaction, and confidence in different aspects of their specific role and the training received. It also investigates the resources provided to the new participant. The Value within the Organization section explored participants' views around the center, culture, and working environment. Additionally, it explored perception of the organization and inclusivity of the center. Lastly, the Future in the Organization section explored the participant's plans for the future regarding their participation in the center and if they would recommend participating in the center to others. The last four sections had a combination of quantitative question using a Likert scale as well as qualitative questions. The full survey can be found in Appendix 3.

Survey Administration

The survey was administered on October 15, 2024 with two reminders send out prior to the submission deadline. Those invited included all ASPIRE participants who had been onboarded between 10/01/2023 and 10/01/2024. Overall, 129 ASPIRE participants were invited and 38 responded to the survey. The survey was completely anonymous. There were no surveys that were started but not completed. The Staff, Post Docs, and Faculty had the highest participation rate at 75%. Even though the students had the most responses, their response rate was only 20%. See Table 1 for full details.

Table 1: 2024 Onboarding Survey Administration and Response

Title	Staff/Post Docs	Student	Faculty	Overall
Invited	19	104	6	129
Bounced	0	1	2	3
Responded	14	21	3	38
Bounce Rate	0%	1%	33%	2%
Response Rate	74%	20%	75%	30%

The majority of responses came from USU (73%) with additional responses from Purdue, University of Colorado Boulder, and University of Utah. While the student responses were spread across most of the above-mentioned campuses, all but one of the staff responses were from USU. There were a small number of responses from post-docs and from faculty. Due to the small number of responses from post-docs and faculty, their responses are only included in the overall summaries.

Lastly, the response to the qualitative questions was robust. There were seven qualitative questions throughout the survey. From the 38 respondents, there were 123 qualitative responses. As will be discussed in the result section, the qualitative responses aligned closely with the quantitative results.

Survey Results

To evaluate the quantitative questions, each questions' full response breakdown was visualized and is found in Appendix 1, organized by survey section. Additionally, to facilitate easier comparison of question responses, the responses were categorized into positive, neutral, and negative responses. The two most positive responses on the Likert scale were categorized as positive, the middle response was categorized as neutral, and the two least positive responses were categorized as negative. The percent of responses that were categorized as positive was then calculated and visualized. The responses were also visualized by staff responses versus student responses (see Appendix 1). The qualitative responses were reviewed and coded to identify common themes. As the survey was anonymous, the qualitative responses are not included in this report.

Overall Results

The responses to both the quantitative questions are available in both Figure 1 and 2 below. Figure 1 shows the percent of participants that responded positively to the quantitative questions for all participants combined. Figure 2 shows the percent of participants that responded positively to the quantitative questions for both the staff group and the student group as compared with the overall. The students responded more positively throughout the entire survey in comparison to the staff. Overall, the post-docs and faculty responded positively.

When comparing the quantitative responses and the thoughts expressed in the qualitative responses, there is significant consistency which does not always occur in surveys. This indicates that the identified themes are congruent across role types and are prevalent enough in participants' minds to be consistently expressed.

Figure 1: Overall Positive Response Rate to Quantitative Questions for all Participants (Ordered from most positive to least)

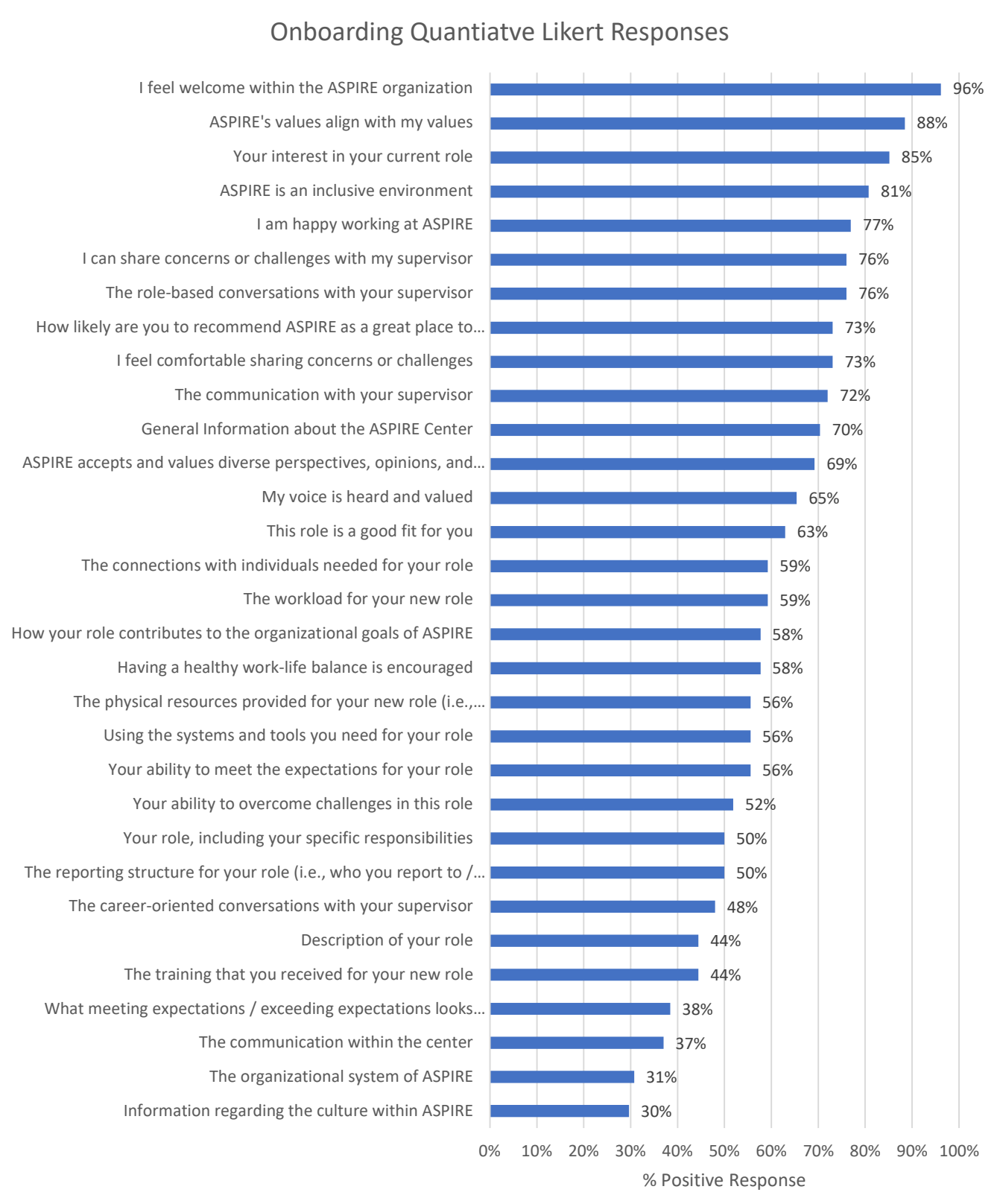
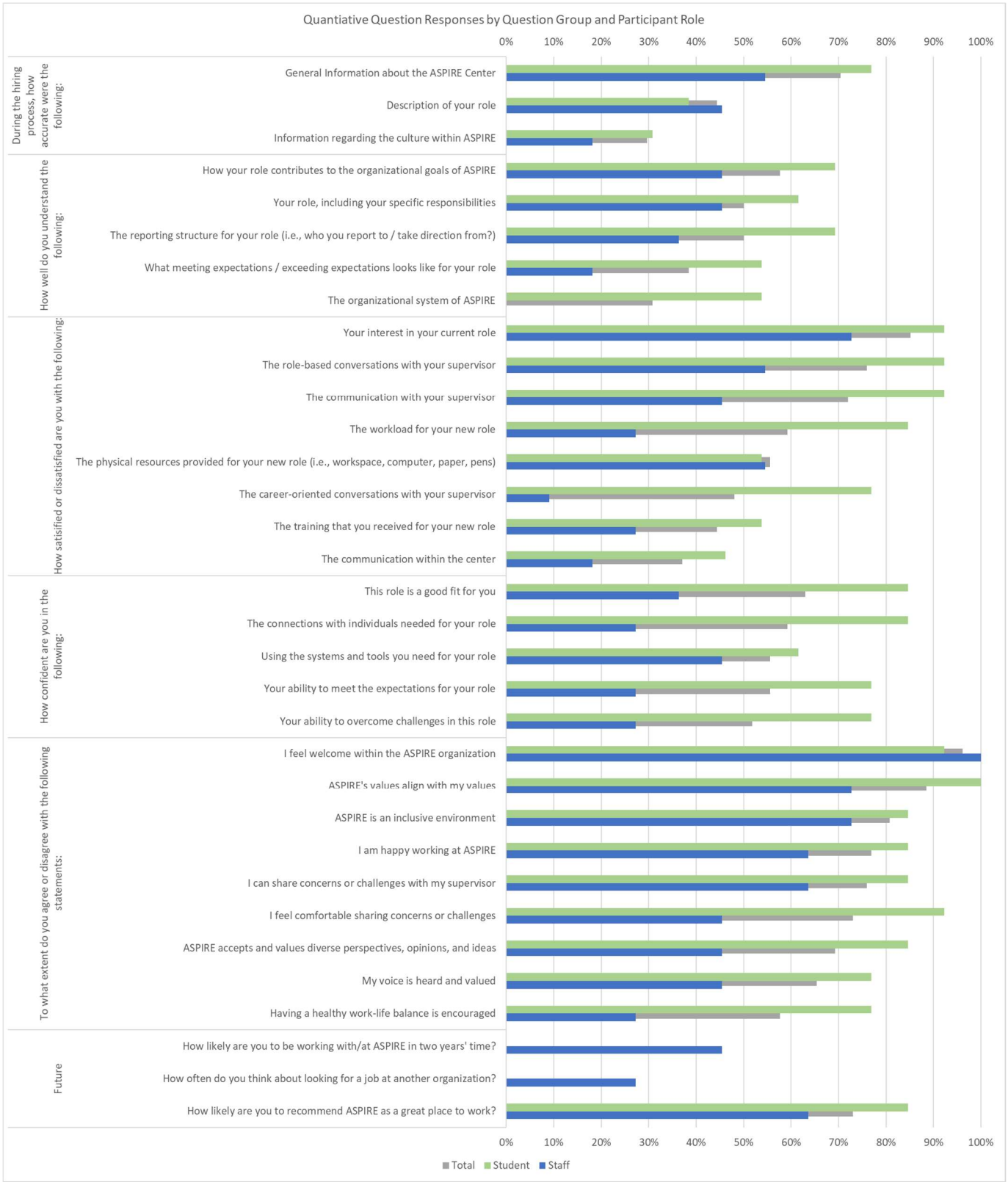


Figure 2: Overall Positive Response Rate to Quantitative Questions for Staff and Students (in question groups)



Onboarding Strengths

When reviewing the themes from the survey results, several strengths were consistent across all participant types. The following onboarding strengths were identified:

1. Friendly, approachable, and welcoming nature of the center and center participants

The survey respondents showed a clear appreciation for the welcoming nature of the center and center participants, both in the quantitative questions and the qualitative comments. The highest positive response received on the survey occurred when participants were asked how much they agreed or disagreed with the statement "I feel welcome within the ASPIRE organization" (96%). Additionally, respondents agreed that ASPIRE is an inclusive environment (81%) and they are happy working at ASPIRE (77%). Respondents wrote that the ASPIRE participants were very friendly and approachable.

Additionally, when asked about the hiring process, respondents consistently related the positive experiences they had with the leadership during the hiring process and into the onboarding experience.

2. Excitement for the mission of ASPIRE and the chance to have a significant impact

Another identified strength is excitement for the mission of ASPIRE and the research going on in the center. Respondents consistently commented on their enthusiasm for the work and mission of the organization as a whole. When asked how much they agreed or disagreed, 89% replied positively that ASPIRE's values align with their values. Additionally, 85% positively responded when asked how satisfied or dissatisfied they were with their interest in their current role. Many expressed their excitement regarding the bigger impact they could have in their role at ASPIRE, both within the center and society.

3. Opportunity to grow through their experience with ASPIRE

Respondents also commented frequently on their enthusiasm for the opportunity to grow through their ASPIRE role. They appreciate the chance to learn new skills and improve as they face new challenges. As challenges arise, the respondents agreed that they felt comfortable sharing their concerns and challenges with their supervisor (76%) and in general (73%). Additionally, appreciation for support and access to professional development opportunities was expressed.

Onboarding Growth Opportunities

As the survey results were analyzed, several areas of growth were found consistently throughout all areas of the survey. For all participants, the following onboarding areas of growth were identified:

1. Need for a robust formal onboarding process

The most consistent feedback received, especially in the qualitative section, was the need for a more robust, formal onboarding process. This was observed across all participant types. Only 44% of respondents positively indicated they were satisfied with the training received. When asked how well they understood their role, including their specific responsibilities, only 50% responded positively. Additionally, respondents didn't feel confident they had the connections to people needed to accomplish their role (27% positive response). Qualitative responses additionally mentioned the need for additional training with the system and tools, such as ClickUp. Several comments acknowledge some training occurred but expressed concern that the 1–2-hour session was not sufficient.

2. *Need for clearly defined processes, procedures, information, and organization*

In addition to a need for an onboarding process, respondents indicated that there was significant need for clearly defined processes, procedures, and organization within the center. Qualitative responses expressed confusion with knowing where to go for information or when questions were encountered. Additionally, concern was expressed that different leaders gave different answers and had different ideas as to how things should be approached/accomplished. Suggestions were given to create a repository of the common processes, procedures, and frequently asked questions to act as a resource to new and existing employees. When asked how well they understood the organization of ASPIRE, only 31% responded positively (with the staff having 0% positive response), the second to lowest response on the whole survey. The lowest overall positive score (30%) was observed when respondents were asked how accurate was the information regarding the culture within ASPIRE provided during the hiring process. Lastly, respondents expressed confusion with regards to the organization of the leadership, knowing who to take direction from, or even who to ask for time off. When asked how well they understood the reporting structure for their role, only 50% responded positively. These concerns were again observed across all participant types.

3. *Need for clear, consistent goals and direction*

Similar to the previous area of growth, the need for clear, consistent goals and direction was strongly expressed. When asked regarding their understanding of what meeting expectations/exceeding expectations looked like, only 39% responded positively. Additionally, while 48% of respondents positively responded to their level of satisfaction regarding their career-oriented conversations with their supervisors, only 9% of the staff responded positively. Through the qualitative questions, multiple concerns were expressed regarding the lack of clear direction or vision for the center and for their specific role. Respondents expressed that they consistently felt pressure to run to accomplish work but were unsure of the direction or reasoning. Lastly, participants felt that they were excluded from the conversations around the goals and directions for the future.

4. *Need to improve communication*

As has been seen consistently in the MERCII annual survey, the need to improve communication was strongly expressed. When asked how satisfied they were with the communication within the center, only 37% responded positively (18% for the staff). Qualitative responses expressed that information and communication seemed siloed or occurring only in small groups. Additionally, concerns were repeated around expectations not being communicated. No specific concerns were expressed with a specific mode of communication. It is possible that, instead of a mode of communication being the root issue, the consistent request to improve communication could be directly related to the two previous areas of growth as communication is strongly related to the need for clear processes, procedures, organization, goals, and direction.

Student Specific Results

While the above-mentioned themes were consistent across all participant types, there were some unique themes found for different participant roles. The overview of student quantitative responses can be found in Appendix 2a. The following themes were observed for the student participants:

Student Onboarding Strengths

1. *Opportunity to gain experience in the field*

One of the key strengths mentioned by students was their excitement to gain experience within the field. Students recognized the fantastic opportunity that ASPIRE has provided and the huge impact it will have on their career.

2. *Mentoring from the leadership*

ASPIRE offers students a unique opportunity to not only work within their field of study but also to network with and be mentored by leaders in their field. The excitement and gratitude students felt for this opportunity was acknowledged in the comments.

Student Onboarding Growth Opportunities

From the responses to the survey, there were no unique areas of growth identified by students that was not observed in the other participant types. The students responded more positively to all but one of the quantitative questions in comparison to the staff.

Staff Specific Results

Like the students, unique themes were identified by staff. The overview of staff responses can be found in Appendix 2b. The following were unique strengths identified by the staff responses:

Staff Onboarding Strengths

1. *Positive experience with the people and teams*

When responding to questions regarding the positive factors experienced in the onboarding process, the staff mentioned their excitement for the team-focused environment and the opportunity to work with the great people at ASPIRE. The collaborative nature of the center as well as the caliber of people working at the center were expressed.

2. *Ability to shape their role and have autonomy*

A common theme identified by staff regarding the hiring process was the staff's ability to shape their role within ASPIRE. Additionally, they were excited at the autonomy that was described. Later comments did express differing views on whether this actually occurred after being hired. Some felt that they had this opportunity to shape their role and have autonomy while others expressed frustration that this hasn't occurred.

Staff Onboarding Growth Opportunities

In addition to the overall areas of growth found by all participants, additional consistent themes were identified by staff. The themes include:

1. *Need for clear role determination and expectations*

The most consistently expressed theme for staff was the need for clear role determination and clearly defined expectations. While this is related to the themes observed generally, the staff have specific concerns around their role and what is expected for their position. The staff showed low positive responses when asked how well they understood the following: the organizational system of ASPIRE

(0%), what meeting expectations/exceeding expectations looks like for their role (18%), the reporting structure for their role (36%), and their role including their specific responsibilities (46%). Additionally, the staff reported very low positive rates when asked how confident they were in their ability to overcome challenges in their role (27%) and their ability to meet the expectations for their role (27%). As a reminder, the staff responded positively to their interest and excitement both for their role and for the ASPIRE mission. Despite this excitement for their role, the staff don't express confidence in their ability to meet the expectations of their role or overcome the challenges. The qualitative comments demonstrated confusion around what was expected and how to meet the expectations from leadership. Some commented that their role has changed significantly from what they were originally hired to do. Additionally, there were comments regarding the uncertainty of the reporting structure and who they should or shouldn't be taking directions from.

2. Need for better work-life balance

Another consistently expressed theme from the staff was around the need for better work-life balance. When asked how much they agreed with the statement "having a healthy work-life balance is encouraged", only 27% of staff responded positively. Additionally, when asked about their satisfaction around the workload for their new role, only 27% responded positively. Concerns around work-life balance were consistently expressed throughout the qualitative questions. Concerns expressed included having too much work, too many priorities, and having too many last-minute stressful requests/pushes. Additionally, the staff expressed frustration around the "startup" culture that exists within the center and the expectation to work like a founder of a startup. Desires were expressed to work towards a more sustainable model that will encourage retention of employees.

3. Need for better physical resources

There were many comments observed around the need for better physical resources. The most common comment addressed the lack of work phones and having to use their personal phones for work without receiving a phone allowance. Additional comments were made around unreliable computers, having to provide chairs and office supplies, and not having business cards. Additional concerns were expressed around the pressure to move to a communal workspace instead of having offices.

Conclusions and Next Steps

The onboarding survey has identified clear strengths as well as clear areas of growth for the ASPIRE center. It is recommended that the center assemble a team to review the results and develop a robust, clearly defined onboarding process. Additionally, it is suggested that the process include variations to meet the unique needs and concerns of the different participant types. As a part of the process, it is recommended that the center identify who is responsible for onboarding each type of participant and the specific steps and resources needed to complete this onboarding.

In addition to creating a robust onboarding process, it is suggested that the center review the processes, procedures, and organization of ASPIRE to ensure the elimination of unnecessary complexity. Additionally, developing a resource around these pieces for new participants to access while onboarding

would be extremely beneficial. Once processes, procedures, and organization are determined, it would be helpful to make sure these are consistently and clearly explained and administered to all ASPIRE participants. Additionally, the center should review their goals and approaches to ensure that the leadership are all on the same page and headed in the same direction. Once the goals and approaches are determined, these need to be clearly and consistently communicated to participants using best practices in change management. It is possible that if these two areas are addressed and communicated to the participants, the concern around communication would decrease.

Lastly, it is recommended that attention be given to addressing the additional concerns of the staff to cultivate their excitement around the center and foster retention.

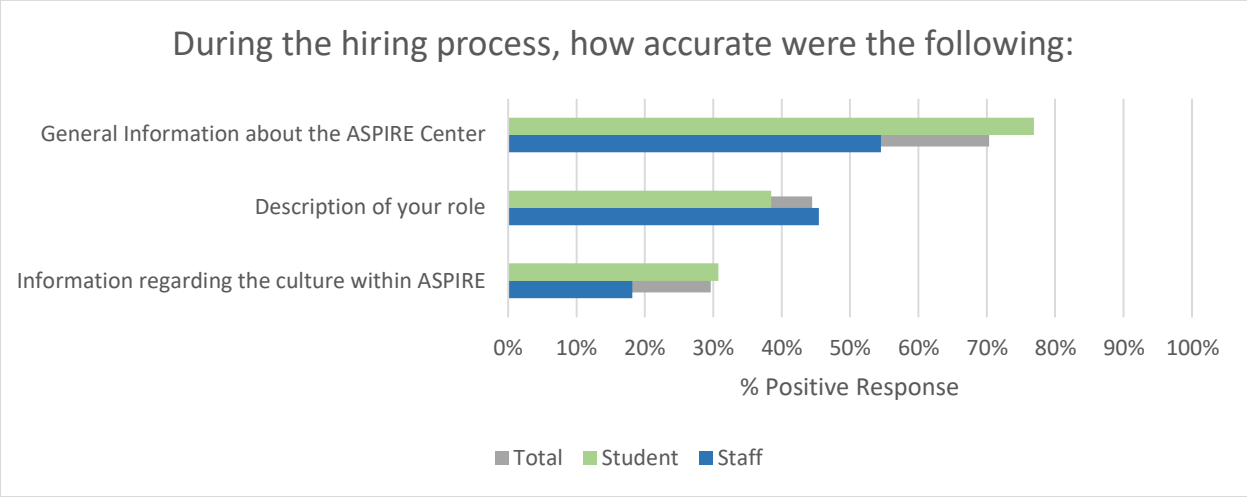
The assessment team will create an abbreviated version of the onboarding survey to be used going forward to monitor how these areas of growth improve as leadership works to implement changes. It is anticipated that these surveys will be analyzed yearly.

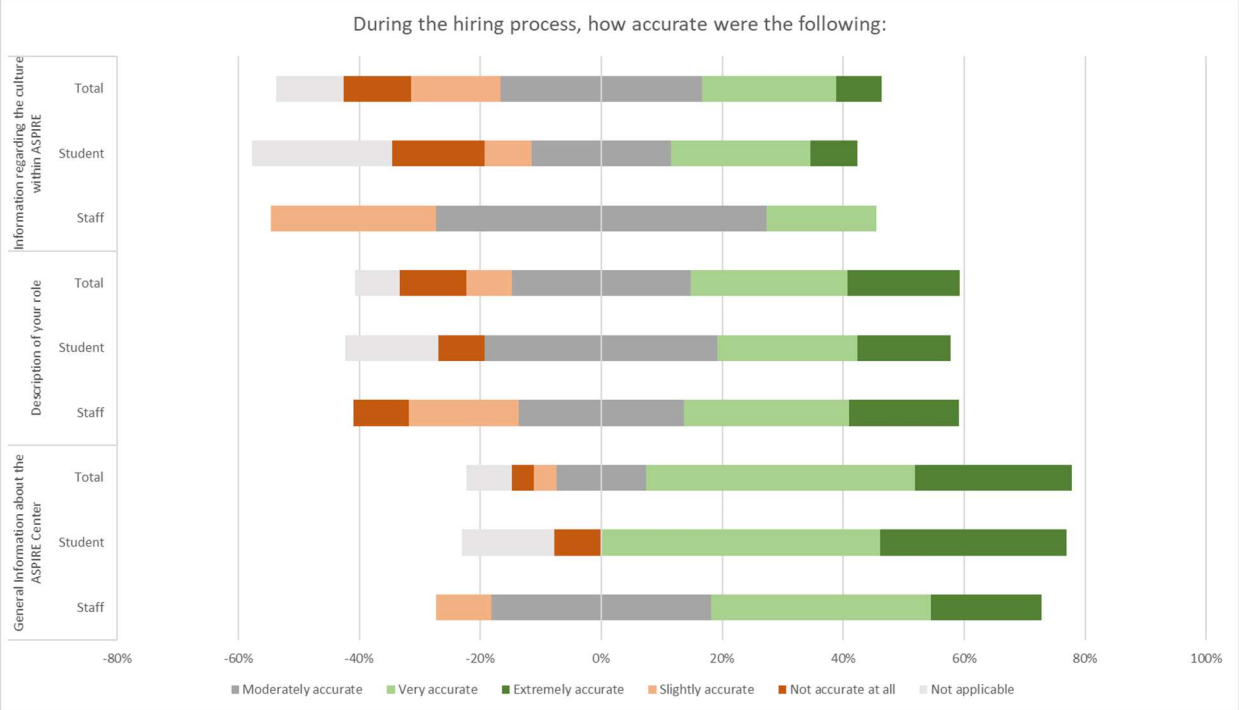
December 2024

Appendices

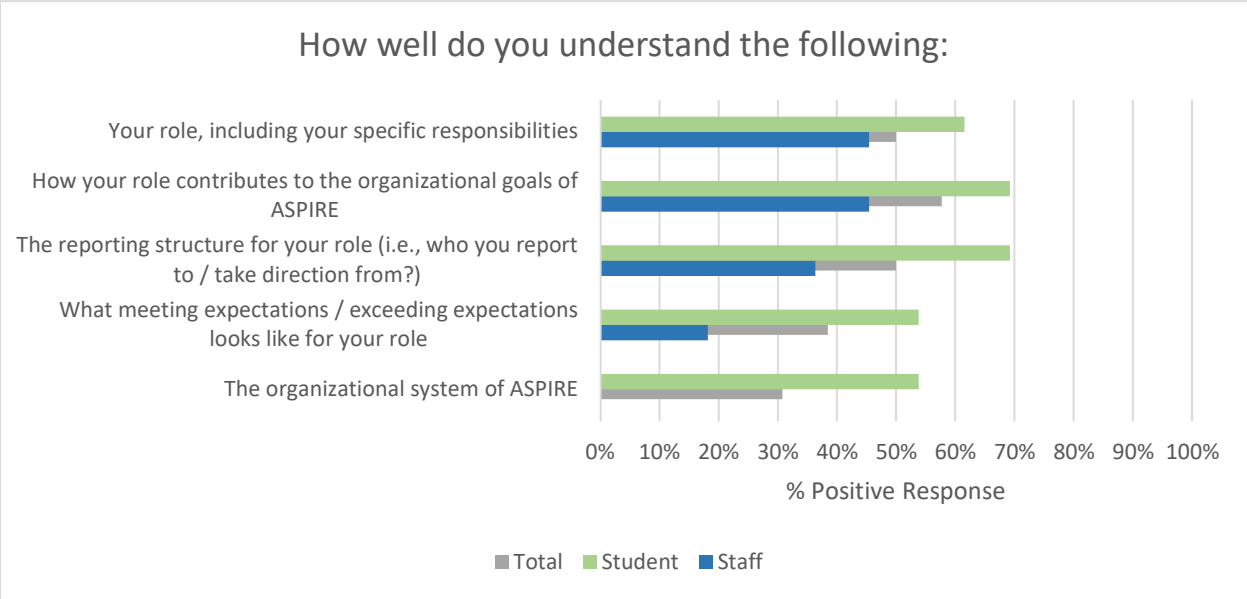
Appendix 1: Quantitative Response Breakdown by Section

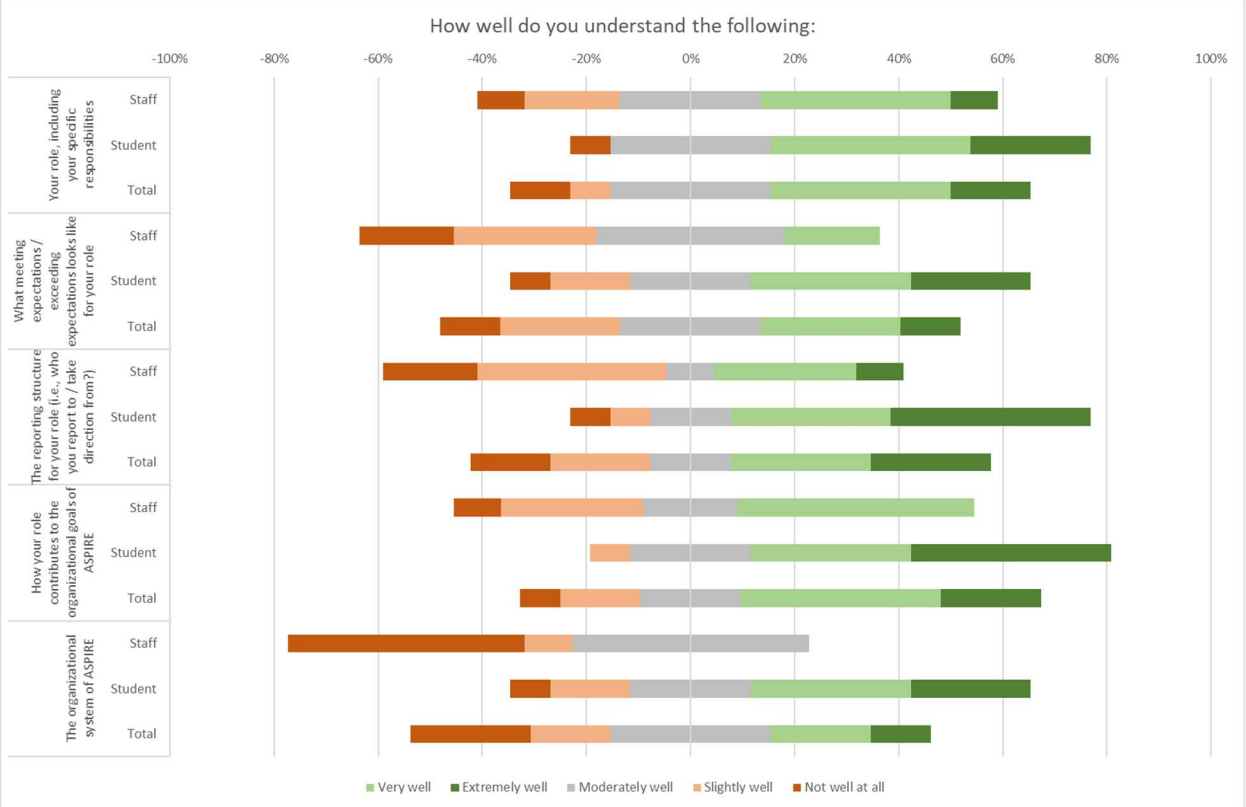
Appendix 1a: Hiring Questions

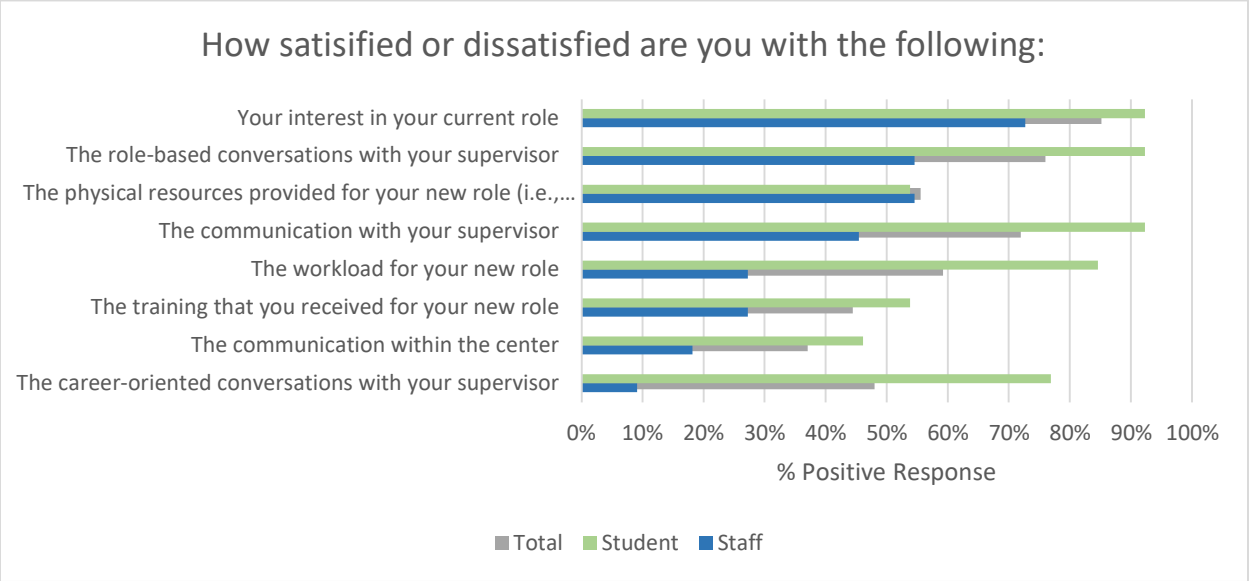


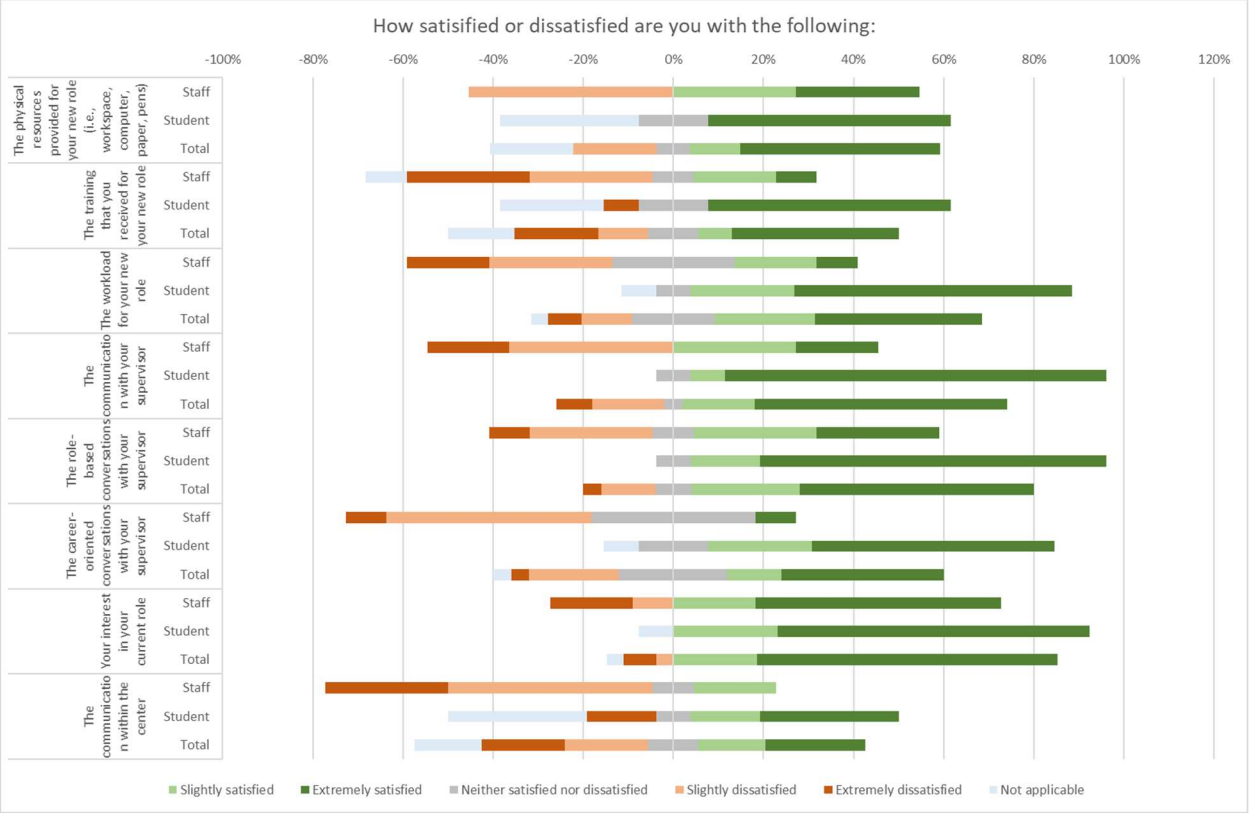


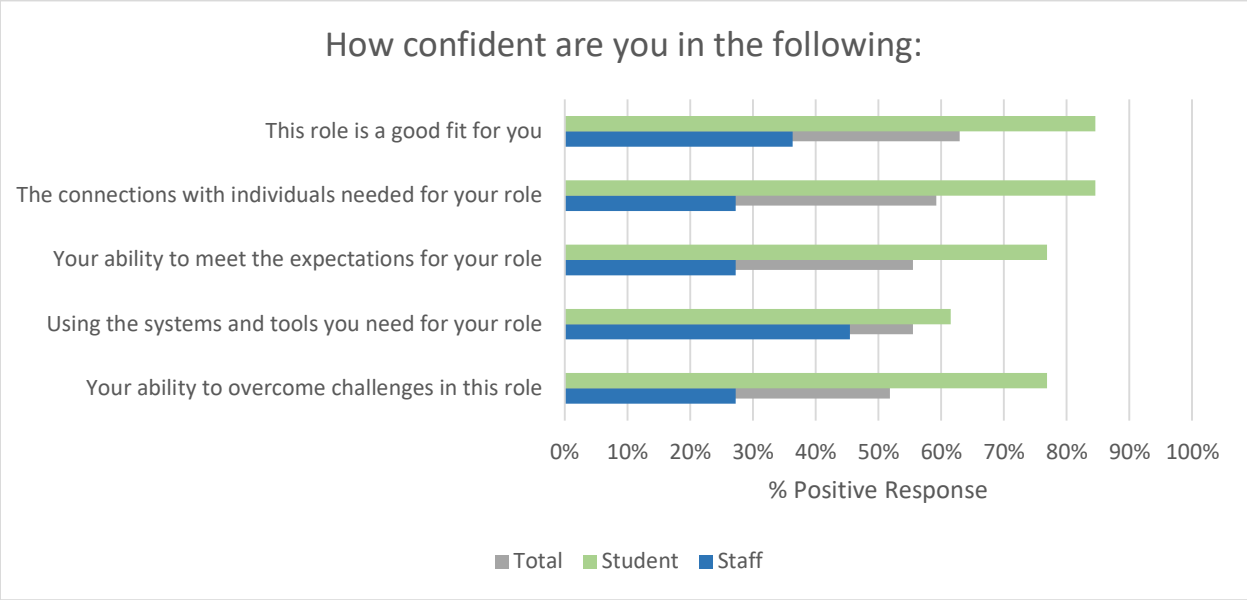
Appendix 1b: Role Training and Resources Questions

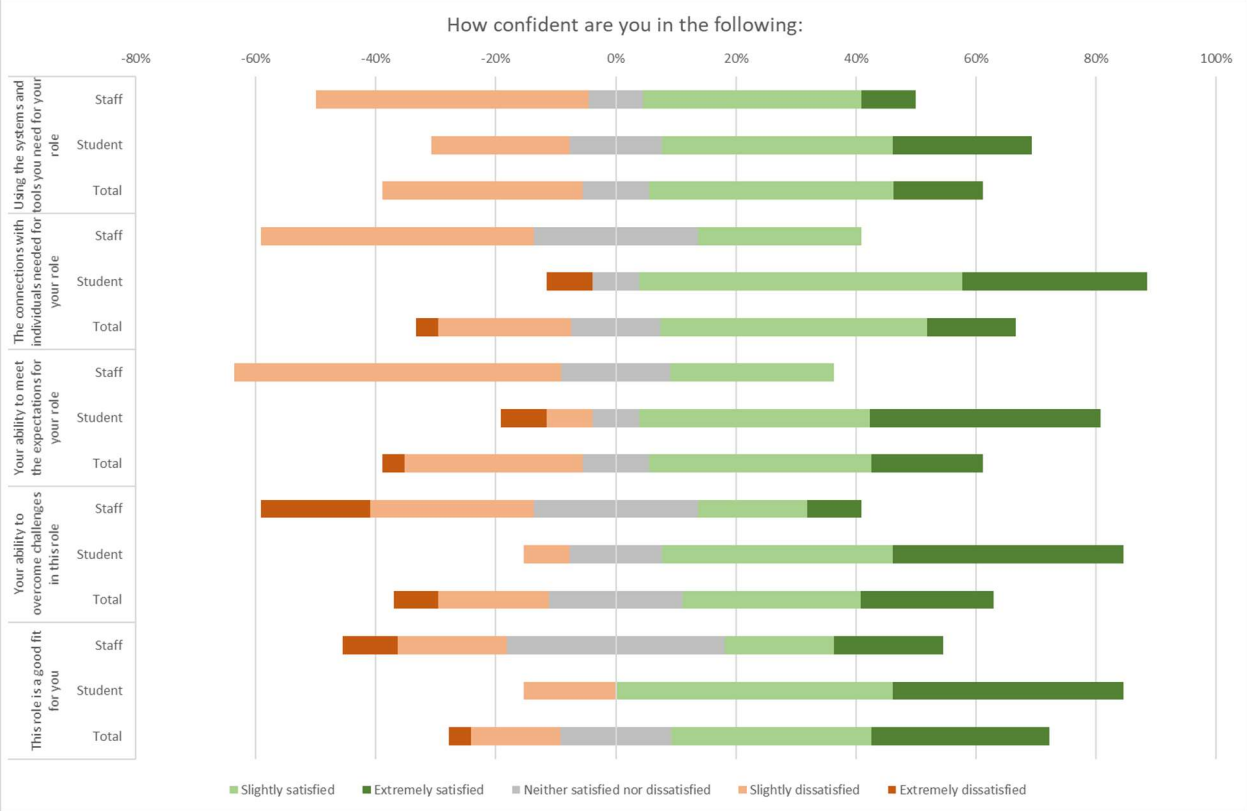




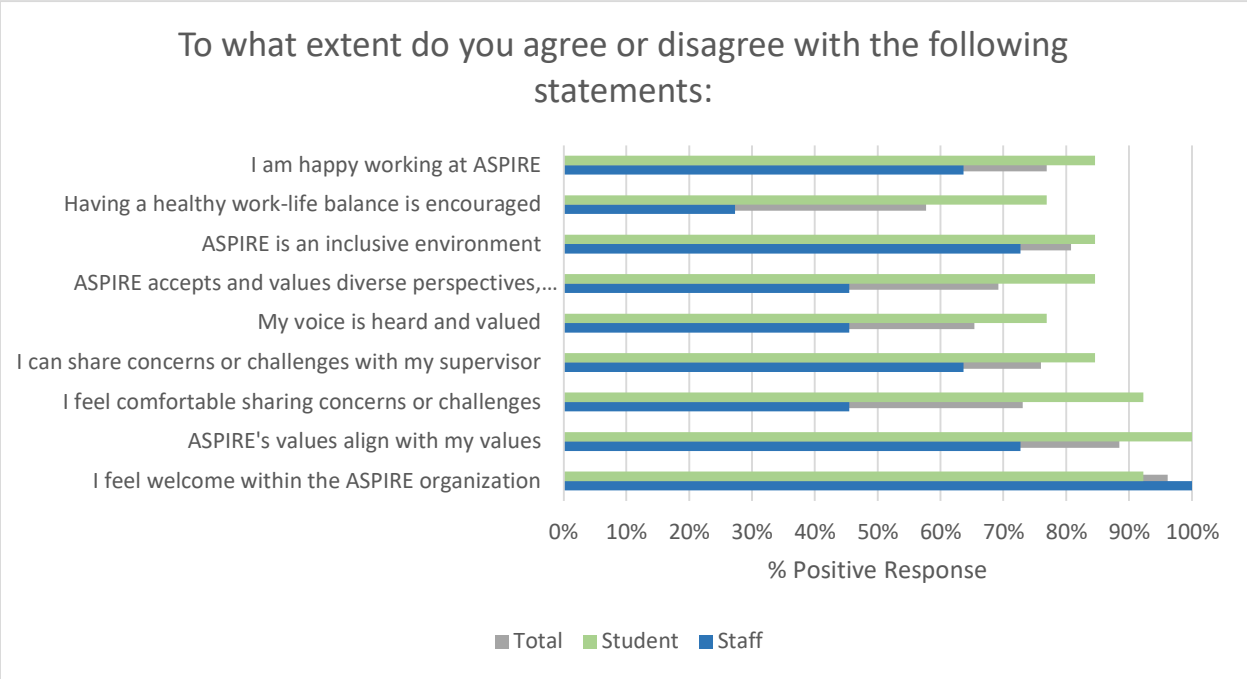

How satisified or dissatisfied are you with the following:
Your interest in your current role
The role-based conversations with your supervisor
The physical resources provided for your new role (i.e.,...
The communication with your supervisor
The workload for your new role
The training that you received for your new role
The communication within the center
The career-oriented conversations with your supervisor
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
% Positive Response
Total
Student
Staff

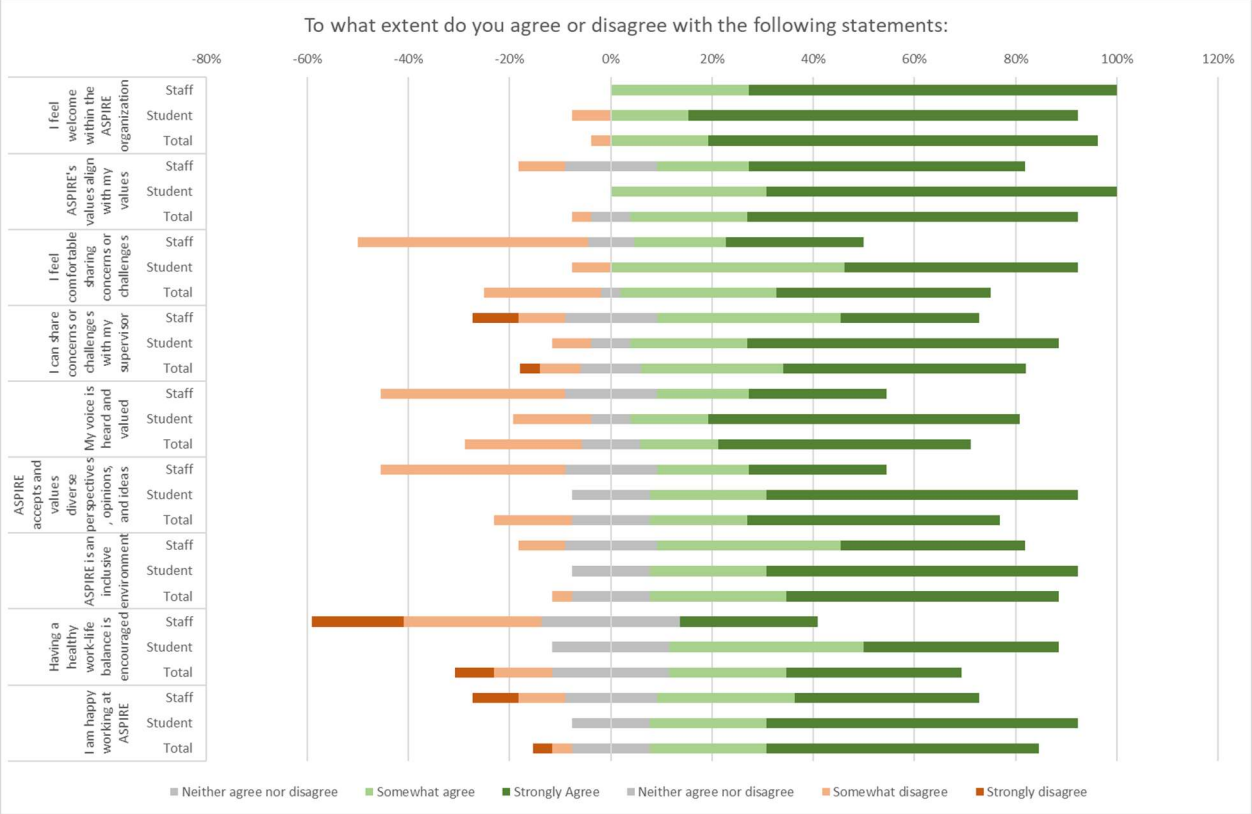

How satisified or dissatisfied are you with the following:
-100% -80% -60% -40% -20% 0% 20% 40% 60% 80% 100% 120%
The physical resources provided for your new role (i.e., workspace, computer, paper, pens)
The training that you received for your new role
The workload for your new role
The communication with your supervisor
The role-based conversations with your supervisor
The career-oriented conversations with your supervisor
Your interest in your current role
The communication within the center
Staff
Student
Total
Slightly satisfied
Extremely satisfied
Neither satisfied nor dissatisfied
Slightly dissatisfied
Extremely dissatisfied
Not applicable


How confident are you in the following:
This role is a good fit for you
The connections with individuals needed for your role
Your ability to meet the expectations for your role
Using the systems and tools you need for your role
Your ability to overcome challenges in this role
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
% Positive Response
Total
Student
Staff

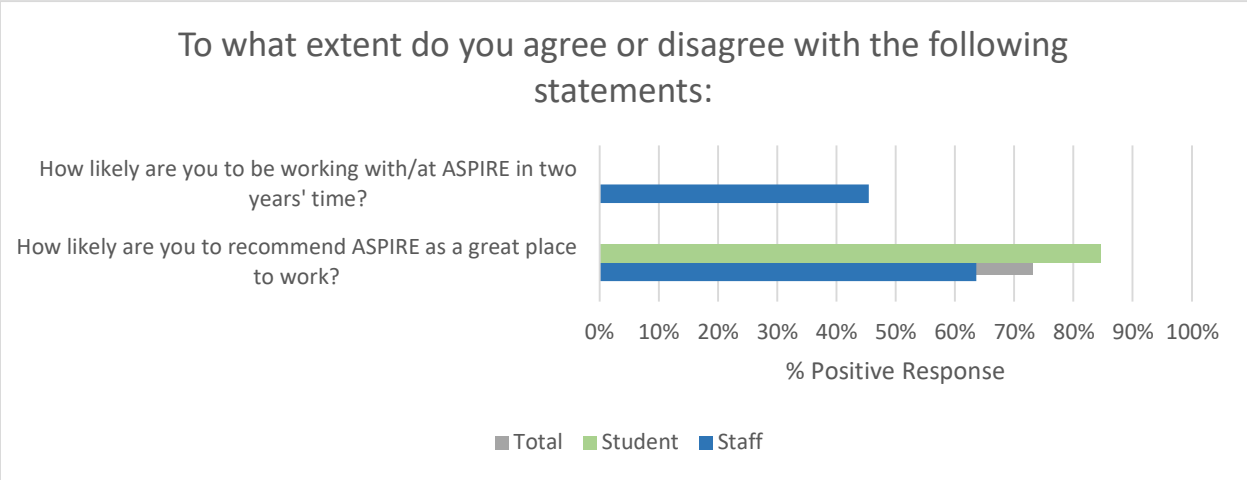

How confident are you in the following:
-80% -60% -40% -20% 0% 20% 40% 60% 80% 100%
Using the systems and tools you need for your role
The connections with individuals needed for your role
Your ability to meet the expectations for your role
Your ability to overcome challenges in this role
This role is a good fit for you
Staff
Student
Total
Slightly satisfied
Extremely satisfied
Neither satisfied nor dissatisfied
Slightly dissatisfied
Extremely dissatisfied

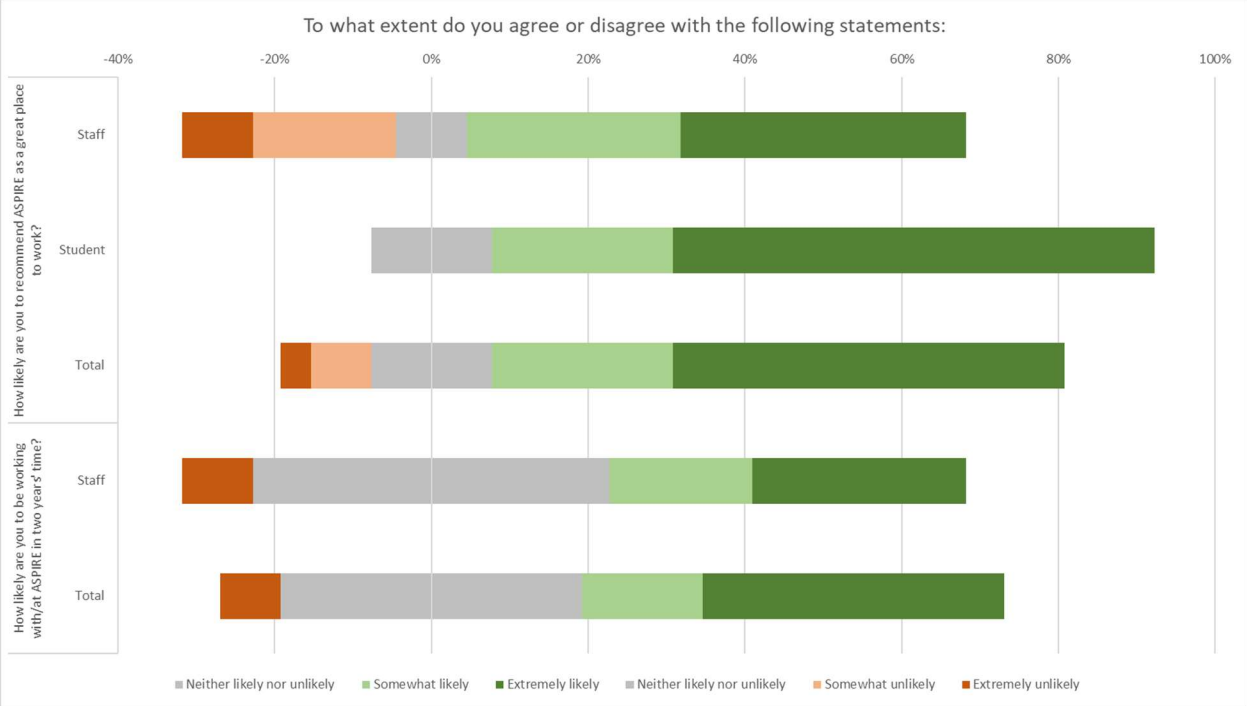
Appendix 1c: Value within the Organization Questions

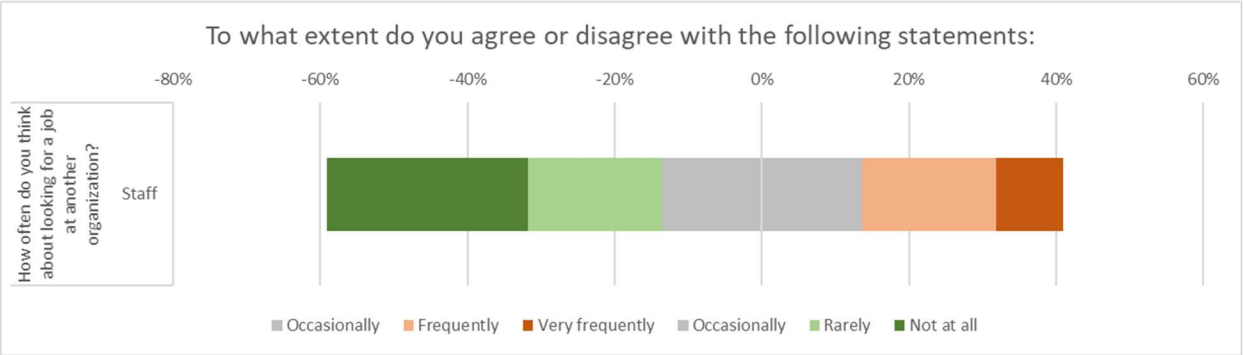




Appendix 1d: Future in the Organization Questions

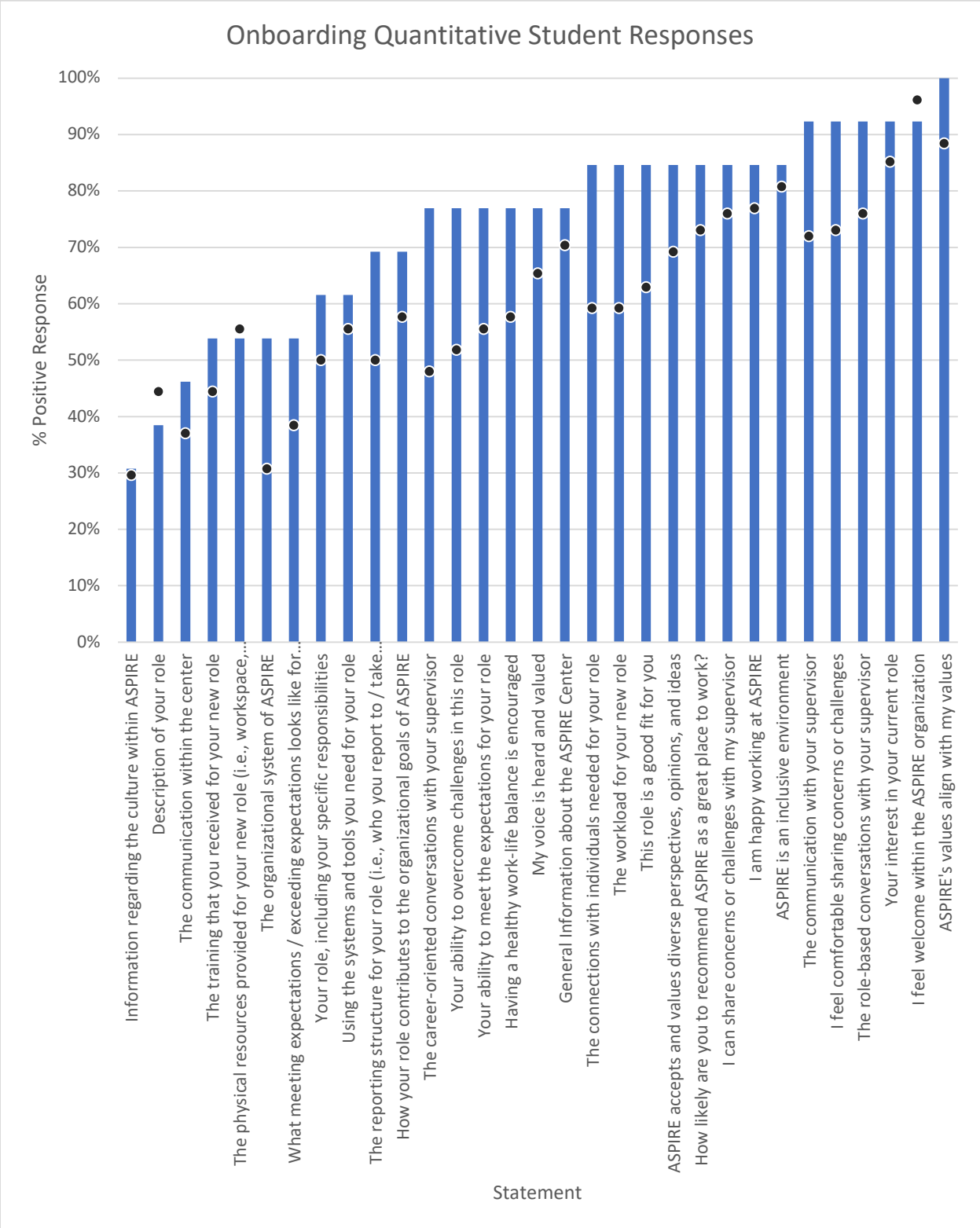




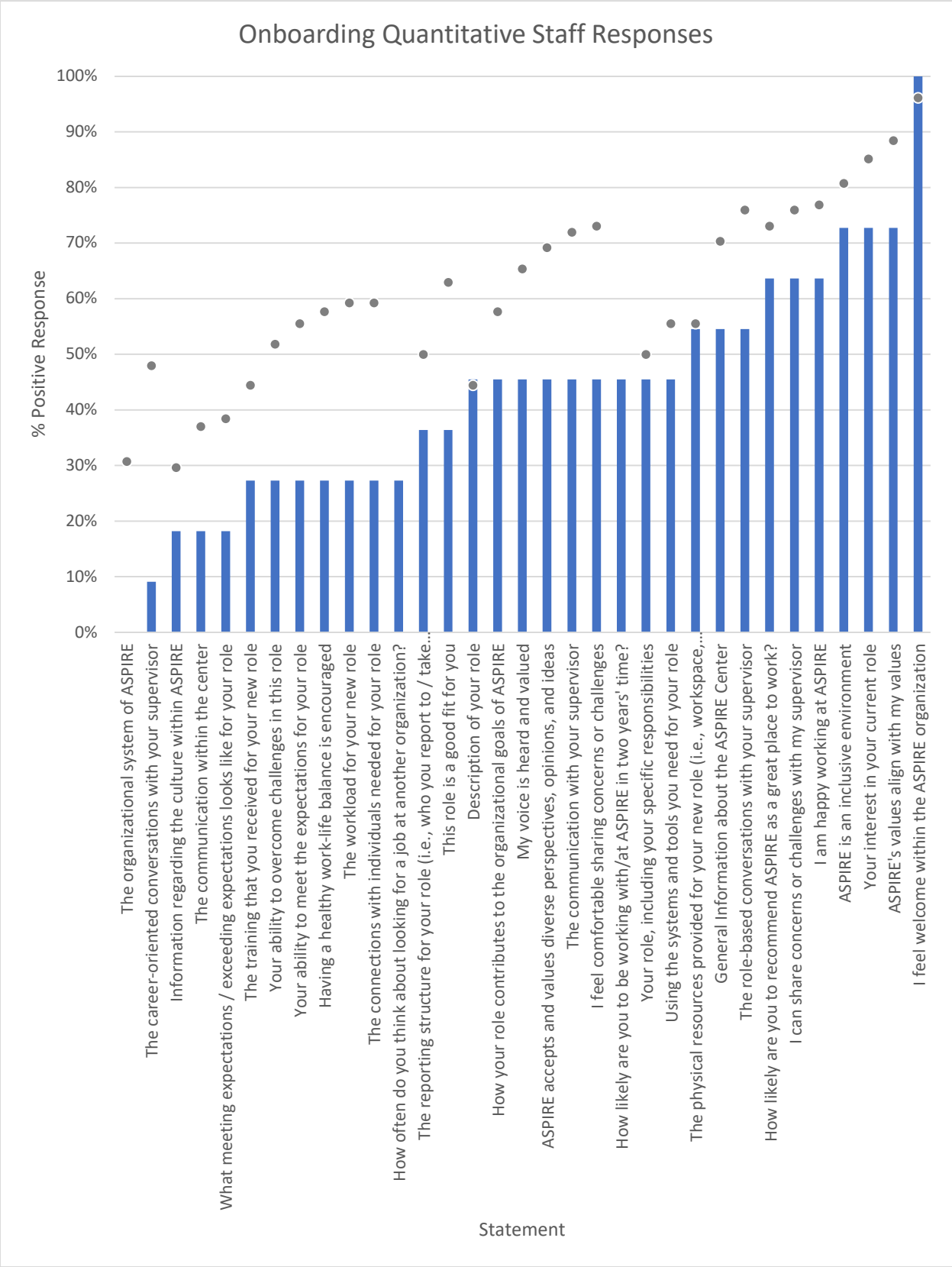


Appendix 2: Onboarding Questions for Staff and for Students

Appendix 2a: Onboarding Question Responses for Students



Appendix 2b: Onboarding Question Responses for Staff



December 2024

Appendix 3: ASPIRE Onboarding Survey Questions

ASPIRE Onboarding Survey - Staff/Post-Doc

Start of Block: Default Question Block

T1 **ASPIRE Onboarding Survey** Thank you for taking the time to complete this survey. The results will be used to improve the onboarding process for future students, staff, and faculty. **Please know your responses are anonymous and no identifying information will be shared. If responses to questions allow for identification of an individual, these responses will not be shared individually and will instead be represented in aggregate.** The survey has five sections with a total of 11 multiple choice questions and 7 open response questions (only the first three questions are required). The number of questions might be less depending on question responses. This survey should take 15 minutes to complete. **Section I**

Q1 What is your current role in ASPIRE?

- Staff (3)
- Post-Doc (4)
- Other: (5) _____

Q2 What campus do you work at primarily?

- Utah State University (1)
- Colorado State University (2)
- Cornell University (3)
- Purdue University (4)
- University of Auckland (5)
- University of Colorado Boulder (6)
- University of Colorado Colorado Springs (7)
- University of Texas at El Paso (8)
- University of Utah (9)
- Virginia Tech (10)
- Other: (11) _____

Q3 Did you start working with/for the ASPIRE organization within the last year?

- Yes (1)
- No (2)

End of Block: Default Question Block

December 2024

Start of Block: Block 1

T2 **Section 2: Hiring Experience**

Q4 During the hiring process, how accurate were the following:

	Not accurate at all (1)	Slightly accurate (2)	Moderately accurate (3)	Very accurate (4)	Extremely accurate (5)	Not applicable (6)
General information provided about the ASPIRE center (1)	○	○	○	○	○	○
Description of your role (i.e., Are you doing what you expected you'd be doing?) (2)	○	○	○	○	○	○
Information regarding the culture within ASPIRE (3)	○	○	○	○	○	○
Responses to your questions (4)	○	○	○	○	○	○

Q5 What positive experiences during the hiring process made you excited to start at ASPIRE?

_____

Q6 Is there something that could have been done to improve the hiring process?

_____

End of Block: Block 1

Start of Block: Block 2

T3 **Section 3: Role Training and Resources**

Q7 How well do you understand the following:

	Not well at all (1)	Slightly well (2)	Moderately well (3)	Very well (4)	Extremely well (5)
Your role, including your specific responsibilities (1)	○	○	○	○	○
What meeting expectations / exceeding expectations looks like for your role (2)	○	○	○	○	○
The reporting structure for your role (i.e., who you report to / take direction from?) (3)	○	○	○	○	○
How your role contributes to the organizational goals of ASPIRE (4)	○	○	○	○	○
The organizational system of ASPIRE (5)	○	○	○	○	○

December 2024

Q8 How satisfied or dissatisfied are you with the following:

	Extremely dissatisfied (1)	Slightly dissatisfied (2)	Neither satisfied nor dissatisfied (3)	Slightly satisfied (4)	Extremely satisfied (5)	Not applicable (6)
The physical resources provided for your new role (i.e., workspace, computer, paper, pens) (1)	○	○	○	○	○	○
The training that you received for your new role (2)	○	○	○	○	○	○
The workload for your new role (3)	○	○	○	○	○	○
The communication with your supervisor (4)	○	○	○	○	○	○
The role-based conversations with your supervisor (5)	○	○	○	○	○	○
The career-oriented conversations with your supervisor (6)	○	○	○	○	○	○
Your interest in your current role (7)	○	○	○	○	○	○
The communication within the center (8)	○	○	○	○	○	○

Q9 How confident are you in the following:

	Not confident at all (1)	Slightly confident (2)	Moderately confident (3)	Very confident (4)	Extremely confident (5)
Using the systems and tools you need for your role (1)	○	○	○	○	○
The connections with individuals needed for your role (2)	○	○	○	○	○
Your ability to meet the expectations for your role (3)	○	○	○	○	○
Your ability to overcome challenges in this role (4)	○	○	○	○	○
This role is a good fit for you (5)	○	○	○	○	○

Q10 What about your role and training makes you excited to continue at ASPIRE?

_____

Q11 What challenges have you encountered in your current role or in training?

_____

End of Block: Block 2

Start of Block: Block 3

T4 **Section 4: Value within the Organization**

December 2024

Q12 To what extent do you agree or disagree with the following statements:

	Strongly disagree (1)	Somewhat disagree (2)	Neither agree nor disagree (3)	Somewhat agree (4)	Strongly agree (5)
I feel welcome within the ASPIRE organization (1)	○	○	○	○	○
ASPIRE's values align with my values (2)	○	○	○	○	○
I feel comfortable sharing concerns or challenges (3)	○	○	○	○	○
I can share concerns or challenges with my supervisor (4)	○	○	○	○	○
My voice is heard and valued (5)	○	○	○	○	○
ASPIRE accepts and values diverse perspectives, opinions, and ideas (6)	○	○	○	○	○
ASPIRE is an inclusive environment (7)	○	○	○	○	○
Having a healthy work-life balance is encouraged (i.e., leaving work at the office, using your annual and sick leave) (8)	○	○	○	○	○
I am happy working at ASPIRE (9)	○	○	○	○	○

Q13 In what positive ways has the ASPIRE organization and management set you up for success in your role?

_____

Q14 How could the ASPIRE organization and management better set you up for success in your role?

_____

End of Block: Block 3

Start of Block: Block 4

T5 **Section 5: Future in the Organization**

Q15 How likely are you to recommend ASPIRE as a great place to work?

- Extremely unlikely (1)
- Somewhat unlikely (2)
- Neither likely nor unlikely (3)
- Somewhat likely (4)
- Extremely likely (5)

Q16 How often do you think about looking for a job at another organization?

- Very frequently (1)
- Frequently (2)
- Occasionally (3)
- Rarely (4)
- Not at all (5)

Q17 How likely are you to be working at ASPIRE in two years' time?

- Extremely unlikely (1)
- Somewhat unlikely (2)
- Neither likely nor unlikely (3)
- Somewhat likely (4)
- Extremely likely (5)

Q18 Is there anything else regarding your onboarding experience that you would like ASPIRE to know?

_____

End of Block: Block 4

Start of Block: Block 5 - If not Onboarded

Q19 To what extent do you agree or disagree with the following statements:

	Strongly disagree (1)	Somewhat disagree (2)	Neither agree nor disagree (3)	Somewhat agree (4)	Strongly agree (5)
I feel welcome within the ASPIRE organization (1)	○	○	○	○	○
ASPIRE's values align with my values (2)	○	○	○	○	○
I feel comfortable sharing concerns or challenges (3)	○	○	○	○	○
I can share concerns or challenges with my supervisor (4)	○	○	○	○	○
My voice is heard and valued (5)	○	○	○	○	○
ASPIRE accepts and values diverse perspectives, opinions, and ideas (6)	○	○	○	○	○
ASPIRE is an inclusive environment (7)	○	○	○	○	○
Having a healthy work-life balance is encouraged (i.e., leaving work at the office, using your annual and sick leave) (8)	○	○	○	○	○
I am happy working at ASPIRE (9)	○	○	○	○	○

Q20 What aspects of working at ASPIRE make you excited to continue as a part of the organization?

_____

Q21 What do you find challenging about working at ASPIRE?

_____

Q22 Is there anything else you would like ASPIRE to know?

_____

End of Block: Block 5 - If not Onboarded

February 2025

Onboarding Program Recommendations

Katherine Grover

Introduction

At the end of 2024, the ASPIRE Assessment Team completed an onboarding assessment in response to comments made in the MERCII survey (administered yearly). The onboarding assessment indicated a clear need for a more robust onboarding process for new ASPIRE participants. As a follow-up to this assessment, interviews were conducted with 13 different ASPIRE participants to compile a list of topics that should be included in an onboarding program. The participants interviewed represent a wide range of experience and areas within ASPIRE. The recommendations provided below are the responses received from these interviews. These onboarding program recommendations go beyond the minimum paperwork required by the hiring institution or NSF.

Recommended Topics to Include in an Onboarding Program

ASPIRE Overview

- **ASPIRE Mission and Vision** – Video welcoming new participants and explaining ASPIRE's mission and vision. Explains the reasoning behind what we are doing and why.
    - Additionally, the first 1-2 recorded lectures of ASPIRE 101 would be a great addition
- **ASPIRE Organization** – Explains the organization of ASPIRE
    - *Arms of ASPIRE* – List of the different functional arms of ASPIRE and how these components interact
        - *NSF* – Explanation of project/ task topics and organization
        - *Current Associated Projects* – Explanation of the projects, deliverables, and timeline
        - *Stakeholders* – List of current stakeholders, what they do, how and when to interact with them, and what the partner ecosystem looks like
    - *Funding* - Explanation of the ASPIRE center funding and how it impacts daily work
    - *Photo Directory of ASPIRE Participants* – A list of photos of participants (at least the ASPIRE employees) and a brief list of responsibilities and contact information
    - *Organization Chart* - Shows the organization and reporting lines for ASPIRE personnel
- **ASPIRE Campuses** - Explains the different campuses affiliated with ASPIRE, campus interactions, and campus director for each campus
- **ASPIRE Participant Benefits** – Shows the benefits of being an ASPIRE participant (i.e., the benefit of involvement in the ASA for students or benefits of ASPIRE involvement for faculty)
- **ASPIRE Involvement** – Covers ways participants could and should be involved in the center.

  - *Regular Meeting Expectations* – Explains the purpose, occurrence pattern, and attendance expectations (Center-wide, REDI Directors, Project meetings, Innovation Exchanges)
  - *ASPIRE Yearly Timeline* - A calendar of reoccurring events and deadlines throughout the year with an explanation of what the events are and the expectations around those events (what is required/optional)
  - *Optional Involvement* – Activities Team events, book club, ASA, SLC, Power Electronics Society
- **ASPIRE Center Communication** – Explains how the center will communicate with participants and the expectations surrounding that communication.
- **ASPIRE Culture** – Explains the cultural elements within the center
  - *Confidential Reporting Form* **–** Explanation of / link to Conflict Reporting & Title IX forms
    - Include the list of campus directors as resources in these situations
  - *Professional Environment Guide* - expected dress, how to collaborate, normalize common struggles (i.e., feeling overwhelmed), when and how to communicate concerns, how to get information or questions answered, not using company resources for personal use
  - *Healthy Work Environment* – Guide on a healthy work-life balance, healthy work communication tips, healthy work practices (i.e., avoid scheduling same-day meetings)

Role Specific Training

- **Reporting Line and Support**
  - *Reporting Line/Direction* – Explain the reporting line for this role and who can give this role direction/assignments without approval from the direct supervisor
  - *Work Time Expectations* – Explain what the expectations are for work time and location
    - Explanation of timecards for this role
    - Vacation / sick time – Availability, accrual, and how to request and use
    - List of organization holidays and where to find them going forward
  - *Role Support* - Help participants identify where to go for support when overwhelmed, struggling, or have concerns; how to deal with unknown or new situations; who to go to when experiencing technical issues
- **Role Responsibilities and Priorities**
  - *List of Role Responsibilities* – Explain what responsibilities fall mainly on this role and clarifies how this role lends support to other projects; how this role fits in the ASPIRE organization
  - *Role Expectations* – Explain what meeting/exceeding expectations look like
  - *Task Priority* – Help the participant understand the priorities of different tasks & timing
  - *Required Reporting* – Explain what reports will be expected and when (project reports, task reports, updating Click-Up, proposals, performance review requirements, etc.)
  - *Required Training for the Role* – Explain what trainings are needed for this role and how often this training occurs

  - *Role Best Practices* – Best practices around different role elements such as requesting letters of recommendation from stakeholders, scheduling meetings, keeping a list of current projects/assignments
- **Close Associates/Team** –
  - *Meeting Close Associates/Shadowing* – Help the new participant set up and meet with close associates; Allow time for the new participant to shadow a close role or area
  - *Team Meetings* – Define the teams this role works with and the team meeting schedule

USU Specific Training

- **EVR Building and Power Lab**
  - *Tour* – In-person tour (virtual option) of facilities, explanation of building security/access protocols, supply locations, explanation of facility use and expectations (i.e., breakroom)
  - *General Lab Safety* – General safety information and expectations for lab spaces (i.e., organization and cleanliness)
  - *Building Reference Guide* – Provide accessible information such as building open and locking times, building visitor guidelines, how to get items printed, parking information
- **USU Specific Resources** – Provide a list (and location) of the resources available at USU to ASPIRE participants.
  - Exempt vs. Non-Exempt Explanation
  - Required yearly training
  - BeWell Rewards Program
  - Service Now Forms
  - Mitel
  - Learning Resources - LinkedIn Learning, Library

Resources & Processes/Procedures

- **ASPIRE Resources** – Includes the list of resources for participants to access
  - *Example of a poster for poster sessions*
  - *SLC and ASA –* Information about the SLC and ASA groups on each campus
  - *Acronym Guide –* List of the acronyms used frequently in the ASPIRE center, the meaning and context
  - *Graphic of a wireless charging system –* With all the parts labeled
- **Purchasing and Supplies**
  - *Purchasing Directions –* Document with instructions including rules on how to use a P-card, etc.
  - *Purchasing Requests –* How to submit a purchasing request for items like lab supplies
- **Requests**
  - *Travel Requests* – Explanation of what is required when a participant travels, how to request a TA, etc.
  - *Building Access* – Instructions on how to request access for new participants
- **Software/Websites –** Provide a list of available software resources, uses, access information, and how to use the software

- *ClickUp*
- *Twist*
- *ASPIRE Account*
- *NSF Required Reporting*
- *Outlook and Excel helpful tips*
- *Box Guide*
- *Others* (Tucker would be a great resource for what other software to include)

Additional Recommendations for the Onboarding Program

- Use a wide variety of training formats (i.e., videos, documents, online resources, in-person)
- Include enough information to ensure a clear understanding of responsibilities and expectations to enable employee accountability
- Find ways to automate the process (such as automatic email after an account is created)
- Identify who is responsible for ensuring each portion of the process is completed
- Create different tracks for different types and locations of participants
- Provide time for the new participant to complete the onboarding process before handing off all role responsibilities
- Identify spaces where participants can continue to ask questions and seek training/support once the onboarding process has been completed
- Provide continuing learning opportunities (such as pilot project field trips) for all continuing participants.

Conclusions & Recommendations

The above recommendations encapsulate the feedback received during the interviews. Those interviewed expressed valuable insights that can help shape a robust and effective onboarding program. As this feedback is not exhaustive, center leadership may have additional insight into additions or adjustments. The request for explanation around the ASPIRE mission, vision, and organization would impact onboarding for all participant types so it is recommended as one of the top priorities. Additional suggested priorities include onboarding around the individual role as well as providing a repository of resources. The ASPIRE assessment team will continue to assess onboarding and evaluate the effectiveness of the changes made by leadership in response to these suggestions.

February 2025

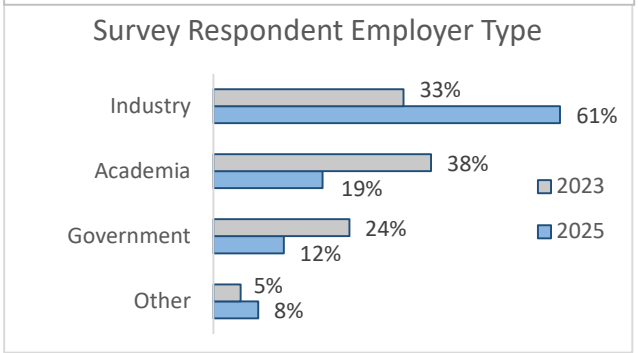
2025 CERV Conference Assessment

ASPIRE Assessment Team

CERV Conference Survey Administration

The CERV Conference survey was administered at the 2025 CERV Conference held in February 2025. Of the over 190 registrants, 90 survey responses were received. This showed an increase in responses compared to the 63 received in 2023. Most participants learned of the conference from a colleague, similar to what was observed in 2023. The primary job function for most respondents was in research & development with additional representation from program management along with other job functions (similar to 2023). The respondents represented a variety of employers though there were more responses from industry in 2025 than in 2023(see Figure 1).

Figure 1: Employer Type of CERV Survey Respondents



Conference Feedback

Conference Satisfaction

Of those who responded to the survey, 96% indicated they were satisfied with the CERV conference, slightly lower than the satisfaction expressed in 2023 (98%). Additionally, the percentage of respondents who agreed with a series of satisfaction statements decreased from 2023 (see Table 1).

Table 1: CERV Participant Agreement with Satisfaction Statements

Agreement Statement	2023 – % Agreed	2025 – % Agreed
the conference was valuable	97	91
the conference met my expectations	97	91
the panel sessions met my expectations	95	89
I would recommend the conference to others	97	89
I plan to attend next year's conference	92	91

The top reasons for conference attendance remained the same from 2023 with the top three reasons being maintaining contacts and interacting with peers (networking), investigating new technologies (state-of-the-art), and increasing general awareness and understanding. Additionally, survey participants indicated the most important aspects of the CERV conference were the technical presentations on various topics and the mix of government, industry, and academic presentations. This feedback was reinforced through the qualitative responses. The comments included the value of networking, the quality of the presentations, the opportunity to learn from experts in the field, and the variety of presenters and attendees.

2025 Conference Recommendations

Survey respondents also had suggestions for future CERV conferences. Connecting with other attendees was the number one reason marked for conference attendance and survey respondents requested more time for this networking. Attendees suggested lengthening the conference to two full days, having more breaks, and holding fewer sessions each day. Respondents also requested less content each day as they felt there was too much information to absorb in a short amount of time.

Feedback also suggested a continued balance of session topics across the conference with some responses indicating that this conference was light on technical updates. Attendees also recommended having more government agencies (DOE, DOT, EPA, FHWA), policymakers, vehicle manufacturers, fleet operators, and electric vehicle OEMs represented at the conference.

Regarding conference logistics, respondents requested access to the slides on their laptops (or the conference app) as the slides were difficult to see from the back. Additionally, the conference room was cold for some participants.

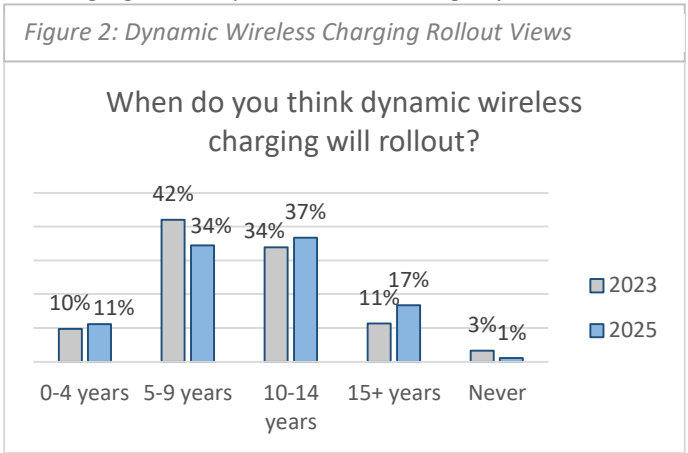
Additional Participant Electrification Perspectives

In addition to gathering feedback for the CERV conference, the CERV conference survey gauged participants' views on different areas of electrification.

Timing and Barriers to Electrification

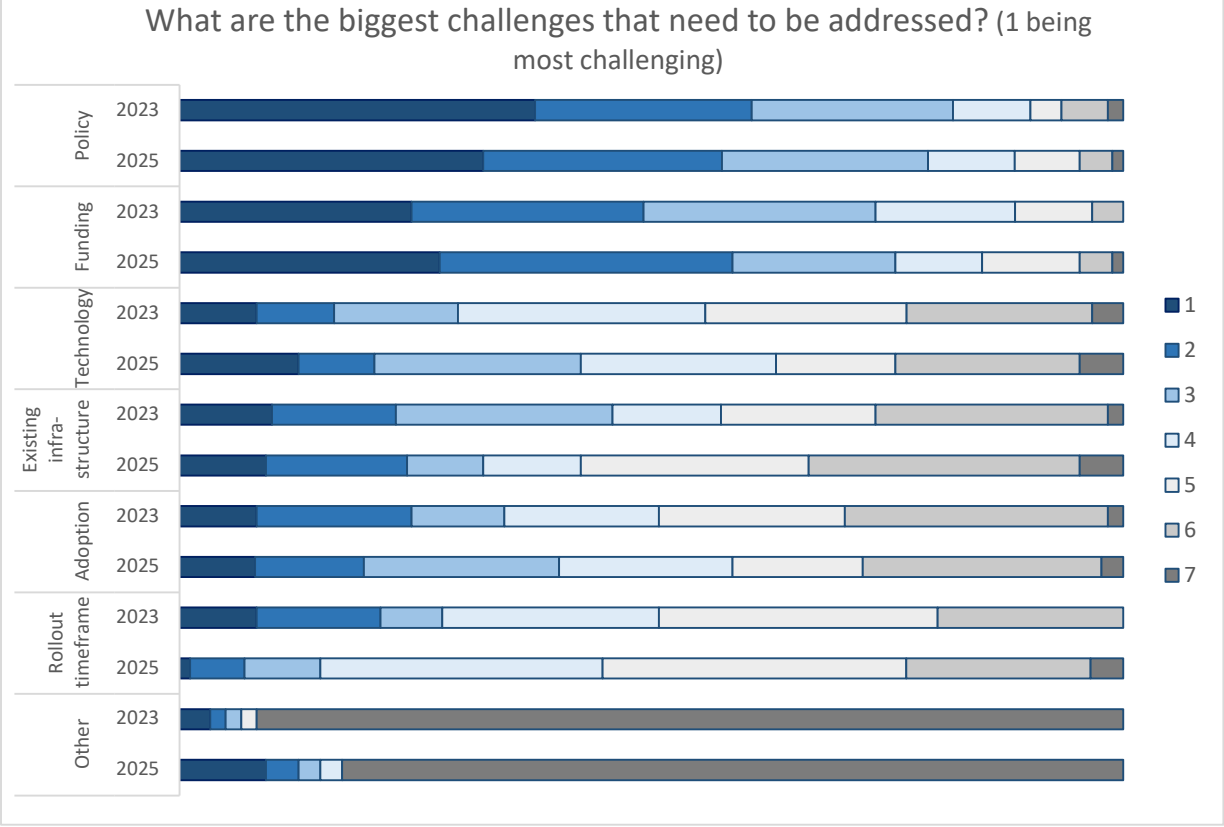
The survey explored respondents' perspectives on rollout timing for different technologies and the challenges associated with this rollout. When asked "When do you think static/stationary wireless charging will roll out?", the responses remained roughly the same from 2023 with around 60% selecting 0-4 years, 30% selecting 5-9 years, 6% selecting 10-14 years, and the rest selecting 15+ years. When asked the same question for dynamic wireless charging, the responses differed slightly from 2023 with fewer responses for 5-9 years and more for 10-14 years and 15+ years (See Figure 2).

Figure 2: Dynamic Wireless Charging Rollout Views



When asked to rank the biggest challenges in this space, responses were similar to 2023 with the top three ranked barriers being policy, funding, and technology (see Figure 3).

Figure 3: Ranking Challenges around Wireless Charging



Participant Interviews

In addition to the CERV conference survey, the ASPIRE assessment team conducted 27 individual interviews with conference participants. The individuals who participated in these interviews represented industry, academia, and government.

Electrification Workforce Development

The individual discussions focused on organizational practices around workforce development, especially within the electrification area. When asked what credentials and skills these organizations look for when hiring, the answers varied. Most responses indicated a four-year degree is required for any engineering position. Beyond that, various technical skills and knowledge were listed but varied based on the position. Interviewees were asked how their organization helps current employees gain new skills around electrification. The results showed no consistent pattern, with some entities conducting internal training and development. Others utilize external training or have no clear training path for current employees. Similarly, no consistent practices were identified when exploring how organizations estimate their upcoming workforce needs. When looking to fill an open position, organizations utilize differing methodologies. Some organizations look internally primarily to fill

positions while others rely heavily on networking outside the organization. Some mentioned internships or career fairs as a good source.

The results indicated a need for further investigation into workforce development to better identify trends. Therefore, the results of these interviews have been handed off to the ASPIRE Electrification Workforce Development team for further investigation.

Perspectives of the ASPIRE Engineering Research Center.

Lastly, participants were asked what they knew about the ASPIRE organization. While some interviewees had been involved with ASPIRE for many years, others had only been acquainted with the organization for a short amount of time. Most comments were positive and complimentary of the work done by the center. Many mentioned the individual connections with ASPIRE personnel and their attendance at other ASPIRE events. Comments included that the center was the best and was at the forefront of the field. Those newly acquainted with ASPIRE expressed a desire to continue the association.

Conclusion

Both the CERV conference survey and interviews provided valuable information. The feedback from the conference was very positive and helpful suggestions were given to improve the conference moving forward. Additionally, the perspectives gathered around electrification and workforce development are helpful to the work of electrified transportation.

March 2025

Student Internship Assessment

Katherine Grover and Melanie Conrad

Introduction

At the request of ASPIRE Leadership, the Assessment Coordinator and Student Engagement Coordinator conducted an assessment around student internship engagement. A combination of focus groups and individual interviews were conducted with 30 students, 3 faculty, and 4 staff to explore the level of participation in internships, the barriers students experience, and the level of support students receive from faculty, staff, and university resources. Additionally, 27 prospective employers were interviewed at the Biennial Conference on Electric Roads & Vehicles (CERV) Conference in February 2025 to learn the best way to connect ASPIRE students to internships and jobs.

Internship Assessment Results

Participation in Internships

Of the 30 students who were interviewed, 20 percent (6 students) had participated in an internship. Other students within the lab groups had obtained internships but those students were not present at the time of the focus group/interview.

Barriers Students Experience Around Internships

Students reported encountering many barriers when seeking an internship. These barriers include:

- A desire to remain in the area and with ASPIRE as there is no guarantee of a job when they return
- Tough job market (hundred of applications per position)
- Inconsistent internship practices, such as timing of internship opening, time lapse between application and notification, and not providing contacts for follow-up
- AI and search algorithms
- Lack of motivation and effort due to poor feedback from others who have completed internships and the time/energy required to go through the process
- Difficulty around international student sponsorships and restrictions
- Don’t have experience but can’t get experience until they get a job/internship
- Graduate programs don’t typically allow time or space for internships without impacting graduation timing.

Internship Support and Resources

The assessment also explored the support students receive when seeking internships. When asked whether their faculty or staff supervisors encourage them to seek internships, the results were mixed. Some felt their supervising faculty and staff were encouraging and helpful around internships. Others reported receiving no encouragement and even some resistance from supervising faculty and staff.

When asked what support are offered to students, the faculty and staff feedback was also mixed. Some strongly encouraged their students to pursue internships and assisted by reviewing resumes. Others referred students to university resources. Some faculty commented they don't encourage them as the research needs to be completed.

Students reported using multiple resources when seeking internships. These included university resources such as career fairs, resume reviews, classes, and faculty. The perspective of the effectiveness of these resources was mixed among the students. Some expressed irritation at the amount of work required to utilize these resources and apply for internships. Instead, students liked applying on LinkedIn with the apply button as it takes little effort. Additionally, students relied heavily on other resources such as AI, YouTube, and peers.

Potential Employer Feedback

At the CERV 2025 conference, 27 potential employers were interviewed. When asked the best way for ASPIRE to connect our students to their organization, they suggested that students:

- Network with industry at events like the cohort trips, annual meetings, poster sessions, and through projects and then utilize these connections in the internship application process
    - Industry suggested making the annual meeting networking session more like a job fair with the correct people there (both students and industry personnel with hiring power)
- Need to apply in the system like everyone else and make sure to use the keywords used in the job description (All applicants must apply the same way as all jobs are equal opportunities)
- Take time to learn and use standard job searching etiquette such as: using polished and customized resumes/cover letters unique for each application, not using AI, practice interviewing skills, and send thank you emails after the interviews.

Recommendations and Conclusion

The assessment feedback highlights a misalignment of the expectations of the students and the potential employers. Students desire to have the potential employers recruit them and have clear pathways created for them to obtain internships, rather than seeking the internships. Employers made it clear the students have to pursue the opportunities and go through the same process as all the other applicants. Based on this misalignment and the suggestions gathered, there are several recommendations on how to improve internship participation, if this is a goal of the center. First, help educate the students on their responsibility in acquiring internship and employment, including the work expected by potential employers, and the common practices and timeframes. Students could also be better connected with resources to help them learn skills such as networking, resume and cover letter writing, utilizing connections made, and interviewing. Secondly, the ASPIRE center could work to create more developed connections and pathways to internships with industry partners. Additionally, the center could work to make ASPIRE events (such as the annual meeting and technology showcases) more effective networking opportunities by inviting both students and industry representatives with involvement in hiring. Overall, while the responsibility to obtain internships falls mainly on the students, ASPIRE can help create learning opportunities and networking options.

March 2025

SLC Cohort Survey Feedback

Katherine Grover & Melanie Conrad

Introduction

The Student Leadership Council (SLC) Cohort program provides students who serve in SLC positions across the ASPIRE campuses to visit industries involved in the work of electrification. During the ASPIRE Engineering Research Center's Year 5, one SLC cohort trip was held in March 2025 in Raleigh, North Carolina and Atlanta, Georgia. Over the week, the students visited eight different organizations, including the EV Braintrust Think Tank, Southwire, and NC State FREEDM Center. At the conclusion of the trip, students were sent a survey to assess their experience on the trip. The survey contained a mixture of quantitative and qualitative questions. During this cohort trip, 10 students participated in the cohort trip while 2 were unable to attend. Those who did not attend explained they missed the trip because of family issues, as well as other conflicts and a lack of alignment with research interests. Of these twelve students, 11 survey responses were received. The responses, both quantitative and qualitative, are available for review in the appendix.

Quantitative Survey Responses

Satisfaction Responses

Students responded to a series of questions that measured their satisfaction of the logistics of the cohort trip. These results are shown in Figure 1. All students were satisfied with the amount of time given to prepare and the staff representative and faculty mentor who attended. There was room for growth around the level of communication of trip details and the communication of the objectives of the program. The area that showed the most opportunity for growth was the variety of topics and disciplines covered during the trip. This was also strongly expressed in the qualitative questions.

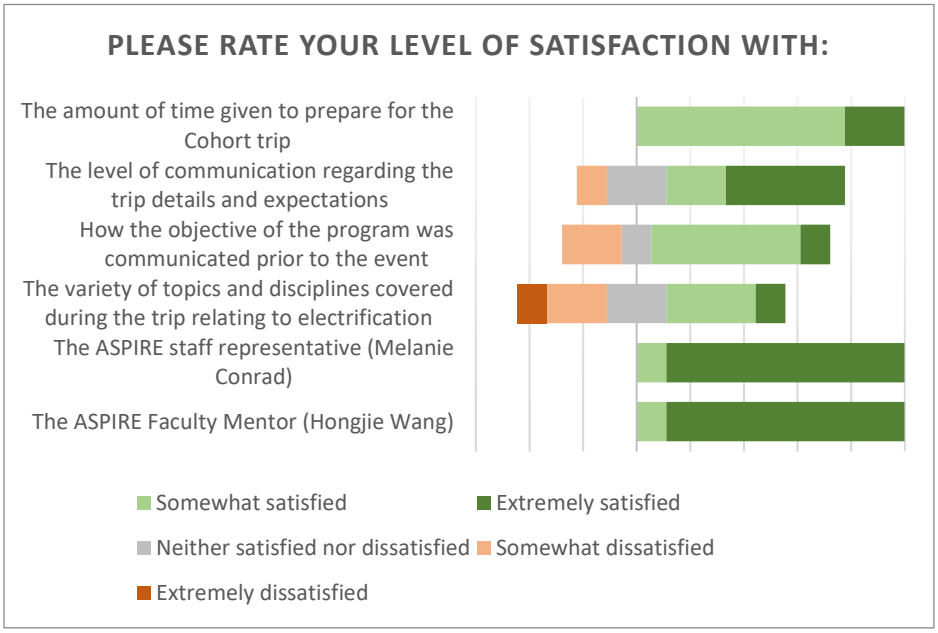


Figure 1: Student Satisfaction in Cohort Trip Logistics

Site Visit Satisfaction Responses

Additionally, students rated their satisfaction with each site visit (See Figure 2). All students expressed they were extremely satisfied with the site visit at Southwire. Additionally, all students were satisfied with the NC State FREEDM Center, which started as an NSF Engineering Research Center. Students commented they found this site very valuable in helping understand how ASPIRE 2.0 could function. Quanta Technology received the lowest satisfaction.

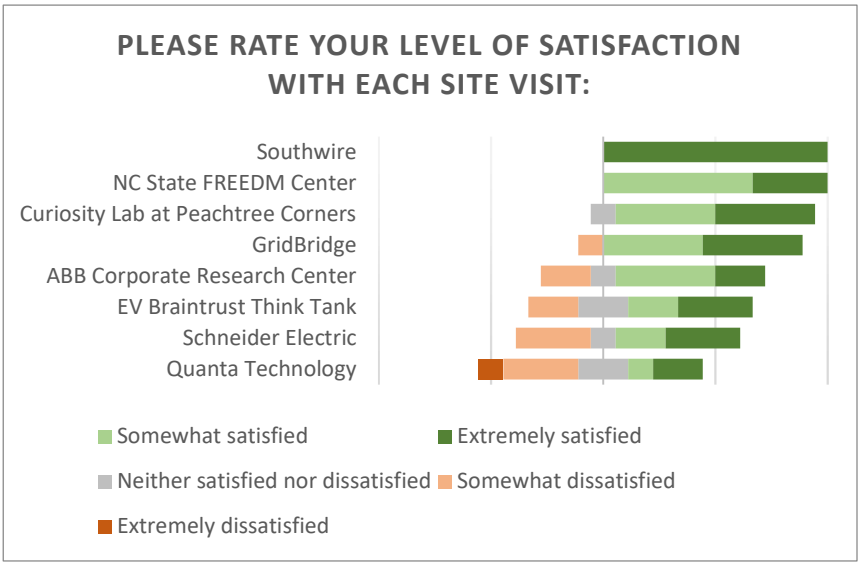


Figure 2: Student Satisfaction by Site Visit

Importance of Gaining Industry Perspectives and Connections with Industry Professionals

Students were asked to indicate how much the cohort trip helped improve their understanding of the importance of gaining industry perspectives. Of the 9 students who attended the cohort trip, 7 reported a great improvement in understanding, 1 reported moderate improvement, and 1 reported their understanding was somewhat improved (see Appendix 1B).

Additionally, students rated their satisfaction with the connections made with industry professionals during the cohort trip. Of the 9 responses, 2 were extremely satisfied, 6 were somewhat satisfied, and 1 was extremely dissatisfied. The dissatisfied student indicated in the qualitative follow-up question the industries visited were not related to their particular field of study (see Appendix 1C).

Qualitative Responses

In addition to quantitative questions, the survey included five qualitative questions to provide space for elaboration on quantitative responses as well as expressing valuable takeaways and suggestions for future cohort trips. The feedback from these responses was very robust and consistent themes were observed for both benefits and growth opportunities.

SLC Cohort Program Value and Benefits

The student's responses were very positive and expressed the value of the cohort program. They expressed gratitude for the experience and encouragement to continue to provide this opportunity to future students. These themes identified are listed below.

Broadened Perspective and Understanding

Through the cohort trip, respondents indicated they gained a broader perspective and deeper understanding of the following:

- The electrification ecosystem and ASPIRE's crucial role, strengths, and opportunities for growth
- The importance of developing a multi-disciplinary mindset and the valuable experience of working within multi-disciplinary teams
- The crucial synergistic collaboration between academia and industry, how knowledge/technological innovation flows between these entities, and the gaps that exist
- The variety of work cultures that exist and the importance in finding the right culture when searching for employment
- The complexity of implementation of electrification solutions and how research is translated into real-world applications
- The diverse potential career and research opportunities available after graduation

Value of Professional Skills

Through their attendance, the students felt they gained a better understanding of the need for professional skills such as:

- Being ready to present and engage effectively with audiences
- Understanding how to network and provide an engaging elevator pitch
- Utilizing effective interviewing and communication skills to obtain employment
- Working within professional teams

Additionally, the SLC indicated they were provided an opportunity to develop these skills through:

- Conducting an effective SWOT analysis
    - ***Students indicated they would not be able to conduct a SWOT analysis effectively for NSF without this vital experience***
- Developing connections and working relationships with the other SLC members
- Fostering effective connections with industry members
- Formulating engaging questions utilized during industry visits

Deeper Understanding of Industry and Industry Perspectives

Another benefit of the cohort trip was the opportunity to develop a greater understanding of the industry environment and industry perspectives including:

- How ASPIRE can better partner with industry to develop a thriving system
- The cutting-edge research being conducted in industry (as well as academia)
- The unique challenges and functions of industries and how these shape the work including finance, scalability, cost-effectiveness, regulatory requirements, and market demand
- How industry perspectives differ from academia
- How best to network and interact with industry (in interviews, partnerships, internships, etc.)

SLC Cohort Program Growth Opportunities

In addition to communicating the value of the cohort program, the students also identified growth opportunities for future cohort trips. These suggestions are found below.

Logistical Adjustments

Students provided suggestions to changes for the trip logistics. In some of the areas, the suggestions were mixed and didn't have clear consensus. Suggestions included:

- Having a more diverse group of site visits to cover a larger number of fields of study as well as more visits with policymakers, non-profits, etc. (most consistent suggestion)
- Engaging both an academic mentor and an industry mentor for each trip
- Having shorter visits to allow for more visits and have more lunches with companies to provide networking opportunities
    - Others suggested having fewer but longer visits
- Continuing to visit multiple states in one trip as it allowed for gaining perspectives from multiple cities/governments
    - Students on other trips have expressed visiting multiple states was very tiring
- Provide training/encourage the SLC to prepare their own elevator pitches prior to travel

SLC Inclusion in Cohort Trip Preparation

The students expressed an interest in being more involved in the planning of the cohort trip. The feedback suggested the SLC perform the following:

- Help with the selection of the organizations to be visited
- Provide the companies with an explanation of who ASPIRE is, the objective of the site visit, and information regarding the background of those that will be visiting
- Research the companies prior to the visit, present this research to all participating students, and then gather questions prior to attending
- Develop a mechanism for the SLC to follow-up with the organizations and contacts after the trip
- Present what they learned to each of their campuses (students expressed this was critical)

Conclusions & Recommendations

This cohort trip provided extremely robust responses in comparison to other cohort trips. The value of the cohort program, both for the center and the individual student, was strongly communicated and gratitude was expressed for the opportunity. Therefore, it is recommended this program continue for student leaders and other active ASPIRE student participants. The recommended improvements for future cohort trips include visiting a more diverse group of organizations, including both an academic and industry mentor, and allowing the SLC to take a more active role in the preparation for the trip.

March 2025

Appendices:

Appendix 1: Quantitative Responses

Appendix 1A: Student Responses to Satisfaction Questions

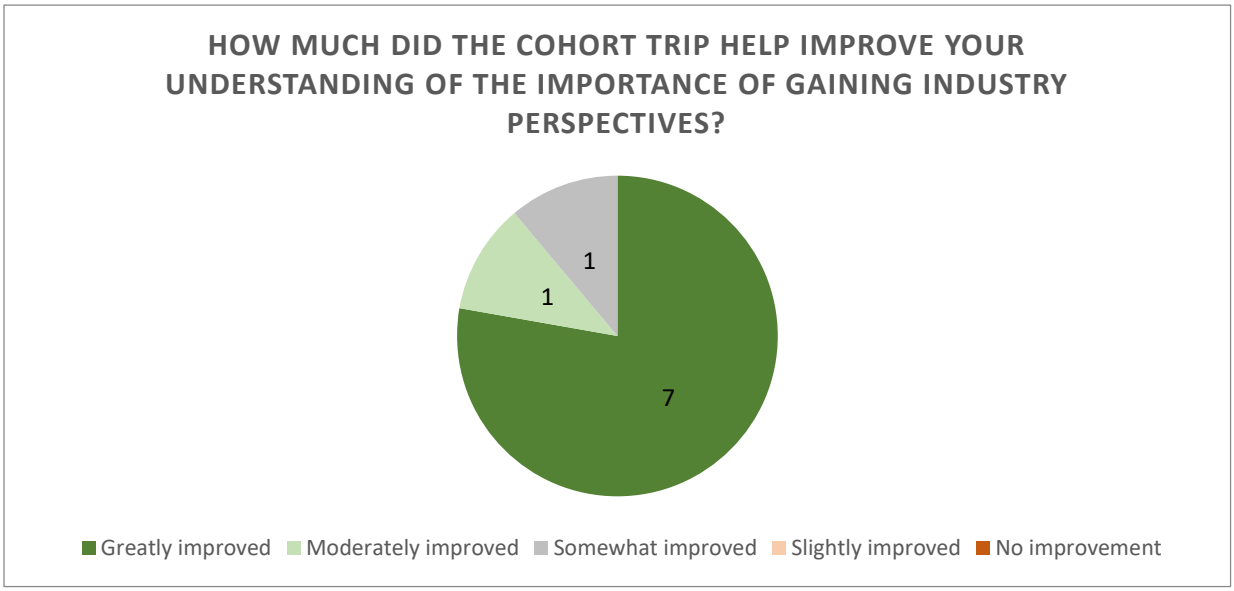
Table 1: General Satisfaction: "Please rate your level of satisfaction with:"

Title	The amount of time given to prepare for the Cohort trip	The level of communication regarding the trip details and expectations	How the objective of the program was communicated prior to the event	The variety of topics and disciplines covered during the trip relating to electrification	The ASPIRE staff representative (Melanie Conrad)	The ASPIRE Faculty Mentor (Hongjie Wang)
Extremely satisfied	2	4	1	1	8	8
Somewhat satisfied	7	2	5	3	1	1
Neither satisfied nor dissatisfied		2	1	2		
Somewhat dissatisfied		1	2	2		
Extremely dissatisfied				1		

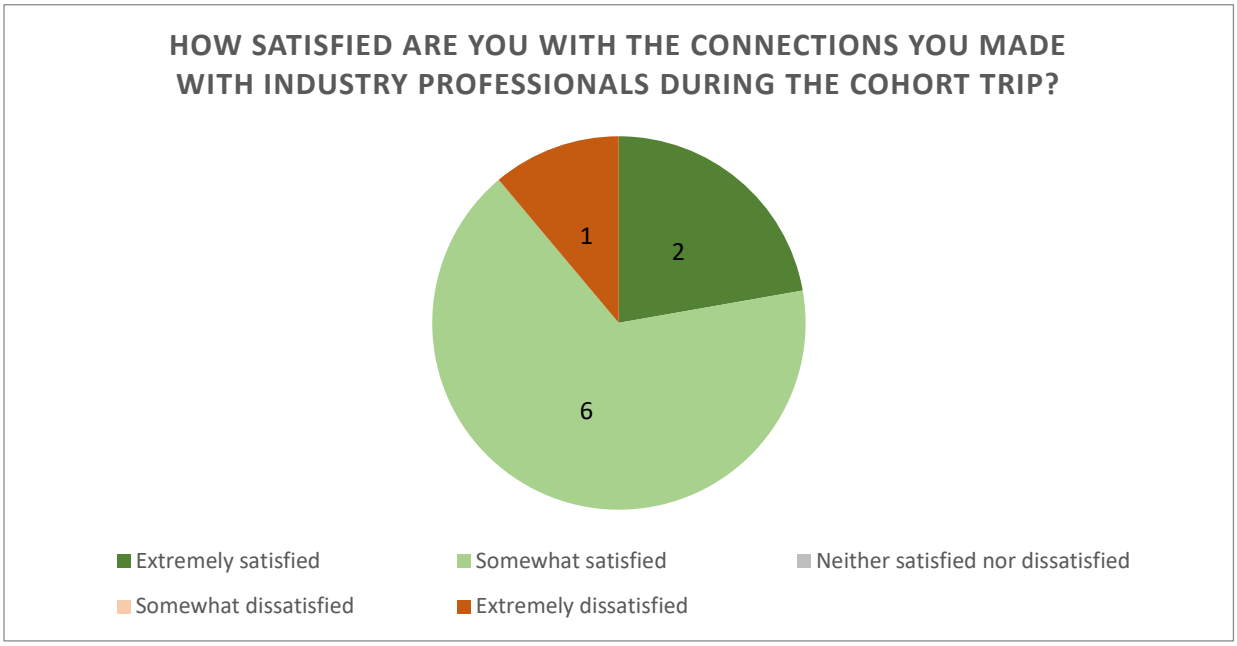
Table 2: Site Visit Satisfaction: "Please rate your level of satisfaction with each site visit:"

Title	Schneider Electric	Quanta Technology	NC State FREEDM Center	Grid-Bridge	ABB Corporate Research Center	Southwire	EV Braintrust Think Tank	Curiosity Lab at Peachtree Corners
Extremely satisfied	3	2	3	4	2	9	3	4
Somewhat satisfied	2	1	6	4	4		2	4
Neither satisfied nor dissatisfied	1	2			1		2	1
Somewhat dissatisfied	3	3		1	2		2	
Extremely dissatisfied		1						

Appendix 1B: Improving Understanding of the Importance of Industry Perspectives



Appendix 1C: Satisfaction with the Connections made with Industry Professionals



Appendix 2: Qualitative Responses

Appendix 2A: Student Nonattendance

Question	Please describe, in as much detail as you feel comfortable, why you did not attend the SLC cohort trip from March 2-7 2025:
Responses	Family issues
	I had other higher priority tasks (conference deadlines, etc). Moreover, there was minimal to no alignment in my research interests and companies we were visiting.

Appendix 2B: SLC Cohort Trip Sit Visit Valuable Takeaway

Title	What was the most valuable takeaway from these site visits?
Responses (Listed in Random Order)	The process we learned about in the R&D section, product development, and the transition from academia to industry, as well as how to present each aspect and understand the importance of product marketing, identifying the gap between research and the industry's perspective on electrification.
	These site visits provided the SLC crucial information that we used in our SWOT analysis for the center. Additionally, it was a good opportunity to get exposure to multi-disciplinary projects in the EV space.
	The main takeaway is to have a better view of the whole EV system. With these visits, we understand topics that we do not research but it affects the EV adoption/usage and, for this reason, are indirectly related to our research. I also think that these visits support my professional development since I considered that I have a better multidisciplinary understanding. The program is extremely beneficial for me because: - I help me to define professional pathways after graduation; - Open my mind about topics that affect my research but I do not research directly; - Provide a better understanding of the ASPIRE role and organization; Besides all these advantages, I also believe that my work as a SLC member will be better now, not just in the SWOT analysis but in general
	The most valuable takeaway from these site visits was seeing how the industry and ASPIRE are working together to promote electrification and sustainability, which aligns closely with my research goals. As an advocate for these areas, I was inspired by the multi-disciplinary approach and the strong connections being made between academia and industry. It was particularly motivating to witness how companies are not only advancing technological innovations but also creating opportunities for students like us to bridge the gap between research and real-world applications. The diverse perspectives shared during the trip helped reinforce the importance of collaboration across disciplines, and I'm excited to contribute further to these efforts, especially as ASPIRE continues to expand its impact in the field. Additionally, the chance to interact with professionals from various industries has given me a clearer understanding of how my research can directly influence sustainable infrastructure and electrification efforts in the future.
	From these site visits, I gained a deeper understanding of the electrification process and its crucial role within the ASPIRE Engineering Research Center. Although each site visit focused on a specific topic, I believe it is essential to incorporate a variety of disciplines that contribute to the research center's broader mission. The varying lengths of the site visits worked well, as shorter visits allowed us to explore more companies without overwhelming our schedule. Some companies were better prepared than others, which highlighted the importance of always being ready to present and engaging effectively with our audience, something we should strive for as ASPIRE leaders. One particularly impressive aspect was seeing a research center that had become fully independent. This demonstrated the potential for ASPIRE to one day evolve into a successful startup, reinforcing the belief in the center's long-term impact.
	For me, the most valuable take away was understanding where ASPIRE fit into the entire electrification ecosystem and comparing ourselves to industry. We are not the only people working on electric infrastructure so it was interesting to see how industry is tackling the issue, what direction they are moving, and if they are moving faster than us. It also showed me how it is possible to partner with industry to help implement our technology and to make a real impact. If we want to plan for ASPIRE technology to be used after the NSF funding has sunset, we need to find ways to work with industry. For example, the FREEDM Center had a hand in GridBridge starting and APIRE could do something similar. These are all things that I plan on bringing into the SWOT analysis.
	The most valuable thing for me was the variety of work cultures I got to see. I had never realized how different each workplace was and thus how important it is to find a workplace I will fit into culture-wise. It was also very useful to make connections and hear the thoughts of industry members what I can do to maximize my learning now so that I am more prepared for the future. It is also critical to be able to take what we learn back to ASPIRE whether it be for internships or co-ops, or to learn how to be a better student and help improve ASPIRE As a whole.
	To learn how to interact with industry members as well as see different ways they handle their day to day in business and research. Gave me a great idea of what our industry partners do as well as potential places I would like to apply to in the future

Appendix 2C: SLC Cohort Trip Site Visit Suggestion

Title	What one suggestion do you have to improve the site visits?
Responses (Listed in Random Order)	As I mentioned, one of the most valuable takeaway of these visits is understanding the whole EV ecosystem. For this reason, I believe that shorter visits in more places are better than longer visits in less places. I would like to have different perspectives and view of institutions related to EVs. Additionally, being able to visit 2 different states, which have different approaches related to EV adoption and usage was very valuable.
	I think the site visits would have benefitted from slightly more diversity of industry sector. Almost everywhere we visited was related to electrical engineering in a way that was not reflected in the disciplines of the SLC. We researched the companies beforehand, but we can't be expected to become electrical engineers just to ask questions during a 1–3-hour visit. While it was beneficial to be exposed to engineering work outside of what I am familiar with, it led to many times where we were expected to ask questions but I didn't even know what to ask. The company I could connect my degree to most was Southwire and that let me ask more specific questions.
	There should be a higher diversity of companies in terms of the fields they are in. This trip, most of the companies were focused on power electronics, which is less useful for those not familiar with that field. Having site visits with more diverse companies would provide everyone, regardless of background, to actively engage with cutting-edge research in their field.
	A few suggestions to improve the site visits include making them more diverse by incorporating different fields within the engineering research center, such as civil, mechanical, and educational engineering. This would provide everyone in the cohort with the opportunity to learn about, or further strengthen their understanding of, the full scope of ASPIRE's work. Also give the companies a purpose and objective on why we are visiting their company, as well as gather any questions the student leadership council has prior to attending and have additional questions in hand once at the site visit.
	It feels like there was some unclear communication as to the purpose of these visits to the companies themselves. Schneider in particular seemed to be a bit unclear (lots of talks about undergraduate opportunities, not much to look at technically).
	It would be beneficial for students to have a little background into the fields we visit so that we can better understand what each company really does. I feel that it would make it easier to connect with and learn from the industry member.
	One suggestion to improve could be allowing students to contribute to the selection of industries or companies visited that align with ASPIRE. Additionally, incorporating a broader range of sectors, such as policymakers, regulatory bodies, or non-profits, would enrich the experience by providing insights into the policy and governance aspects of electrification and sustainability. This would offer a more well-rounded view of the challenges and opportunities within the industry and foster a deeper understanding of the ecosystem surrounding our research
	Keeping it to 1 or 2 visits per day to gain a better understanding of their companies. Giving the companies a better outline of what we are thinking for the industry visits
	It was great that students from different backgrounds became familiar with all aspects of ASPIRE and its research. However, it could be even better if we made it more diverse by including companies and industry members related to all aspects of ASPIRE, such as electrical, industrial, civil engineering, and computer science, rather than focusing on just one aspect.

March 2025

Appendix 2D: Understanding of Importance of Industry Perspective

Title	Use this space to elaborate on how the trip did or did not improve your understanding of the importance of industry perspective:
Responses (Listed in Random Order)	With aspire being strictly research, it is difficult seeing what working in the industry looks like compared to working in academics. It as well helped me to know how to interact with industry during interviews and know what they are expecting as well as what my expectations should be.
	The trip significantly enhanced my understanding of the importance of the industry perspective by providing firsthand exposure to how research is translated into real-world applications. Engaging with industry professionals allowed me to see the practical challenges and considerations that go beyond academic research, such as scalability, cost-effectiveness, regulatory requirements, and market demand. It also highlighted the crucial role of collaboration between academia and industry in bridging the gap between innovation and implementation. Moreover, the discussions with industry experts reinforced the significance of interdisciplinary approaches, as various engineering and business aspects must align for successful technology adoption
	Before the trip I don't think I had even considered the industry perspective fully. At the annual visit, we do talk with industry partners but do so in a manner focused on ASPIRE. On this trip, we were able to have similar discussions but focused on the industry instead. It showed me that ASPIRE is cutting edge, but the private sector is also trying to be cutting edge and is investing millions to do so.
	Details and approaches to the projects that they were working on in particular.
	Industry is a whole different world and in getting to see different examples of industry in different fields it expanded my view of not only electrification but also of engineering as a whole. Being able to gain an idea of the processes and development was very helpful too.
	I believe I already had a decent appreciation for how valuable the industry perspective can be, so I'm not sure this trip had much to improve on.
	The trip significantly improved my understanding of the importance of industry perspective by demonstrating how research translates into real-world applications (prototype to product journey) and highlighting the challenges companies face in electrification. Engaging with Schneider Electric, Quanta Technology, ABB, and Southwire provided insights into grid management, high-power charging, and energy disruptions key areas where ASPIRE's research can make an impact. Visiting these companies also helped me understand the practical constraints and implementation of electrification solutions, including the technical, financial, and regulatory factors that influence deployment. For example, Schneider Electric and Quanta Technology emphasized the complexities of integrating high-power charging into the grid while maintaining reliability. Discussions at ABB and Southwire highlighted industry needs and priorities, such as grid resilience and material innovations for sustainable electrification. The trip also provided valuable exposure to how research is translated into industry impact. GridBridge's work on grid interfaces and DC microgrids showcased how academic research can be commercialized into scalable solutions. Additionally, I gained insight into multi-disciplinary collaboration at EV Brain Trust and Curiosity Lab, seeing how engineering and business decisions intersect to drive innovation in the electrification spaces aligning with ASPIRE's vision for bridging research and industry. One of the most valuable aspects of the trip was the opportunity to ask various questions, including ones I might not typically ask in a formal setting like an internship or job interview. I felt comfortable asking questions that could be seen as "silly" or less technical, such as those related to company culture or the practical aspects of transitioning research into real-world applications. These questions are often overlooked in professional settings but are essential to fully understanding how industries operate. This environment encouraged open discussions, ultimately providing deeper insights into the industry's values, processes, and people' things that I wouldn't normally get to explore in a traditional work environment. Finally, visiting Southwire's copper rod plant and interacting with HR and technical staff provided a deeper understanding of company culture and operations. Observing how companies structure their R&D, make investment decisions, and engage with stakeholders reinforced the importance of aligning academic research with industry needs. Overall, I believe firsthand experience is essential for truly understanding the industry, and these visits provided precisely that.
	The trip did improve my understanding of the importance of industry perspective since it strengthen my knowledge of sustainability, working with different fields and people of diverse backgrounds, and to be very thankful for the opportunity ASPIRE has given me.
	I believe my previous answers already covered this topic, but summarizing: after visiting these companies, I start to think on points that affect the topic of my research that I would not think if I have not visit them - basically, it opened my mind for the area of EVs and also ASPIRE role.

Appendix 2E: Understanding of Importance of Industry Perspective

Title	Use this space to elaborate on why you were satisfied or dissatisfied with the connections you formed with industry professionals during the cohort trip:
Responses (Listed in Random Order)	I was somewhat satisfied with the connections I formed with industry professionals during the cohort trip, but I believe there is room for improvement, particularly in terms of the diversity of companies represented. While the trip provided valuable insights into industry expectations and challenges, having a broader range of companies from different sectors related to ASPIRE such as electrical engineering, industrial engineering, civil engineering, and computer science would have allowed for more targeted networking opportunities. By including professionals from a wider array of industries, we could establish connections in fields more closely aligned with our specific interests and career aspirations. This would not only enhance our understanding of various industry perspectives but also create more opportunities for collaboration and potential career paths. Expanding the representation of industry members would make future trips even more impactful.
	There were some people we met during the cohort trip that I am planning on connecting my supervisor with because of the direct relevance of their work to my area of ASPIRE. Meeting with people on this trip will be help my research for the next several years and provide entire new directions for partnerships.
	I was able to get a good relationship with them but only for the companies we are lunch with because it gave us an opportunity to talk without any structure which is healthy for building relationships.
	I have no thoughts about the connections formed.
	I am very satisfied. It would be great if we could have access to the emails and contacts of the people that we would speak with during the trip before the visits (at least for those we could). This would allow us to research a bit about each of them in advance, helping to strengthen the connections that we would make.
	Most of the companies on this trip were focused on power electronics, which is not my field, so I felt most of the connections I made weren't relevant to me or my research specifically.
	I am completely satisfied with the industry professionals' connections I created during the cohort trip because they all assisted me in any concerns, I had regarding looking for a future position, what to expect in an interview, how to improve my work and life balance, and what I should be looking for in a company I want to work in.
	I am satisfied with the connections I formed with industry professionals during the cohort trip because it provided a unique opportunity to engage with experts in electrification, grid infrastructure, and transportation. The interactive setting allowed for meaningful discussions beyond technical topics, including company culture, industry priorities, and potential collaboration opportunities. However, expanding industry outreach to include policymakers and non-profits could further enhance these connections by bridging the gap between technical solutions and societal implementation. Additionally, keeping a follow-up of these connections will be crucial in strengthening this industry-academia collaboration.

Appendix 2F: Questions or Suggestions for future SLC Cohort Sessions

Title	Use this space to elaborate on any of your answers to the previous questions or provide suggestions for future SLC cohort sessions. Thank you for your feedback.
	I think there needs to be a more structured introduction to these companies to help bridge the gap between different majors and expertise levels. We brought up the idea of having mini-talks during the SLC meeting; I think that's probably a good first step.
	For future SLC cohort sessions, we can focus on improving how we present ourselves and communicate our research effectively. Organizing workshops on presentation skills would be highly beneficial, particularly in helping cohort members confidently introduce themselves, their projects, and ASPIRE's mission in a concise yet impactful way. A dedicated session on delivering a compelling 2–3-minute pitch about our work would enhance our ability to engage with industry professionals and spark meaningful discussions. Additionally, to promote ASPIRE more effectively, we should develop a structured approach to presenting its goals and contributions. Having a standardized but adaptable introduction about ASPIRE would make it easier to communicate its value to different audiences. This could include key talking points that highlight ASPIRE's research focus, industry partnerships, and future directions. We have already decided to summarize the companies we will visit, which is a great step toward being more prepared. Expanding on this, we could assign small teams to research each company and share insights with the group before the trip. This would give us a clearer understanding of what to expect, allow us to tailor our questions more effectively, and help us identify potential collaboration opportunities in advance. To further enhance our engagement with industry, structured networking training sessions could be introduced. Learning strategies for initiating conversations, asking insightful questions, and following up with industry professionals would maximize the benefits of our interactions. Additionally, inviting professionals from diverse engineering and technology sectors for panel discussions could provide valuable industry perspectives and guidance on how we can bridge the gap between research and real-world applications. By implementing these improvements, future SLC cohorts will be better equipped to communicate their research, strengthen industry connections, and maximize the impact of their interactions with professionals in their fields.
Responses (Listed in Random Order)	Points that I like: + The experience is valuable, it opened my mind to my career, my research and ASPIRE role; + Going to the EV Braintrust was great! For next cohort trip, I suggest more visits in institutions related to policies for EV adoption; + It was great to go in companies/institutions of two different states; + Have a good hotel location made a difference in logistics; + The time for the SLC team work in the end of the trip is crucial; + The time during the trip is busy, but it was good to have a bit of free time, at least in some nights. When we had that, in the other day, the productivity was higher; Points that I would like: o Shorter and more visits (instead of longer and less visits); o Previous contact information of people that we connect; o It was very good to have the academic mentor in the trip. It would be good to have an industry-mentor following us too; These are the main points I can remember. Other points were mentioned to Melanie, but I believe they were more related to minor logistical details. I would like to emphasize how important this program is for our professional development. When searching for a job, whether in industry or academia, I am sure I will mention this experience not just to describe it, but because I truly believe it has broadened my perspectives. I can refer to this program as a key reason why I have a more multidisciplinary mindset compared to other students who have not had similar experiences.
	The SLC Cohort sessions are a wonderful and vital part. The connections that I got to build were wonderful, not only with industry members but with the students across the various campuses as well. It is so useful not only personally but to help students in their own ASPIRE campuses. The cohort trips provide deeper insight into how industry works and into the possibilities for students, that can then be taken back and dispersed to each student. It is also vital for SWOT analysis in helping to be accurate and effective in describing the ASPIRE center. Without the knowledge of other companies, it would not be as effective.

	The cohort trip was an invaluable experience in terms of exposure to industry perspectives and understanding how research translates into real-world applications. I particularly appreciated the opportunity to engage with professionals across various sectors, from grid infrastructure to high-power charging. It allowed me to see firsthand how different disciplines intersect in driving electrification innovations, and how ASPIRE's research can contribute to addressing industry challenges. For future SLC cohort sessions, I would suggest expanding the outreach to include a broader range of industries beyond the electrical engineering domain, such as policy, finance, and environmental sustainability. This could provide a more holistic view of the electrification space and offer more opportunities for cross-sector collaboration. Additionally, I believe incorporating more interactive sessions, such as workshops or roundtable discussions, would be beneficial for discussing specific challenges and potential solutions with industry experts. This hands-on approach would encourage deeper insights and practical learning experiences. I also think students should have a more active role in pre-trip planning, helping to select the industries to visit and determining relevant points of focus. This could increase the relevance of the visits to individual research and career goals. Furthermore, it would be helpful to develop a follow-up mechanism, such as virtual check-ins or webinars, to maintain engagement with the companies we visited and explore ongoing collaboration opportunities. This would help keep the momentum going and offer more chances to build lasting professional relationships.
	I think some companies were much more prepared for us than others, especially for a group that was mostly PhD students. For example, Schneider Electric was an interesting company, but they were completely unprepared for our specific cohort and treated us as any other random student visit. One of the HR people that was leading things did not even know what a graduate student was when asked about specific opportunities for graduate students and was visibly shocked when it was mentioned we were mostly PhD students, like we had deviated from the script and he was unprepared for that difference. Their panel of early career engineers included people younger than us and with less work experience, even including an intern, which made it frustrating and a little insulting when they were trying to give advice on the difference between taking classes and work. I don't need someone who graduated in 2024 telling me what their job in HR is like, I need someone to talk about how Schneider can strategically form a partnership with ASPIRE and what benefits we can bring each other. While there was valuable information given about internship opportunities that I can share with the other students at my campus, I feel like I would have gained much more had they been prepared for our specific cohort. On the other side Southwire went out of their way to tailor our visit to our experiences. We did have some of the standard tour they give visitors, but that set the stage for more specific interactions later. Southwire chose people to talk to us who work high up in R&D because we were mostly PhD students and if we go into industry will likely land in an R&D role. We were able to ask questions about going from academia to industry as two different sectors, very different from just graduating and getting a job in industry, and how we can use our experience effectively. They were also better at striking a balance between technical talks and more general knowledge. For example, Kiran, the VP of Research we met was able to adapt a presentation he gave to the executive business people and lawyers about Southwire's research, but talk about it casually enough where the students could ask questions and learn more about the technology without needing a PhD in Physics or Electrical Engineering. It felt like they understood the group more and treated us as peers rather than just another group of students to advertise internships to. When picking companies in the future, we should make sure that there is some alignment with the SLC's research and educational background and that the companies we visit are prepared for us specifically and not just doing the generic student tour.
	I was all around impressed by what I was able to learn as well as the companies we visited. I am extremely grateful for the opportunity I was given to go on this cohort trip and it has taught me things that will be extremely useful in my future. Definitely would recommend giving other students this opportunity as well.
	The SLC cohort trips are essential for the success of the student leadership council and the ASPIRE culture. From this trip it was acknowledged that ASPIRE has some work to do to keep growing and innovating, grow its network, start preparing for being independent from the NSF, and feed its core values.

2025 Leadership Retreat Feedback Summary

Katherine Grover

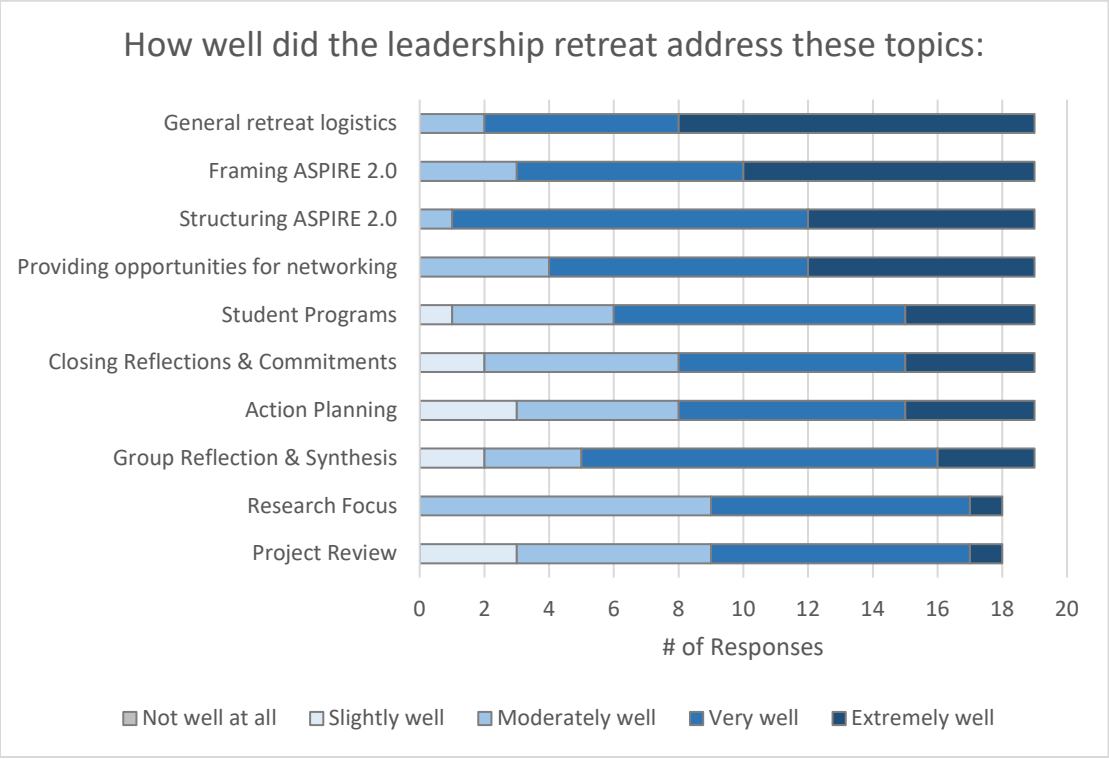
Introduction

The ASPIRE organization held a leadership retreat at Purdue in May 2025. Over 30 of the ASPIRE leaders were in attendance to discuss the future of ASPIRE and engage in strategic planning. As a part of the retreat, leaders were invited to participate in a short interview with the Assessment Coordinator. Additionally, a post-event survey was sent to provide participants with an opportunity to provide feedback on the retreat experience. The results from these two assessment tools are found below.

Post Event Survey

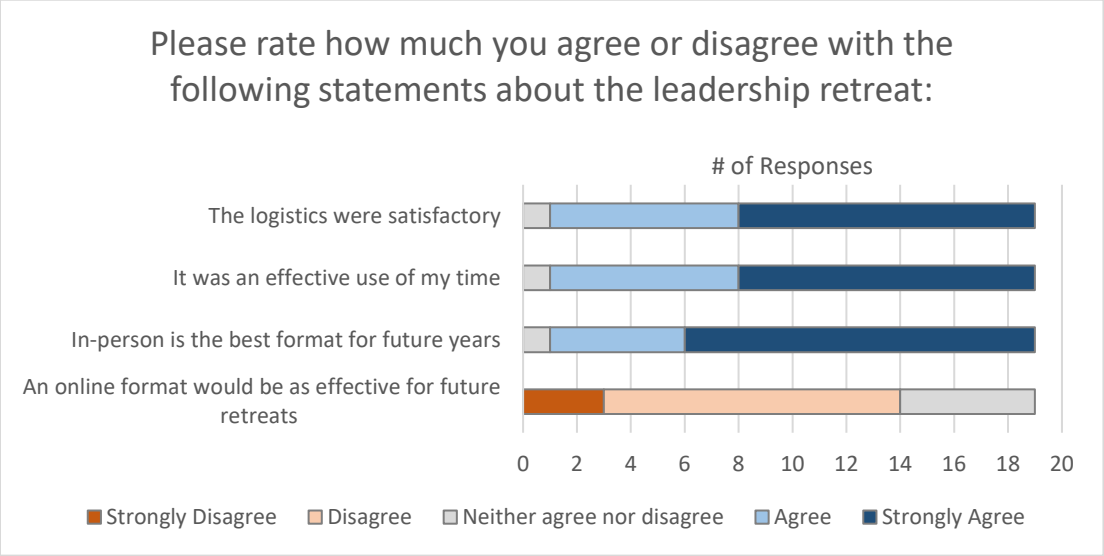
The post-event survey received 19 responses from various participant types (9 faculty, 5 staff, 2 postdocs, 2 students, and 1 consultant). The responses were very positive across all questions. When asked how well the leadership retreated addressed the topics on the agenda, the responses were primarily positive (see Figure 1.)

Figure 1: Satisfaction with Agenda Topics



Additionally, when asked how much they agreed or disagree, the vast majority agreed or strongly agreed that the logistics of the retreat were satisfactory and it was an effective use of their time (see Figure 2). When asked about the best format method, respondents showed a strong preference for the in-person format for future leadership retreats.

Figure 2: Satisfaction with Retreat Logistics and Format



When asked what they liked most about the event, the responses included:

- The in-person format and open discussions
- Learning the future direction for ASPIRE
- Discussion around strategic changes, timely challenges, and high priority topics
- The time and space provided for networking
- The organization, location, and space of the event

When asked to identify suggestions for improvement, the responses included:

- Seeking more contribution and input from attendees, both in advance and at the event
- Focusing less on student engagement
- Having campus directors provide vision, challenges, and opportunities for their campuses
- Allowing more time for the project leaders to present outcomes and room for improvement
- More team building
- Having discussion around how to move forward within the current political climate

Lastly, there was mixed feedback on the use of slides, with one comment appreciating the lack of slides while another wanted more slides to encourage staying on topic.

These responses indicate that participants were very pleased with the retreat experience overall and would prefer to continue the in-person format moving forward.

Leadership Interviews

During the first morning of the retreat, the leadership were invited to participate in short interviews focused on the value experienced through ASPIRE participation and their future participation. Twenty-two participated in these interviews from a variety of participant types including faculty, students, post-docs, and staff.

Value of ASPIRE

First, respondents were asked what value their participation in ASPIRE brings to them. The responses consistently demonstrated that ASPIRE participants experience value in the following areas:

- Opportunity to create cross-disciplinary, cross-institutional networks across academia, industry, and government
- Gain a broader understanding and vision of the electrification ecosystem
- Develop professional and leadership skills
- Be a part of a group working to creatively and innovatively solve real world problems that have an impact on society
- Help the next generation of professionals

Future Role in ASPIRE

After establishing the current value that ASPIRE participation brings, the next set of questions sought to identify ASPIRE leaders' understanding and future vision for their role in ASPIRE. When asked "If you could waive a magic wand, what would your participation in ASPIRE look like in 5 years?", most respondents couldn't clearly define a vision for their future role other than to increase the depth of their particular field of research/work. This led to comments regarding the lack of funding, resources, or support preventing that growth now. Many respondents indicated feeling uncertainty regarding their future in ASPIRE. Most expressed a desire to continue their involvement but didn't feel confident there would be a place for them in the future. This was especially prevalent amongst the post-docs and students but was seen in all role types. Additionally, respondents expressed different levels of desire to continue in a leadership capacity. Some indicated a desire to step back from leadership and focus more in research while others expressed a willingness to take a more active role in leadership and the growth of the center.

When asked what additional value they would like to experience, respondents sought additional value through further involvement within different areas of the center. These included policy development, operational functions of the center, project management, mentoring future professionals, and increased collaboration both within projects/tasks as well as with industry, expressing that the current collaboration fall short of expectations.

Other Feedback Provided

At the end of each interview, each participant was asked if there was any feedback they would like to provide ASPIRE about any topic. Below is the feedback provided by the participants:

Appreciation for ASPIRE:

- Participation in the center is appreciated and enjoyed, despite the challenges that occur. Working with the leaders is an honor.

Center Suggested Improvements:

- Collaboration is appreciated but could be greatly improved. Silos can't make a difference and there is far more potential than what is occurring.
- Communication between projects, lab groups, and universities needs to be improved. Networking is also needed amongst the projects.
- Continuing to seek and act upon feedback is critical to ASPIRE in these formative years. The center needs to close the feedback loop.
- There is a huge need for onboarding for all role types. The first year was filled with trying to figure out what they are supposed to do, what meetings to attend, who the task leads are, etc.

Feedback around Specific Roles:

- The center needs to help leading faculty feel valued and rewarded as the requested workload is high in comparison to compensation. There is a clash between the innovation culture and the academic culture in which most faculty work.
- Participants are often asked to redo work multiple times which only adds to the workload.
- The student leadership experience wasn't as valuable as their student had hoped and they weren't able to give the center feedback like they had hoped.
- Participants wish there was less uncertainty around the continuation of positions, how to deal with changing political climate, and who to take direction from.

Growth and Future of ASPIRE:

- ASPIRE needs to be more intentional regarding strategy, goals, and bringing in students and faculty into critical conversations.
- Cash flow is critical to monitor and leadership needs to consider what projects are spending versus what it is returning.
- The positive ASPIRE culture and environment doesn't extend to the campus level. Support for campuses isn't at the same level as the center.
- The growing size of ASPIRE make it difficult to know everyone, maintain the positive culture created, and move the center in the needed direction.
- With the growing size, the leadership need to maintain the personal connection with center participants and be more visible and accessible.

ASPIRE and the Electrification Ecosystem:

- Need to position ASPIRE on the national scene, starting with internally understanding and articulating the value proposition of ASPIRE.
- Industry collaborations need to be fostered more intentionally, making sure there is compatibility before the research faculty are asked to get involved. Faculty need more assistance engaging with industry and creating deeper conversation.

Conclusions & Recommendations

In conclusion, the leadership retreat was very successful and was appreciated by all who attended. The participants appreciated the timely conversations as well as the fantastic retreat location and logistics. Individual leader interviews identified consistent value gained through current center participation but were unclear as to their future with the center or the additional value that could be experienced. Additionally, when asked to provide feedback to the center around any topic, a wide variety of topics were addressed.

From this feedback, it is recommended that the leadership take the following actions:

- Continue to hold a year in-person leadership retreat
- Continue to help the participants understand and identify the value they experience through their participation
- Frequently and repeatedly give updates and continued vision for the future of the center, especially around how individual roles could grow and evolve.
- Communicate with each of the leaders individually to determine their desired level of future involvement in the center and in an administrative role; then help them see the path and direction to take to achieve the desired outcome
- Carefully read and consider the other feedback provided and determine what action or changes need to be implemented.

ASPIRE Year 5 Newsletter Analysis

Katherine Grover

Introduction

In an effort to improve communication across the ASPIRE center (a growth opportunity identified through previous assessment), the ASPIRE Content Director and team have distributed a quarterly newsletter to all center participants. The distribution data gathered from the newsletters has been analyzed to learn more about the interaction with the newsletter. The data was analyzed both by role type as well as by organization. Unfortunately, the data for the first quarter newsletter of Year 5 was lost due to a software issue. The data included in this analysis includes the information gathered from the January(Q2), April(Q3), and June(Q4) newsletter.

Newsletter Engagement

Over the last three quarters, a total of 1444 emails have been sent to center participants and the links within the emails were clicked 470 times. The open rate (the percentage of successfully delivered emails that were opened by recipients) and click rate (the percentage of successfully delivered emails that registered a click) were used to measure newsletter engagement. Overall, the average open rate was 42% which is slightly higher than the industry average of 35-40% reported on the INTUIT Mailchimp website ("Email Marketing Benchmarks and Metrics Businesses Should Track," n.d.). Because the open rate improved from January to June (41% to 45%) there is hope this will continue to increase. The average click rate of 9% observed for the ASPIRE newsletter was close to three times the industry average click rate (2-3%). June had the highest open rate while April had the highest click rate.

Newsletter Engagement by Role Type

Figure 1: Newsletter Open Rate by Role Type

The open rate and click rate where then analyzed by participant role type (see Figure 1). The faculty had the highest average open rate of 59%. The staff had a lower average rate at 46% due to a low rate in January but has since increased to 53 and 55 the last two quarters. The students showed the lowest rate with only 36%.

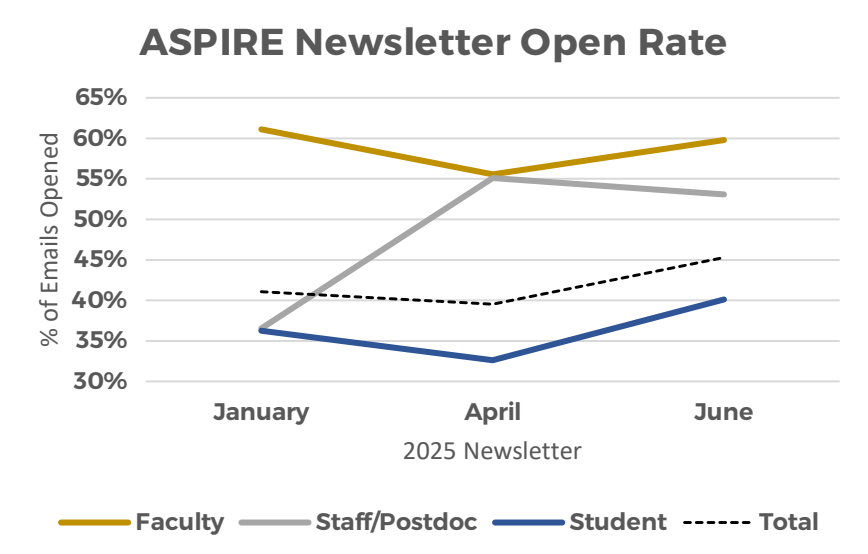


Figure 2: Newsletter Click Rate by Role Type

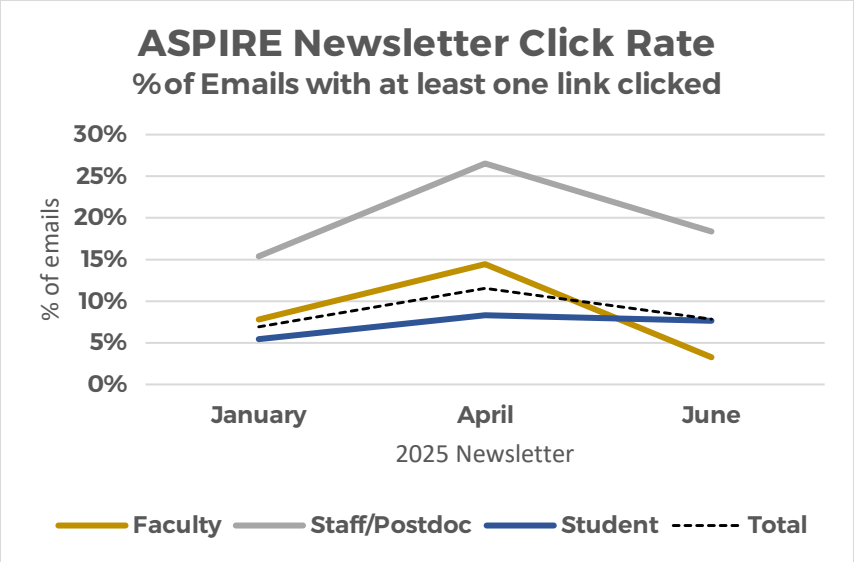


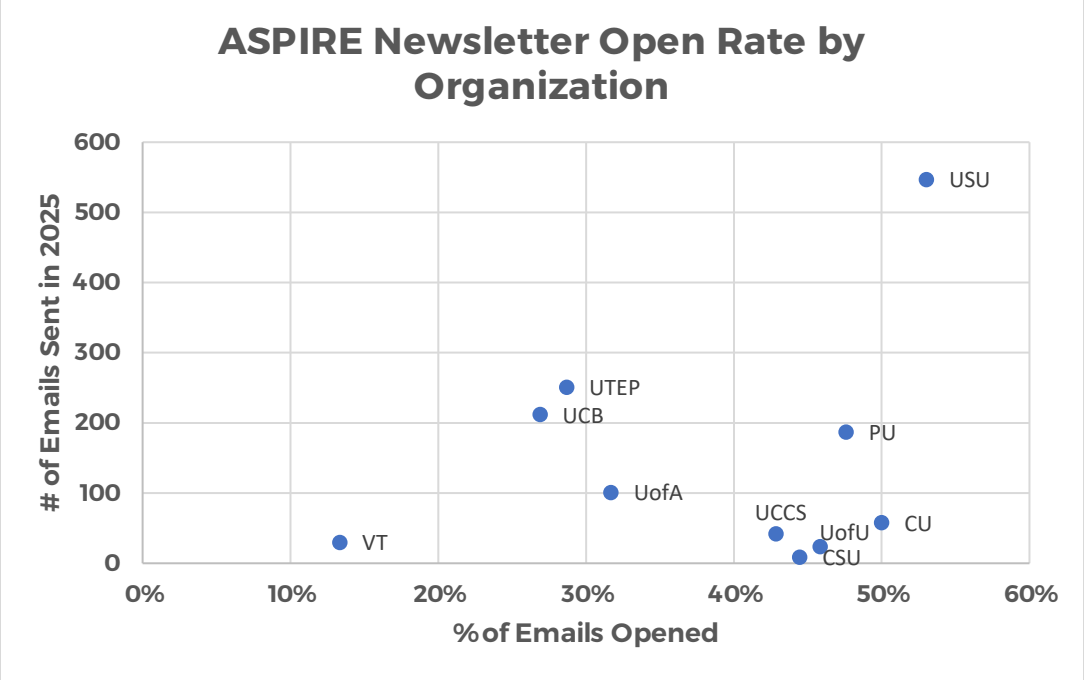
Figure 2 shows that staff/postdocs had the highest average click rate (20%). The other role types had lower click rates with the faculty at 8% and the students at 7%.

These results show that the different role types do engage with the ASPIRE newsletter differently. The faculty are the most likely to open the email but do not click on the links as much as the staff. The students are the least likely to open the newsletter or to click on a link.

Newsletter Engagement by Organization

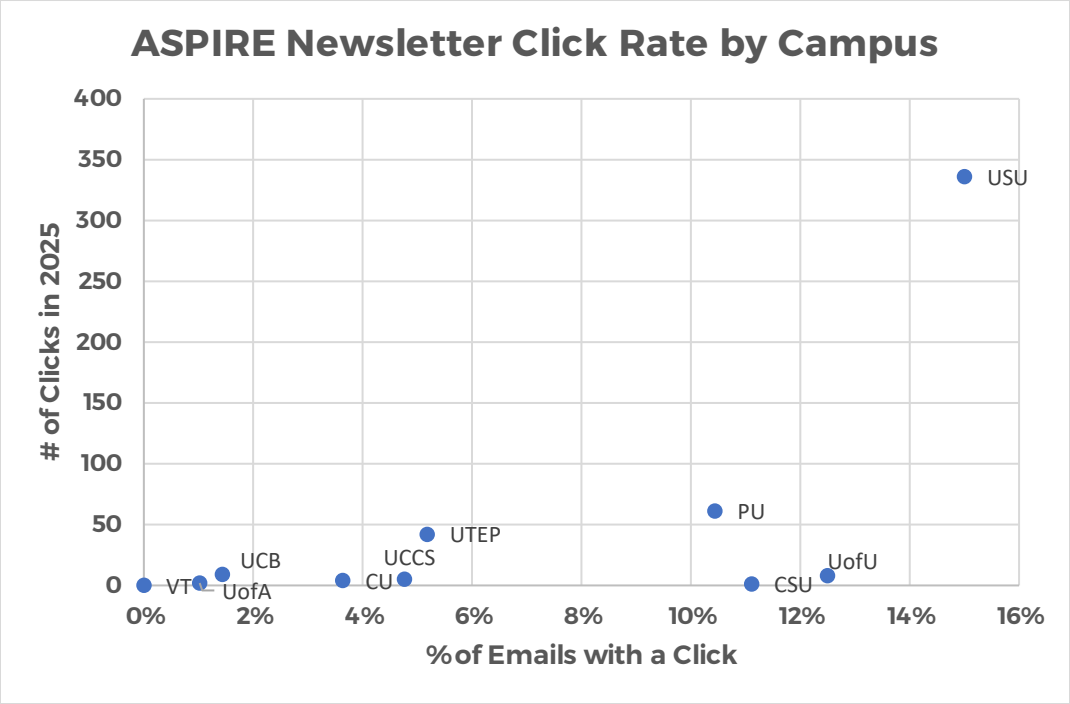
In addition to role type, the newsletter engagement was also analyzed by the participant's organization. In Figure 3, the open rate was mapped along with the total number of emails sent between January-June of 2025. USU, which has the highest number of participants, not only received the most emails but also had the highest open rate at 54%. Other campuses with high open rates included Cornell, Purdue, University of Utah, Colorado State, and University of Colorado-Colorado Springs. The lowest open rate was observed at Virginia Tech.

Figure 3: Newsletter Open Rate by Organization



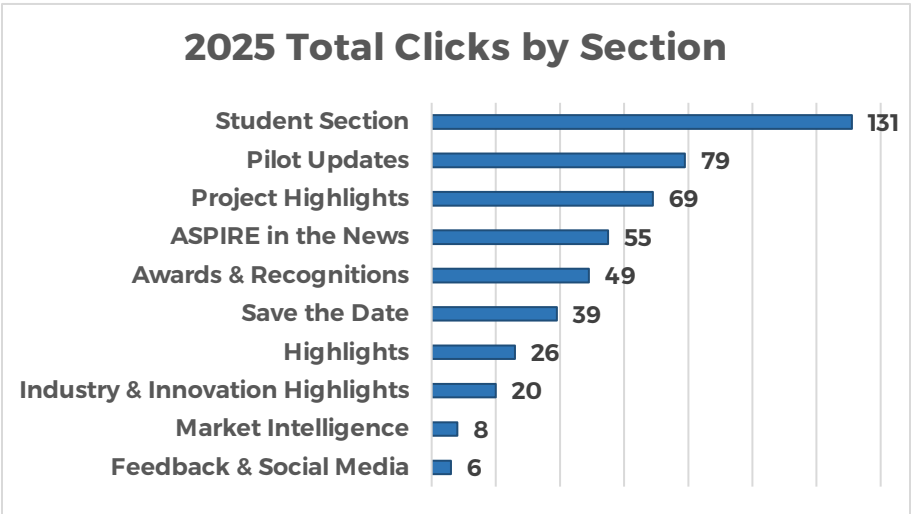
The click rate analysis by organization showed similar results. In Figure 4, the click rate was mapped along with the total number of clicks between January-June of 2025. USU had the highest click rate of 15% as well as the highest number of total clicks in 2025. The University of Utah, Colorado State University, and Purdue all had click rates higher than 10%. Virginia Tech, University of Auckland, and University of Colorado Boulder had the lowest click rates.

Figure 4: Newsletter Click Rate by Organization



These results show that USU had the highest percentage of participants engaging with the newsletter by opening and clicking on the links. Purdue, Colorado State, and the University of Utah also show higher newsletter engagement compared to the rest of the organizations.

Figure 5: Total Clicks in 2025 by Section Type



Newsletter Section Popularity

The engagement for different sections of the newsletter was measured by the number of clicks that occurred in each section. As would be expected, different sections showed different levels of engagement (Figure 5).

The Student Section showed almost double the amount of engagement than any other section. The next highest sections were the pilot updates and project updates. The highest engagement observed for the entire years was the June Student Highlights section with a total of 70 clicks. This was followed by the April Student Highlights (40 clicks) and the April Awards & Recognitions (30 clicks). This shows that participants are most likely to engage in sections that highlight students.

Center Communication Impact

As mentioned previously, communication has consistently been identified as a growth opportunity for the center and led to the implementation of a quarterly newsletter. To measure the impact the newsletter has had on communication, information from the annual survey was used. The annual survey, administered the last four years, includes a series of questions around communication, including a question on how much participants agree or disagree that "Communication within ASPIRE is adequate". The percent of the respondents that responded positively to this question has decreased annually (61.3% to 60.3% to 56.2%), until 2025, when it increased 1.4 percentage points from the previous year (57.6%). This led to the question being moved from the Needs Review list to the Small Change list which represents a positive shift. While it hasn't returned to the original 61.3%, growth was observed in place of regression for the first time in three years. Additionally, this survey was administered in March and only two newsletters had been sent in Year 5. This suggests that the newsletter may be having a positive impact on the perception of communication within the center. More information regarding the annual survey can be found in the full 2025 Annual Survey report.

Conclusions & Recommendations

This analysis shows positive engagement with the ASPIRE Newsletter with an open rate at or above industry average and a click rate far above industry average. Hopefully this engagement will increase as the center has already decided to increase the frequency of the newsletters to monthly. Faculty and staff/postdocs are more likely to open the newsletter, with staff/postdocs interacting with the links most. The students' engagement is lower than the other role types and it is recommended the center consider options to encourage increased student participation. Options to encourage participation could also be considered for the organizations with lower engagement. The assessment team will continue to track the newsletter engagement to facilitate more targeted content and increase center communication.

References

Intuit Mailchimp. (n.d.). *Email Marketing Benchmarks and Metrics Businesses Should Track.* **https://mailchimp.com/resources/email-marketing-benchmarks/**

Appendices:

Appendix 1: Newsletter Engagement Data by Role Type

Role Type	Month	# Of Emails Sent	Open Rate	Click Rate	# Of Total Clicks
Faculty	January	90	61%	8%	26
	April	90	56%	14%	31
	June	92	60%	3%	7
	Subtotal	272	59%	8%	64
Staff/Postdoc	January	52	37%	15%	24
	April	49	55%	27%	42
	June	49	53%	18%	25
	Subtotal	150	48%	20%	91
Student	January	331	36%	5%	74
	April	325	33%	8%	154
	June	354	40%	8%	85
	Subtotal	1010	36%	7%	313
Overall	**Total**	**1444**	**42%**	**9%**	**470**

Appendix 2: Newsletter Engagement Data by Organization

Organization	# Of Emails Sent	Open Rate	Click Rate	# Of Total Clicks
Colorado State University	9	44%	11%	9
Cornell University	55	53%	4%	55
Purdue University	182	48%	10%	182
University of Auckland	98	32%	1%	98
University of Colorado - Boulder	209	27%	1%	209
University of Colorado - Colorado Springs	42	43%	5%	42
University of Texas at El Paso	251	29%	5%	251
University of Utah	24	46%	13%	24
Utah State University	540	54%	15%	540
Virginia Tech	30	13%	0%	30
Beth Myers Consulting	4	100%	25%	4
Total	**1444**	**42%**	**9%**	**470**

MERCII Annual Survey – Multiyear Analysis

Katherine Grover & Beth Myers

Introduction

ASPIRE has participated in the Multi-ERC Instrument Inventory (MERCII) survey administration for the last four years. MERCII is a common quantitative survey developed for use by all ERCs to evaluate programming. The MERCII quantitative survey assesses understanding of the ERC, research and professional skills, mentorship experiences, STEM-related future plans, and program satisfaction. ASPIRE also added questions addressing communication within ASPIRE. The MERCII survey was administered the last four years via individualized links from Qualtrics that were emailed to ASPIRE ERC students, staff, faculty and other personnel during the spring. In 2025, it was sent in March to 374 individuals.

Survey Engagement

Survey Engagement Details in 2025

Survey engagement is measured by the percent of participants that either partially or fully completed the survey. Table 1 shows the survey engagement details for 2025. Of the 374 invitations, 182 individuals completed or partially responded to the survey, representing 49 percent of those invited.

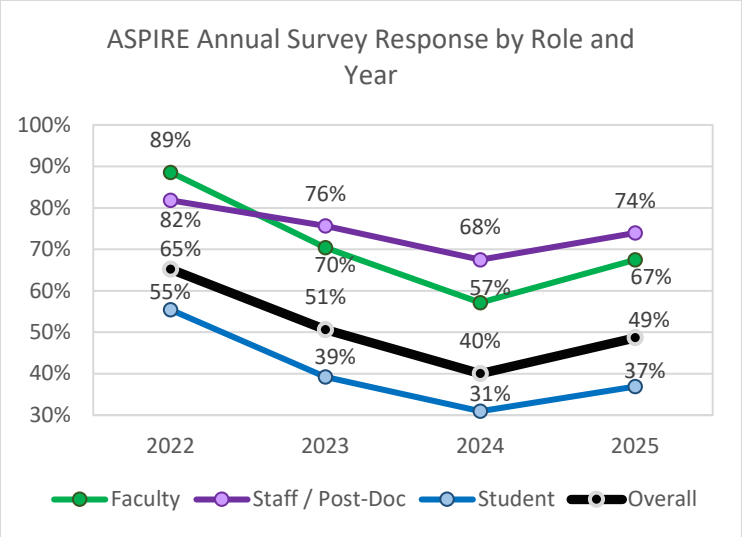
Table 1: Survey Response by participant role

Role	Non-Response	Finished	Partial Complete	Grand Total	Full complete response rate	Partial or full complete response rate
Faculty	28	57	1	86	66.3%	67.4%
Staff/Post-Doc	12	32	2	46	69.6%	73.9%
Student	152	87	2	241	36.1%	36.9%
Other	0	1	0	1	100.0%	100.0%
Grand Total	192	177	5	374	47.3%	48.7%

Comparison of Survey Engagement by Year

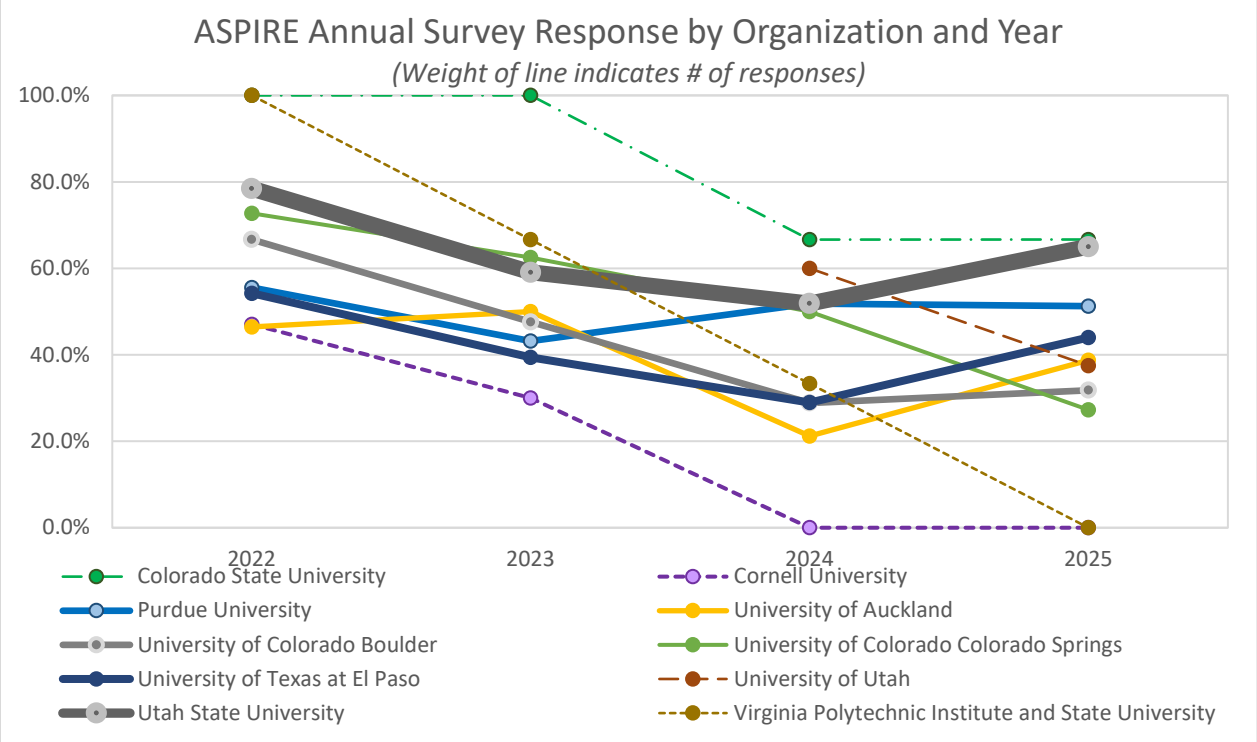
Survey engagement was highest in 2022 with 65 percent of ASPIRE participants responding to the survey. Engagement decreased with each of the two consecutive years (50 percent and 40% respectively). It was theorized this could be attributed to an increasing number of invitations being sent each survey year including individuals who are no longer active with the center but haven't been removed from the participant list. To address this hypothesis, the participant list was reviewed and cleaned as a part of the survey administration. The engagement increased this year to 48%, close to the engagement in 2023. Though while lower than the first year, this does show that the decrease in 2024 was at least partially due to an inaccurate participant list.

Figure 1: Survey Engagement by ASPIRE Role and Year



Survey engagement was analyzed by the participant role at ASPIRE (Figure 1) and organization affiliation (Figure 2). The results show that faculty and staff have higher engagement with the survey compared to the students, with the staff being the most engaged the last three years. The engagement varies across the different organizations. All decreased from the first year but several organizations saw more engagement this last year than in 2024.

Figure 2: Survey Engagement by Organization and Year



Quantitative Question Results

Survey Quantitative Question Responses for 2025

For the responses received in 2025, the question responses were analyzed by the groups of questions outlined in the survey. Appendix 2 at the end of the document shows the breakdown of responses for each set of questions.

Question Response Changes from 2022

The responses to the survey questions were analyzed across the four years. Most questions used a 5-point Likert scale for the response choices. To evaluate survey response changes, the responses were categorized into positive, neutral, and negative responses. The two most positive responses on the Likert scale were categorized as positive, the middle response was categorized as neutral, and the two least positive responses were categorized as negative. The percent of responses categorized as positive was then tracked for each question and compared across the survey years. This analysis was completed for all Likert-scale survey questions. The percent of positive responses as well as the percentage point change from 2022 were then visualized on a scatterplot (see Figure 3). The following results focus on the center-wide questions; student-specific questions regarding internships, degrees, and careers were not included in the below outlined results. The detailed information for these student-specific questions is summarized later in this report and in the appendix.

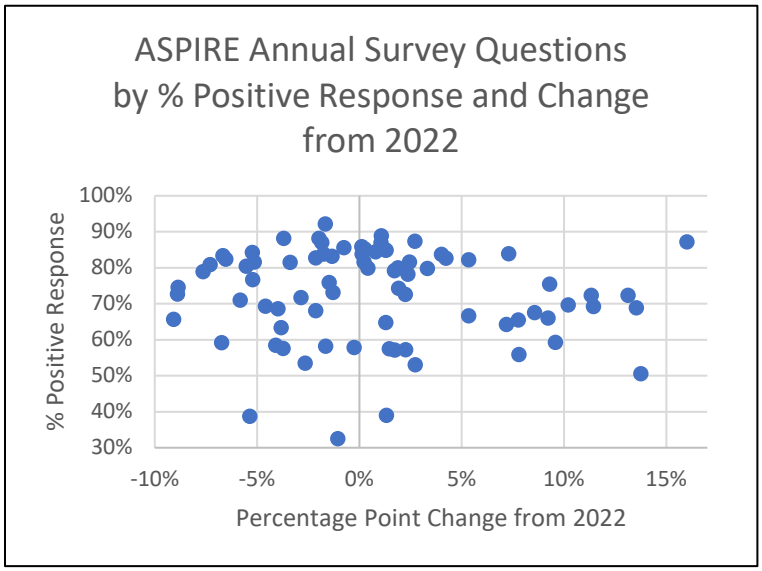
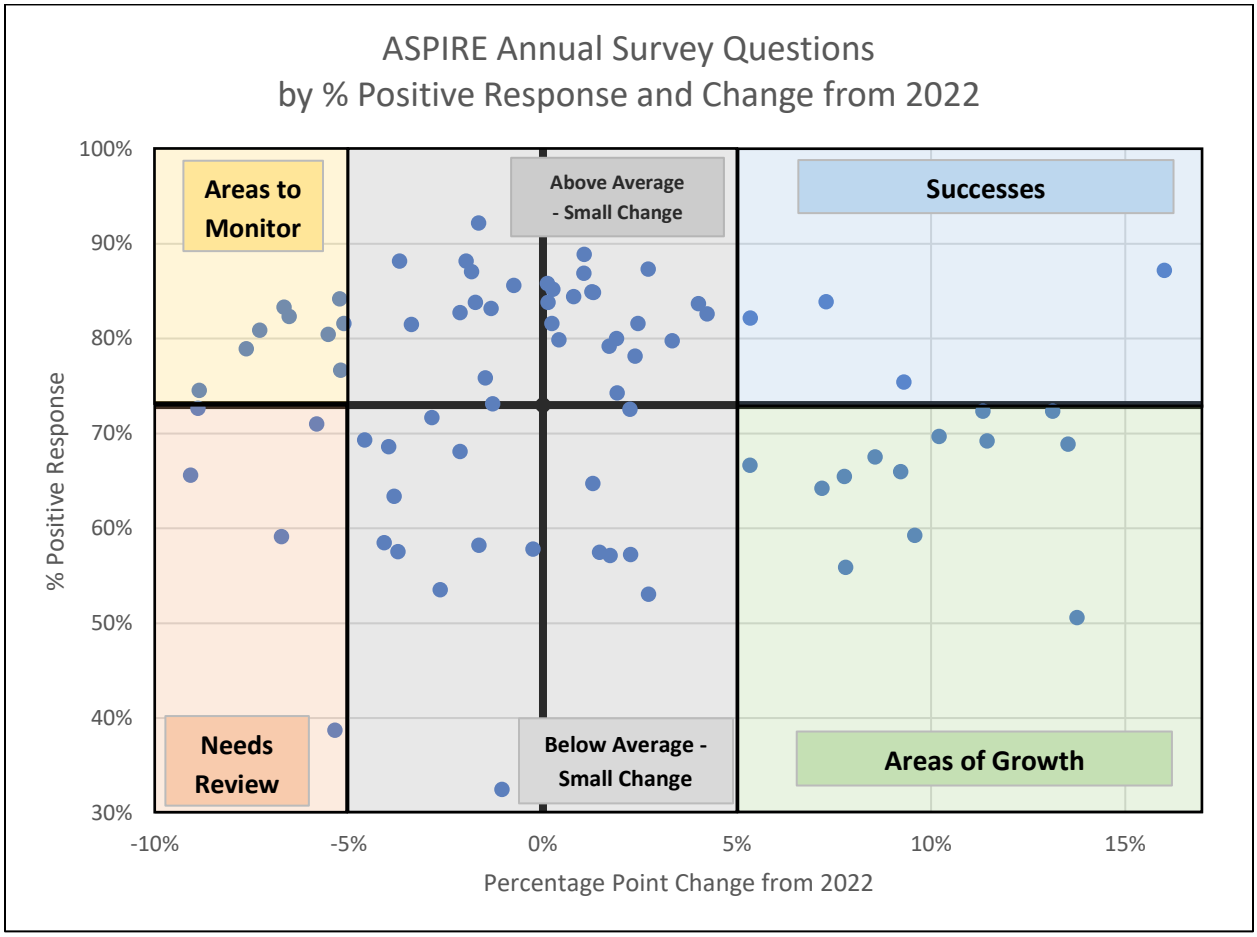


Figure 3: % of Positive Responses and % Change from 2022 for Center-wide Questions

These two parameters (% positive response and percentage point change from 2022) were then used to categorize the questions into six watchlist groups. First, an average (73%) was calculated for the % positive responses for all center-wide questions. Survey questions with 73% percent positive responses or higher in 2025 and had five percent point or more growth in positive responses from 2022 were categorized in the "Successes" category. These represent areas of success in the center with high positive responses that have continued to improve over the last three years. Survey questions with below 73 percent of positive responses in 2025 but had a five percent point or more growth in positive responses from 2022 were categorized in the "Areas of Growth." While the positive response rate is below the average of 73%, the center has seen growth in these questions over the last three years. The questions with less than a five-percentage point growth or decrease were categorized into two categories: the "Above Average-Small Change" category for the questions with a 73% or higher positive response rate and the "Below Average-Small Change" category for questions with a positive response rate below 73%. These categories are important to note because there isn't significant movement from 2022. Survey questions with above a 73 percent positive response rate in 2024 but had a five-percentage point or more decrease in positive responses from 2022 were categorized in the "Areas to Monitor." These questions are still above average but the regression should be noted and monitored. Finally, survey questions with below 73 percent positive responses and had a five-percentage point or more decrease in positive responses was categorized as "Needs Review" and warrant more attention due to the lower scores. Figure 4 visually represents these breakdowns.

Figure 4: Center-wide Questions by Watchlist Categories



Additionally, the change in proportion of positive responses between 2022 and 2025 was further investigated by conducting a two-sided proportion Z-test to determine if the change for each question was statistically significant. Also, using the new 73% average positive response cut-off, the 2024 watchlist category for each question was identified.

Lastly, to enable better understanding of the information, the questions were divided into two sets of watchlists. The first set, labeled the "Skills and Mentoring Watchlists", included the questioned asked in the mentoring, professional skills, and research skills question groups. The second watchlist, labeled the "ASPIRE Experience Watchlists", included all questions asked in the understanding, feeling, experience, and communication question groups. These dealt with the respondents' experience with the center as a whole. The information for each set of watchlists, which includes the questions by category, % positive response in 2025 (provided for the whole and also broken into role types - faculty/staff versus student), percentage point change from 2022, p-value, and 2024 watchlist category are available for review in Appendix 1.

Main Takeaways from the Quantitative Watchlists

These watchlists aid in the identification of major themes from the quantitative questions. Below are the main takeaways identified and a summarized view (Figure 5 and 6).

Skills and Mentoring Watchlists

Figure 5: Skill and Mentoring Questions by Watchlist Categories

Annual MERCII Survey Questions with a change greater than 5% between 2022 and 2025

Skill and Mentoring Questions

Areas to Monitor **Positive Response > 73% and Change < -5%**		**Small Change - Above Average** **Positive Response > 73%, -5% < Change < 5%**		**Successes** **Positive Response > 73% and Change > 5%**	
Survey Question	**2024 Category**	**Survey Question**	**2024 Category**	**Survey Question**	**2024 Category**
Mentor - challenged me to extend my abilities	Above Average, Small Change	Mentor - demonstrated knowledge and expertise	Above Average, Small Change		
Mentor - advocated for me	Above Average, Small Change	Mentor Gave - encouragement to strive for success	Above Average, Small Change		
Mentor - helped me further my career goals	Areas to Monitor	Mentor - established a relationship with me based on trust	Above Average, Small Change		
		Mentor - demonstrated respectful workplace behavior	Above Average, Small Change		
		Mentor Gave - advice that supports my future plans	Above Average, Small Change		
		Mentor - encouraged my professional development	Above Average, Small Change		
		Mentor Gave - feedback that is constructive	Above Average, Small Change		
		Mentor Gave - direction on my research project	Above Average, Small Change		
		Mentor - served as a role model	Above Average, Small Change		
		Mentor - cared about me as a person	Above Average, Small Change		
		Mentor Gave - inspiration to pursue a career in a STEM-related field	Above Average, Small Change		
		Mentor Gave - support in conducting independent work	Above Average, Small Change		
		Mentor - advised on my research goals	Above Average, Small Change		
		Mentor Gave - support to develop my professional network	Above Average, Small Change		
		Professional Skills - working on a research team	Below Average - Small Change		
Professional Skill - communicating orally	Needs Review	Professional Skill - collaborating with others	Below Average, Small Change	Research Skills - solving research-related problems	Areas of Growth
		Professional Skill - working on a cross-disciplinary research team	Needs Review	Research Skills - using research-related tools	Below Average, Small Change
		Research Skill - conducting research in an ethical and responsible manner	Below Average, Small Change	Research Skills - collecting data to answer a research question	Areas of Growth
		Professional Skill - networking across ASPIRE partner universities	Needs Review	Research Skills - interpreting research results	Areas of Growth
		Professional Skill - being innovative	Below Average, Small Change	Research Skills - making connections between research and industrial/practical applications	Areas of Growth
		Professional Skill - taking on leadership roles	Needs Review	Research Skills - analyzing research data	Below Average, Small Change
		Research Skill - practicing general lab safety	Areas of Growth	Research Skills - conducting research independently	Below Average, Small Change
		Research Skill - formulating research questions	Below Average, Small Change	Research Skills - making connections between classroom learning and research	Areas of Growth
		Professional Skill - managing time efficiently	Below Average, Small Change	Research Skills - making connections between existing literature and research	Below Average, Small Change
		Research Skill - practicing secure data management	Below Average, Small Change	Professional Skills - writing documents	Areas of Growth
		Professional Skill - being entrepreneurial	Needs Review	Professional Skills - creating visual displays	Areas of Growth
				Professional Skills - networking with industry	Areas of Growth
Positive Response < 73% and Change < -5% **Needs Review**		**Positive Response < 73%, -5% < Change < 5%** **Small Change - Below Average**		**Positive Response < 73% and Change > 5%** **Areas of Growth**	

Overall, participants reported high satisfaction with the mentoring experience as all mentoring questions were above the average 73 percent positive response. While none had grown more than 5 percentage points from 2022, the majority had seen only a small amount of change. Just a couple appeared in the areas to monitor category. The professional and research skills, as was seen in previous years, almost all fall below the average percent positive response. Yet, there was frequent positive growth seen for these questions, including some that tested as statistically significant. These are very prevalent in the Areas of Growth section. Interestingly, the responses of the students are higher than the faculty and staff on many of the questions. The only exception is the professional skill of networking across ASPIRE partner universities where faculty and staff answer more positively. Even though the lowest scoring skill question was the same as last year (being entrepreneurial), there was improvement from last year and the question moved from "Needs Review" to "Below Average-Small Change". The professional skill of communicating orally remains on the needs review list.

Recommended Actions:

- Review the skill questions that have lower positive responses to determine whether these are skills the participants should be gaining from the center
- Review the faculty/staff responses to determine if there is any concern in these categories
- Review the questions showing regression to determine whether steps should be taken

ASPIRE Experience Watchlists

The Experience watchlists saw almost the opposite trend as the Skill and Mentoring watchlists. A large number of the questions are above the average 73 percent positive response. Yet, when looking at change from 2022, there was more regression from 2022 than growth. Growth was seen with understanding how project contributes to the ASPIRE mission and regularly using Box. Additionally, communication across ASPIRE moved from the "Needs Review" watchlist to the "Below Average – Small Change" list. The regression was seen most prevalently in the "Feel" questions.

When looking at participant role, there was variation from faculty/staff and students. Student positive responses were lower for the questions related to feeling connected to ASPIRE members, being welcomed, accepted, feeling proud to be a member of ASPIRE, understanding potential pathways, communication questions, and understanding how tasks contribute to ASPIRE mission.

Faculty and staff positive responses were lower on feeling comfortable discussing difficult issues, regarding ASPIRE as respected in the community, satisfaction with the ASPIRE experience, recommending working with ASPIRE to others, ASPIRE work gives a feeling of personal accomplishment, ASPIRE inspires them to do their best work, and receiving meaningful recognition when they do a good job. These observations are substantiated by several of the main themes identified in the qualitative section later in this report.

Recommended Actions:

- Review the experience questions that have seen regression since 2022, especially the differences between the student responses and the faculty/staff responses and review the recommended actions in the qualitative questions.

Figure 6: Experience Questions by Watchlist Categories

Annual MERCII Experience Survey Questions with a change greater than 5% between 2022 and 2025

Experience Questions

Areas to Monitor **Positive Response > 73% and Change < -5%**		**Above Average - Small Change** **Positive Response > 73%, -5% < Change < 5%**		**Successes** **Positive Response > 73% and Change > 5%**	
Survey Question	**2024 Category**	**Survey Question**	**2024 Category**	**Survey Question**	**2024 Category**
Feel welcomed by other ASPIRE members	Above Average - Small Change	Understanding the mission of ASPIRE	Above Average - Small Change	Understanding how my project/task contributes to the ASPIRE mission	Successes
Feel I am treated fairly as an ASPIRE member	Areas to Monitor	I regard ASPIRE as respected in the community	Above Average - Small Change	Understanding which problems are addressed by ASPIRE	Successes
Feel accepted by other ASPIRE members	Above Average - Small Change	Feel I am given equal opportunities to fully participate in ASPIRE activities	Above Average - Small Change	In my ASPIRE team, I am comfortable discussing difficult issues	Above Average - Small Change
Feel proud to be a member of ASPIRE	Above Average - Small Change	Understanding how ASPIRE-specific research helps people address real world issues	Successes	I regularly use Box to access and share ASPIRE information	Below Average, Small Change
Feel respected by other ASPIRE members	Above Average - Small Change	I would continue working with ASPIRE if given the opportunity	Above Average - Small Change		
Feel I can be myself in ASPIRE	Above Average - Small Change	I am satisifed with my ASPIRE experience	Successes		
		In my ASPIRE team, it is safe to make mistakes	Above Average - Small Change		
		I would recommend working with ASPIRE to others	Above Average - Small Change		
		Understanding concepts associated with ASPIRE field(s) of study	Above Average - Small Change		
		In my ASPIRE team, I am comfortable highlighting problems	Successes		
		My work at ASPIRE gives me a feeling of personal accomplishment	Above Average - Small Change		
		ASPIRE inspires me to do my best work	Above Average - Small Change		
		In my ASPIRE team, I receive meaningful recognition when I do a good job	Above Average - Small Change		
		Feel comfortable voicing my ideas and opinions, even if they are different from others	Above Average - Small Change		
		Feel connected to other ASPIRE members	Below Average - Small Change		
Feel my contributions are valued by other ASPIRE members	Above Average - Small Change	Feel I have seen others like me succeed in ASPIRE	Above Average - Small Change	Understanding potential career pathway(s) associated with the ASPIRE-specific field(s) of study	Areas of Growth
Feel my voice is heard by other ASPIRE members	Above Average - Small Change	Feel I belong in ASPIRE	Above Average - Small Change		
Feel my life experiences are valued by other ASPIRE members	Above Average - Small Change	I have the opportunity to provide feedback	Below Average - Small Change		
Communication between campuses is well coordinated	Needs Review	Updates on the progress of ASPIRE are regularly shared	Below Average - Small Change		
		Information on ASPIRE activities is easily accessible	Below Average - Small Change		
		Communication within ASPIRE is adequate	Needs Review		
		Communication between projects is well coordinated	Below Average - Small Change		
Positive Response < 73% and Change < -5% **Needs Review**		**Positive Response < 73%, -5% < Change < 5%** **Below Average - Small Change**		**Positive Response < 73% and Change > 5%** **Areas of Growth**	

Qualitative Questions Responses for 2025

In addition to the quantitative questions, the annual survey included two qualitative, open-response questions focused on successes, challenges, and recommendations for ASPIRE. These two questions generated 94 text responses and convergence was observed with the trends in the quantitative questions. The successes and areas of growth identified below represent responses from a mixture of organizations and from all response types unless otherwise specified.

Successes

Four themes were identified when respondents were asked to relate the successful aspects of their ASPIRE experience.

A) Growth of Skills & Knowledge

The most common successful aspect expressed was the growth of the respondents' skills & knowledge. The specific skills mentioned varied as would be expected by the diverse participant roles within the center. This supports the results seen in the quantitative section with the improvement of positive responses around professional skills and research skills.

B) People

Responses also indicated that the people working at ASPIRE are one of the most successful aspects of the experience. Not only did they mention the center's top-quality scholars; they also indicated that the staff are incredibly smart, helpful, caring, and willing to help.

C) Network

In addition to the positive experiences with the center participants, survey respondents indicated an appreciation for the network they were building within academia and with industry. This was indicated by all role types.

D) Leaderships' Recent Efforts

Several comments expressed appreciate for the recent efforts made by leadership to create a better culture and for more strategic efforts in partnerships and external funding.

Opportunities for Growth

In addition to identifying successes, survey participants were asked to identify challenges with their ASPIRE experience or give recommendations to improve the ASPIRE experience. Below are the main themes identified from the responses. In addition to a description of the theme, the assessment team has provided recommended actions for these areas.

A) Leadership

The most prevalent theme expressed focused on feedback for leadership positions as well as requested support. This included: A desire for clearer center goals, center directives, and metrics; clearer strategic decisions with the scope and work of the center; more guidance and assistance with the critical strategic decisions made in the projects and work throughout the center; clearer policies and procedures; more

opportunities to connect with center leadership and provide feedback; and more trust, communication, accountability, and respect.

Recommended Actions:

- Proactively prioritize the work in ASPIRE and deprioritize work when there isn't capacity Intentionally communicate these priorities and any de-prioritization
- Hold open office hours on a regular basis
- Create additional regular, anonymous feedback opportunities

i. Personnel Management (Sub-category) *(Responses received from a mixture of organizations with most from staff, postdocs, and students with one comment from faculty)*

Enough responses were received around personnel management to warrant separation into a sub-category. The comments within this sub-category included suggestions and requests to better support/manage the personnel within the center. These suggestions included: defining and communicating roles and responsibilities; providing more timely feedback and clearer guidance and assignments; challenging poor performance or behavior that impact other participants; providing resources and manage workload; and managing burnout. These sentiments may be contributing to the regression observed in the experience questions.

Recommended Actions:

- Clearly define and communicate roles and responsibilities
- Provide timely and constructive feedback on a regular basis
- Intentionally monitor and address burnout with participants (Pulse checks)
- Hold personnel accountable for the clearly defined roles, responsibilities, tasks assigned, and interactions with others

ii. Climate (Sub-category) *(Responses represented a mixture of roles from USU)*

Enough responses were received around climate to warrant separation into another sub-category. It is important to note that all comments within this section were received from participants at USU. Participants expressed the need to: conduct a climate survey; train participants on conflict management and respectful work environment with faculty and staff; be more respectful of women and those with conservative views; and improve the overall culture. The observed regression in the feel questions could be a reflection of these sentiments.

Recommended Actions:

- Conduct a climate survey
- Provide trainings on conflict resolution and respectful communication, etc.
- Address challenging team members

B) Onboarding and Training

As has been observed in previous assessments, the need to improve onboarding and training was a major theme. This was expressed by all participant role types and across multiple organizations. The requests included clarifying roles, processes and procedures, and training in various areas (i.e., proposal writing, lab safety).

Recommended Actions:

- Create a structured onboarding process
- Provide support and training around proposal writing, especially across campuses (proposal best practices workshop, etc.)
- Facilitate understanding of participant roles and responsibilities
- Provide training for those in leadership, management, and supervisory positions
- Provide training around lab safety, project management, presentation skills, entrepreneurship, networking, etc.)

C) Professional Development, Engagement, & Retention

Another theme identified reflects participants' desire to grow professionally and to retain excellent members. The feedback identified a critical need to help not only students grow but also the staff and faculty. This could contribute to the lower faculty/staff responses seen in the quantitative skill questions. Additionally, respondents expressed a need to identify ways to retain high performing members, prevent burnout, and to celebrating accomplishments.

Recommended Actions:

- Provide and support role-appropriate networking opportunities and professional development to all participant types
- Find meaningful ways to recognize the accomplishments of all roles, including the work of the less visible roles (peer recognition) – Take the time to stop and celebrate wins
- Provide role-appropriate resources to lessen burnout and overload (project management support, etc.)

D) Collaboration *(Responses received from faculty and students, no staff, from a variety of organizations)*

Faculty and students contributed to the theme around collaboration. Responses indicated the difficulties in collaborating across campuses and across projects making some feel isolated or like silos despite their efforts toward collaboration. Additionally, participants expressed a desire for increased collaboration moving forward.

Recommended Actions:

- Provide a space (Twist or Box) to list potential collaboration opportunities or those who are interested in collaboration across the entire center (not restricted by project)
- In connection with training events, provide collaboration matching opportunities
- Identify the individual roles and responsibilities for facilitating collaborations

E) Communication

Communication continues to be a theme of the feedback received from participants. This includes the need for clear directions from all leaders and clearly defined processes and procedures. The quantitative questions show that there has been some improvement in the space of overall communication. Participants still express difficulties with communication across campuses and projects.

Recommended Actions:

- Provide centralized, unified, consistent communication and direction for participants
    - Have common talking points for all leaders
- Clearly define and document processes and then provide this documentation to all participants to improve transparency (wiki, Box, etc.)
- Clearly identify and define the opportunities and designated spaces for communication between campuses and between projects. (Who, what, where, when, how); communicate this information to participants

F) Networking & Career Development – *(Responses received from students at a variety of organizations)*

Lastly, students requested more support when exploring careers and finding jobs. Students also requested more dedicated opportunities to network with industry and visit industry partners. Additionally, international students expressed difficulty finding jobs in electrification.

Recommended Actions:

- Clearly identify and define the opportunities for students to network with industry and communicate this information to students regularly
- Identify what additional support ASPIRE could provide for career development and job placement

Internship Questions Responses for 2025

In addition to the standard MERCII questions, student respondents were asked a series of questions around their experiences with internships. Of the 85 students who responded to this set of questions, the majority (75%) had not been offered an internship since they began their program of study.

Table 2: Student Participation in Internships

Have you had, or been offered, any internship since you began your current program of study?		
Response	**# of Responses**	**% of Responses**
No	64	75%
Yes, and I accepted the internship	18	21%
Yes, but I did not accept the internship	3	4%

Those who had received an internship were asked to identify the internship organization as well as skills gained from the internship. This information is available in Appendix 3.

Students were also asked what barriers they had experienced when searching for an internship. Students identified the following as the main barriers: limited opportunities and high competition; application timing issues; lack of awareness or support; misalignment with research focus; personal and logistical constraints; international student challenges; and experience gaps.

For those that were offered an internship but declined the offer, the main reasons identified were the desire to stay and work on a project or degree as well as personal constraints.

ASPIRE Experience

In addition to questions around internships, student participants were asked to describe the skills they are developing through their ASPIRE participation that will be helpful for their career. Students expressed the development of research skills, technical skills, communication skills, collaboration and teamwork, leadership and professional skills (i.e., time management, understanding of ecosystem). They appreciated the hands-on experience, exposure to real-world problems, and learning from experienced mentors. When asked what additional skills ASPIRE could help them develop in preparation for their career, participants expressed a desire to develop skills in industry and professional readiness, communication and presentation skills, and additional technical and analytical skills. Additionally, students asked for further support with job and internship placement and exploration of non-traditional careers and alternative pathways. Lastly, participants indicated a desire for more supervisor/mentor feedback and career guidance.

Career and Degree Information

A full breakdown of the career and degree responses are available on Appendix 3.

Conclusions & Recommendations

Overall, the annual survey administered in 2025 provided very valuable and actionable information. First, the improvement in survey response indicates that the lower survey participation observed in 2024 can be partially contributed to an inaccurate center participant list. Moving forward, it is recommended that the participant list be cleaned annually prior to the administration of the annual survey. Additionally, there is room for growth in student participation which could be a focus of the survey administration next year.

Second, it is recommended that the center review the watchlists, movement between watchlist categories, and the questions with statistically significant changes. Recognition could be given to those whose work contributes to the significant positive growth observed. Additionally, special attention should be given to the “Areas to Monitor” and “Needs Review” categories to determine, one, if the question covers an area of importance for the center, and, two, what actions or plans should be implemented to address the area.

Third, it is recommended that the center review the qualitative response themes and recommended actions to determine what strategic actions will be implemented. Many of the themes from the comments tied in with the results seen from the quantitative survey questions. Implementing strategic actions around these themes should not only improve the comments observed in the qualitative questions but also increase the positive responses on the related quantitative questions.

In conclusion, the results from this analysis show that our center is improving in many aspects. Additionally, there are still areas for growth within the center. The Assessment and Evaluation team plans to conduct the same survey annually and will continue to gather, analyze, and publish the results to advance the continual improvement of the center and to ensure a complete feedback loop.

Appendices:

Appendix 1: 2025 Full-Detailed Watchlists

Experience Watchlists

Annual MERCII Survey Questions with a change greater than 5% between 2022 and 2025

ASPIRE Experience Watchlists

Successes

Survey Questions with a positive response rate above 73% and a 5% or greater increase from 2022

Survey Question	% Positive Response 2025	% Positive Response Faculty/Staff	% Positive Response Students	% Change	p-value	Prior List
Understanding how my project/task contributes to the ASPIRE mission	87.2%	91.0%	**83.0%**	16.0%	0.000	Successes
Understanding which problems are addressed by ASPIRE	83.9%	85.0%	82.0%	7.3%	0.078	Successes
In my ASPIRE team, I am comfortable discussing difficult issues	82.2%	**79.0%**	86.0%	5.3%	0.208	**Above Average - Small Change**
I regularly use Box to access and share ASPIRE information	75.4%	77.0%	74.0%	9.3%	0.053	**Below Average - Small Change**

Above Average - Small Change

Survey Questions with a positive response rate above 73% and with change from 2022 between -5 and 5%

Survey Question	% Positive Response 2025	% Positive Response Faculty/Staff	% Positive Response Students	% Change	p-value	Prior List
Understanding the mission of ASPIRE	84.9%	86.5%	83.1%	1.3%	0.731	Above Average - Small Change
I regard ASPIRE as respected in the community	83.8%	**78.7%**	89.3%	0.1%	0.973	Above Average - Small Change

Feel I am given equal opportunities to fully participate in ASPIRE activities	83.8%	84.4%	83.1%	-1.7%	0.650	Above Average - Small Change
Understanding how ASPIRE-specific research helps people address real world issues	83.7%	81.7%	85.9%	4.0%	0.315	**Successes**
I would continue working with ASPIRE if given the opportunity	82.8%	83.1%	82.4%	-2.1%	0.579	Above Average - Small Change
I am satisifed with my ASPIRE experience	81.6%	**76.4%**	87.1%	2.4%	0.557	**Successes**
In my ASPIRE team, it is safe to make mistakes	81.6%	80.9%	82.4%	0.2%	0.956	Above Average - Small Change
I would recommend working with ASPIRE to others	81.5%	**77.5%**	85.7%	-3.4%	0.386	Above Average - Small Change
Understanding concepts associated with ASPIRE field(s) of study	80.0%	80.0%	80.0%	1.9%	0.654	Above Average - Small Change
In my ASPIRE team, I am comfortable highlighting problems	79.9%	78.7%	81.2%	0.4%	0.922	**Successes**
My work at ASPIRE gives me a feeling of personal accomplishment	79.8%	**75.3%**	84.5%	3.3%	0.444	Above Average - Small Change
ASPIRE inspires me to do my best work	79.2%	**75.0%**	83.5%	1.7%	0.694	Above Average - Small Change
In my ASPIRE team, I receive meaningful recognition when I do a good job	78.2%	**73.0%**	83.5%	2.4%	0.592	Above Average - Small Change
Feel comfortable voicing my ideas and opinions, even if they are different from others	75.9%	76.9%	74.7%	-1.5%	0.741	Above Average - Small Change
Feel connected to other ASPIRE members	74.3%	78.3%	**69.9%**	1.9%	0.684	**Below Average - Small Change**
Areas to Monitor						

Survey Questions with a positive response rate above 73% and a 5% or greater decrease from 2022

Survey Question	% Positive Response 2025	% Positive Response Faculty/Staff	% Positive Response Students	% Change	p-value	Prior List
Feel welcomed by other ASPIRE members	84.2%	87.8%	**80.2%**	-5.2%	0.146	**Above Average - Small Change**
Feel I am treated fairly as an ASPIRE member	83.3%	84.4%	82.1%	-6.7%	0.065	Areas to Monitor
Feel accepted by other ASPIRE members	82.4%	86.5%	**77.8%**	-6.5%	0.081	**Above Average - Small Change**
Feel proud to be a member of ASPIRE	81.6%	84.6%	**78.3%**	-5.1%	0.185	**Above Average - Small Change**
Feel respected by other ASPIRE members	78.9%	78.9%	79.0%	-7.6%	0.058	**Above Average - Small Change**
Feel I can be myself in ASPIRE	74.6%	75.6%	73.5%	-8.9%	0.040	**Above Average - Small Change**

Areas of Growth

Survey Questions with a positive response rate below 73% and a 5% or greater increase from 2022

Survey Question	% Positive Response 2025	% Positive Response Faculty/Staff	% Positive Response Students	% Change	p-value	Prior List
Understanding potential career pathway(s) associated with the ASPIRE-specific field(s) of study	65.5%	69.0%	**61.9%**	7.8%	0.127	Areas of Growth

Below Average - Small Change

Survey Questions with a positive response rate below 73% and with change from 2022 between -5 and 5%

Survey Question	% Positive Response 2025	% Positive Response Faculty/Staff	% Positive Response Students	% Change	p-value	Prior List
Feel I have seen others like me succeed in ASPIRE	71.7%	72.6%	70.7%	-2.9%	0.558	**Above Average - Small Change**

Feel I belong in ASPIRE	69.3%	71.4%	67.1%	-4.6%	0.333	**Above Average - Small Change**
I have the opportunity to provide feedback	68.6%	69.7%	67.5%	-4.0%	0.409	Below Average - Small Change
Updates on the progress of ASPIRE are regularly shared	63.4%	69.7%	**56.6%**	-3.8%	0.446	Below Average - Small Change
Information on ASPIRE activities is easily accessible	57.8%	58.4%	57.1%	-0.3%	0.960	Below Average - Small Change
Communication within ASPIRE is adequate	57.6%	58.4%	56.6%	-3.7%	0.472	**Needs Review**
Communication between projects is well coordinated	39.0%	37.1%	41.0%	1.3%	0.798	Below Average - Small Change

Needs Review

Survey Questions with a positive response rate below 73% and a 5% or greater decrease from 2022

Survey Question	% Positive Response 2025	% Positive Response Faculty/Staff	% Positive Response Students	% Change	p-value	Prior List
Feel my contributions are valued by other ASPIRE members	72.7%	74.4%	70.7%	-8.9%	0.047	**Above Average - Small Change**
Feel my voice is heard by other ASPIRE members	71.0%	72.7%	69.1%	-5.8%	0.217	**Above Average - Small Change**
Feel my life experiences are valued by other ASPIRE members	65.6%	67.1%	64.1%	-9.1%	0.071	**Above Average - Small Change**
Communication between campuses is well coordinated	38.7%	41.6%	**35.7%**	-5.4%	0.303	Needs Review

Mentoring and Skills Watchlists

Annual MERCII Survey Questions with a change greater than 5% between 2022 and 2025

Skill and Mentoring Watchlists

Successes

Survey Questions with a positive response rate above 73% and a 5% or greater increase from 2022

Survey Question	% Positive Response 2025	% Positive Response Faculty/Staff	% Positive Response Students	% Change	p-value	Prior List
NONE						

Above Average - Small Change

Survey Questions with a positive response rate above 73% and with change from 2022 between -5 and 5%

Survey Question	% Positive Response 2025	% Positive Response Faculty/Staff	% Positive Response Students	% Change	p-value	Prior List
Mentor - demonstrated knowledge and expertise	92.2%	89.5%	94.0%	-1.7%	0.607	Above Average, Small Change
Mentor Gave - encouragement to strive for success	88.9%	88.1%	89.4%	1.1%	0.791	Above Average, Small Change
Mentor - established a relationship with me based on trust	88.2%	88.3%	88.1%	-2.0%	0.614	Above Average, Small Change
Mentor - demonstrated respectful workplace behavior	88.2%	88.3%	91.7%	-3.7%	0.333	Above Average, Small Change
Mentor Gave - advice that supports my future plans	87.3%	**84.2%**	89.4%	2.7%	0.543	Above Average, Small Change
Mentor - encouraged my professional development	87.1%	85.5%	88.1%	-1.8%	0.661	Above Average, Small Change
Mentor Gave - feedback that is constructive	86.9%	**80.0%**	91.8%	1.1%	0.806	Above Average, Small Change

Mentor Gave - direction on my research project	85.8%	**81.3%**	88.6%	0.1%	0.981	Above Average, Small Change
Mentor - served as a role model	85.6%	83.9%	86.7%	-0.8%	0.865	Above Average, Small Change
Mentor - cared about me as a person	85.2%	83.1%	86.7%	0.3%	0.955	Above Average, Small Change
Mentor Gave - inspiration to pursue a career in a STEM-related field	85.0%	**75.8%**	88.8%	1.3%	0.805	Above Average, Small Change
Mentor Gave - support in conducting independent work	84.4%	**80.8%**	86.7%	0.8%	0.868	Above Average, Small Change
Mentor - advised on my research goals	83.2%	80.4%	84.8%	-1.3%	0.789	Above Average, Small Change
Mentor Gave - support to develop my professional network	82.6%	83.6%	81.9%	4.2%	0.400	Above Average, Small Change
Professional Skills - working on a research team	73.1%	**70.4%**	75.9%	-1.3%	0.789	**Below Average - Small Change**

Areas to Monitor

Survey Questions with a positive response rate above 73% and a 5% or greater decrease from 2022

Survey Question	% Positive Response 2025	% Positive Response Faculty/Staff	% Positive Response Students	% Change	p-value	Prior List
Mentor - challenged me to extend my abilities	80.9%	**71.2%**	86.9%	-7.3%	0.119	**Above Average, Small Change**
Mentor - advocated for me	80.5%	**77.4%**	82.5%	-5.5%	0.258	**Above Average, Small Change**
Mentor - helped me further my career goals	76.7%	76.0%	77.1%	-5.2%	0.327	Areas to Monitor

Areas of Growth

Survey Questions with a positive response rate below 73% and a 5% or greater increase from 2022

Survey Question	% Positive Response 2025	% Positive Response Faculty/Staff	% Positive Response Students	% Change	p-value	Prior List
Research Skills - solving research-related problems	72.4%	**57.6%**	83.7%	13.1%	0.015	Areas of Growth
Research Skills - using research-related tools	72.4%	**58.1%**	80.2%	11.3%	0.036	**Below Average, Small Change**
Research Skills - collecting data to answer a research question	69.7%	**61.3%**	77.5%	10.2%	0.061	Areas of Growth
Research Skills - interpreting research results	69.2%	**50.7%**	83.9%	11.4%	0.036	Areas of Growth
Research Skills - making connections between research and industrial/practical applications	68.9%	67.1%	70.7%	13.5%	0.014	Areas of Growth
Research Skills - analyzing research data	67.5%	**55.4%**	78.8%	8.6%	0.118	**Below Average, Small Change**
Research Skills - conducting research independently	66.7%	**54.9%**	77.2%	5.3%	0.336	**Below Average, Small Change**
Research Skills - making connections between classroom learning and research	66.0%	**56.1%**	74.1%	9.2%	0.100	Areas of Growth
Research Skills - making connections between existing literature and research	64.2%	**52.8%**	74.7%	7.2%	0.198	**Below Average, Small Change**
Professional Skills - writing documents	59.3%	**51.9%**	66.7%	9.6%	0.085	Areas of Growth
Professional Skills - creating visual displays	55.9%	**45.6%**	65.9%	7.8%	0.163	Areas of Growth
Professional Skills - networking with industry	50.6%	49.4%	51.9%	13.8%	0.011	Areas of Growth

Below Average - Small Change

Survey Questions with a positive response rate below 73% and with change from 2022 between -5 and 5%

Survey Question	% Positive Response 2025	% Positive Response Faculty/Staff	% Positive Response Students	% Change	p-value	Prior List

Professional Skill - collaborating with others	72.6%	**70.0%**	75.3%	2.2%	0.639	Below Average, Small Change
Professional Skill - working on a cross-disciplinary research team	68.1%	69.0%	67.1%	-2.1%	0.673	**Needs Review**
Research Skill - conducting research in an ethical and responsible manner	64.7%	**55.4%**	73.2%	1.3%	0.813	Below Average, Small Change
Professional Skill - networking across ASPIRE partner universities	58.5%	64.4%	**51.9%**	-4.1%	0.434	**Needs Review**
Professional Skill - being innovative	58.2%	55.8%	60.7%	-1.6%	0.757	Below Average, Small Change
Professional Skill - taking on leadership roles	57.5%	58.1%	56.8%	1.5%	0.788	**Needs Review**
Research Skill - practicing general lab safety	57.3%	**45.6%**	67.2%	2.3%	0.722	**Areas of Growth**
Research Skill - formulating research questions	57.1%	54.7%	59.5%	1.7%	0.759	Below Average, Small Change
Professional Skill - managing time efficiently	53.5%	**41.4%**	66.3%	-2.7%	0.619	Below Average, Small Change
Research Skill - practicing secure data management	53.1%	**49.3%**	56.8%	2.7%	0.641	Below Average, Small Change
Professional Skill - being entrepreneurial	32.5%	30.8%	34.2%	-1.1%	0.841	**Needs Review**

Needs Review

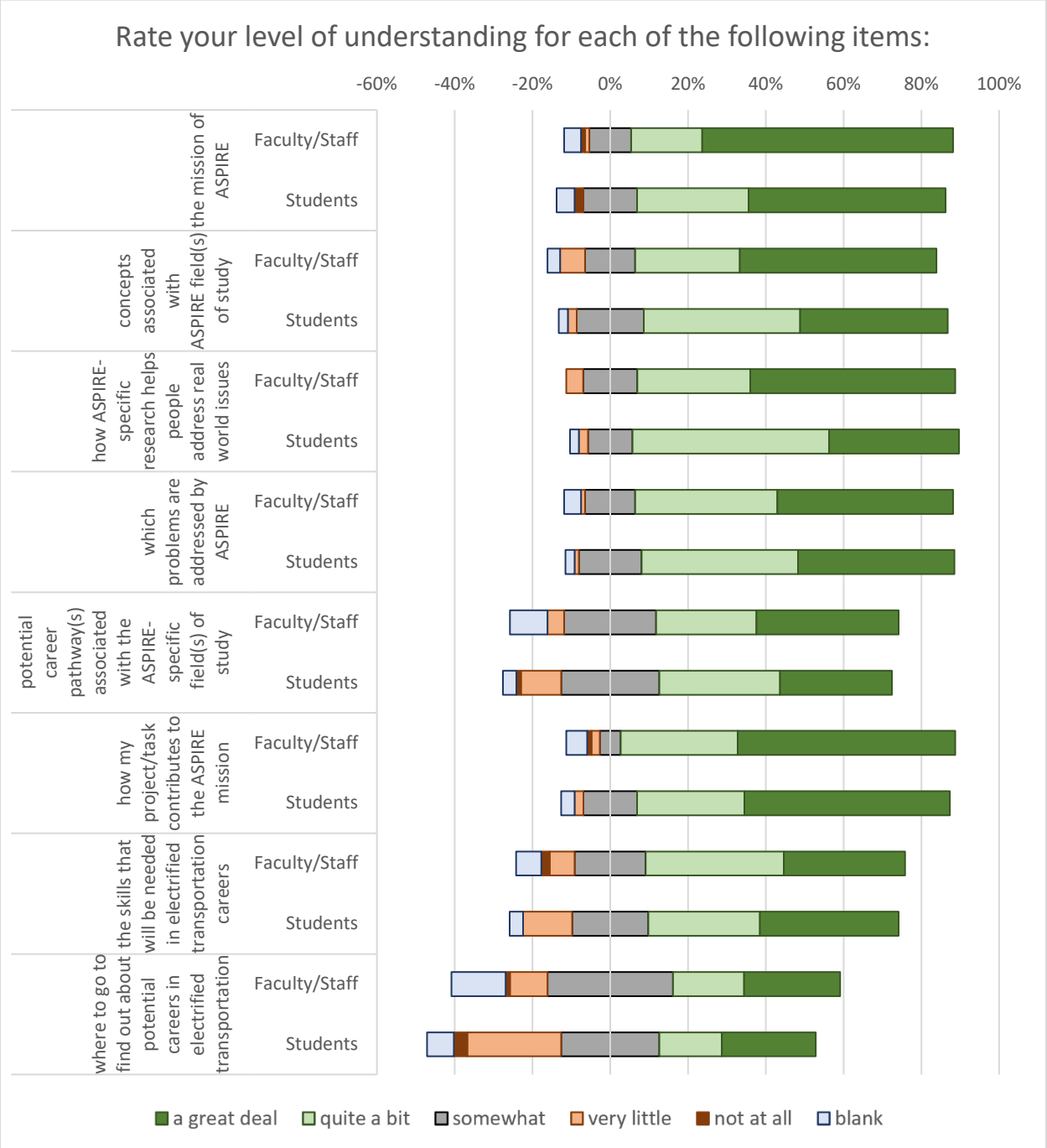
Survey Questions with a positive response rate below 73% and a 5% or greater decrease from 2022

Survey Question	% Positive Response 2025	% Positive Response Faculty/Staff	% Positive Response Students	% Change	p-value	Prior List
Professional Skill - communicating orally	59.1%	**50.6%**	67.5%	-6.7%	0.203	Needs Review

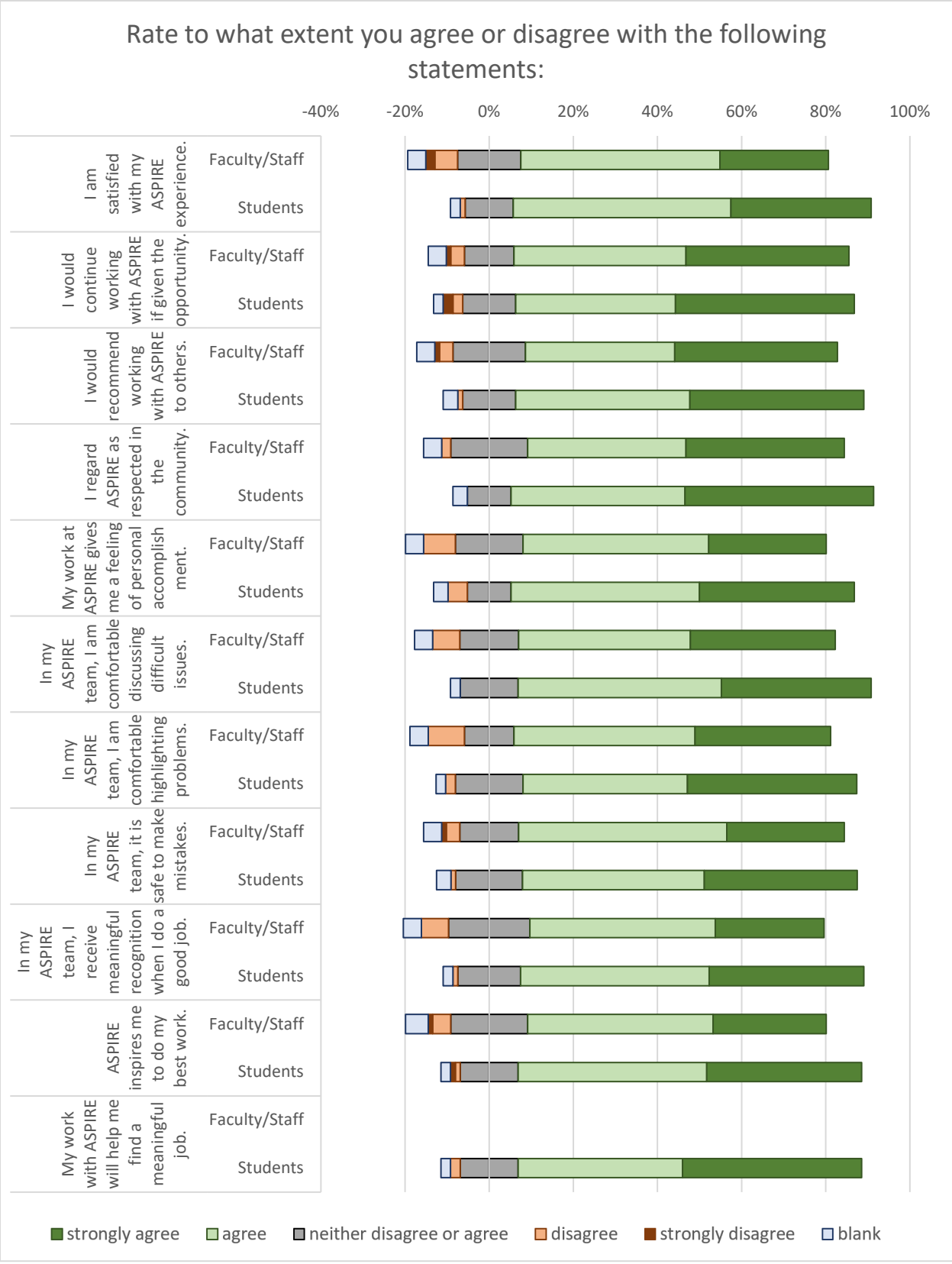
Appendix 2: 2025 Detailed Survey Results by Quantitative Question Groups

Experience Quantitative Questions

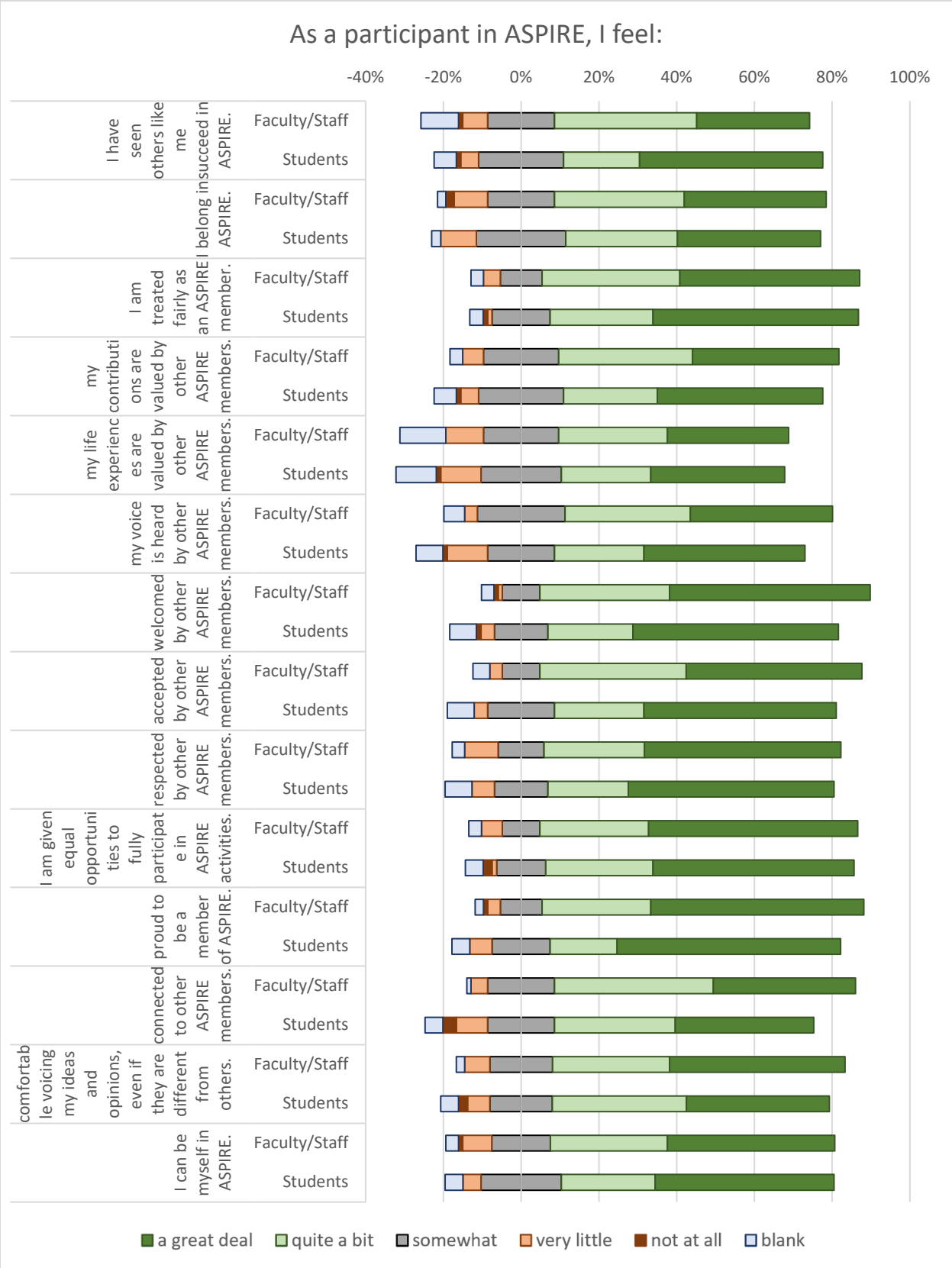
A. Understanding Questions



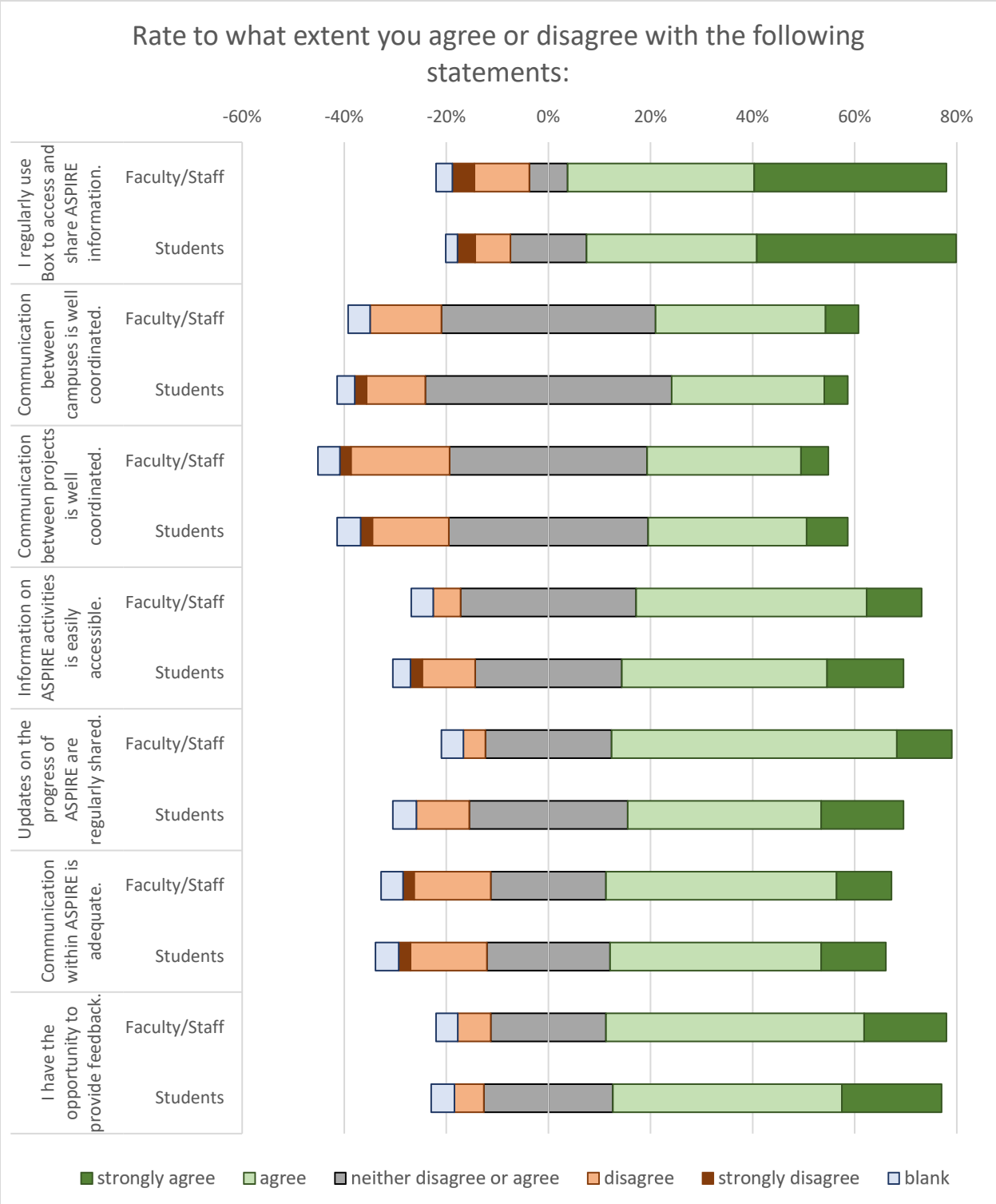
B. Experience Questions



C. Feel Questions

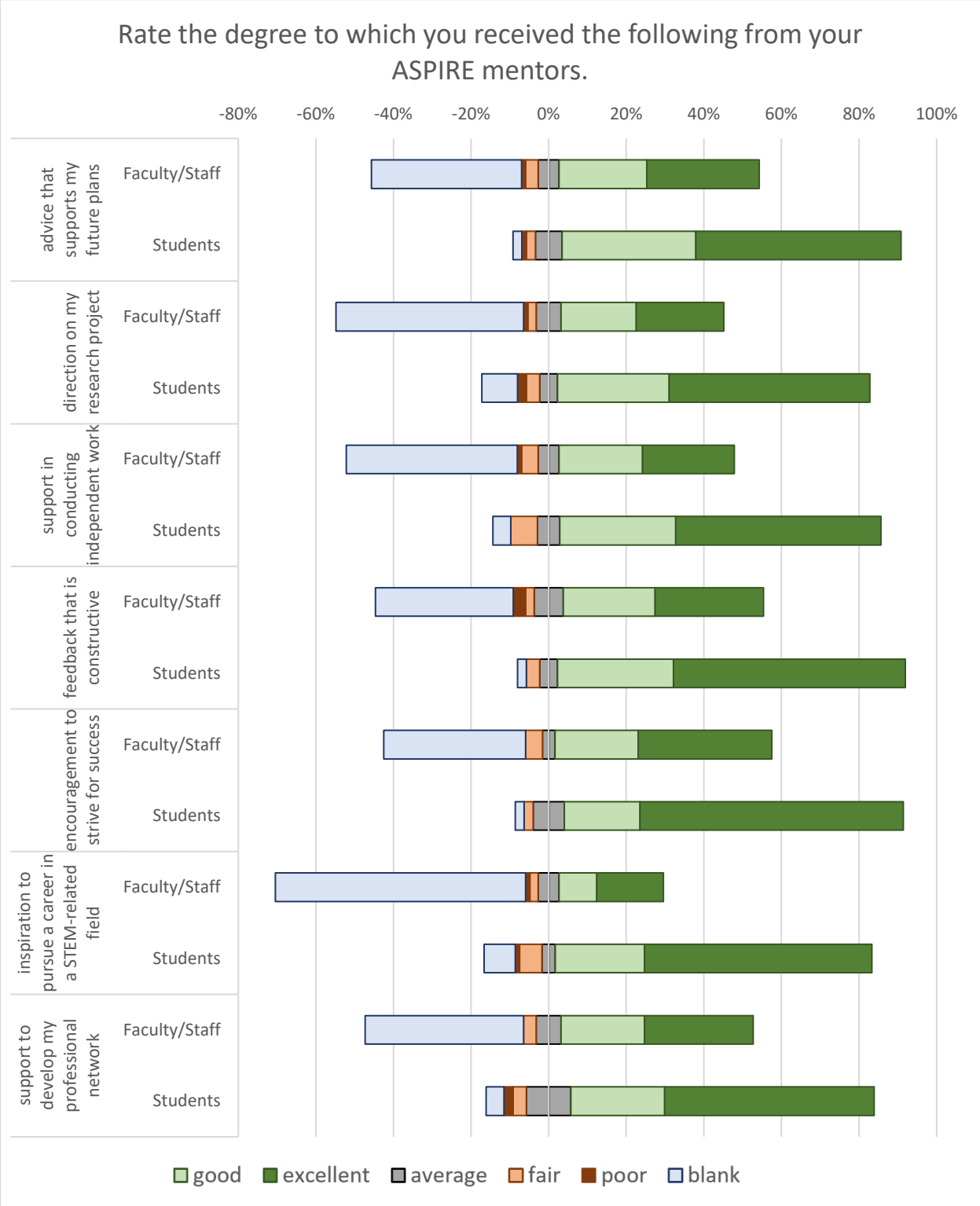


D. Communication Questions

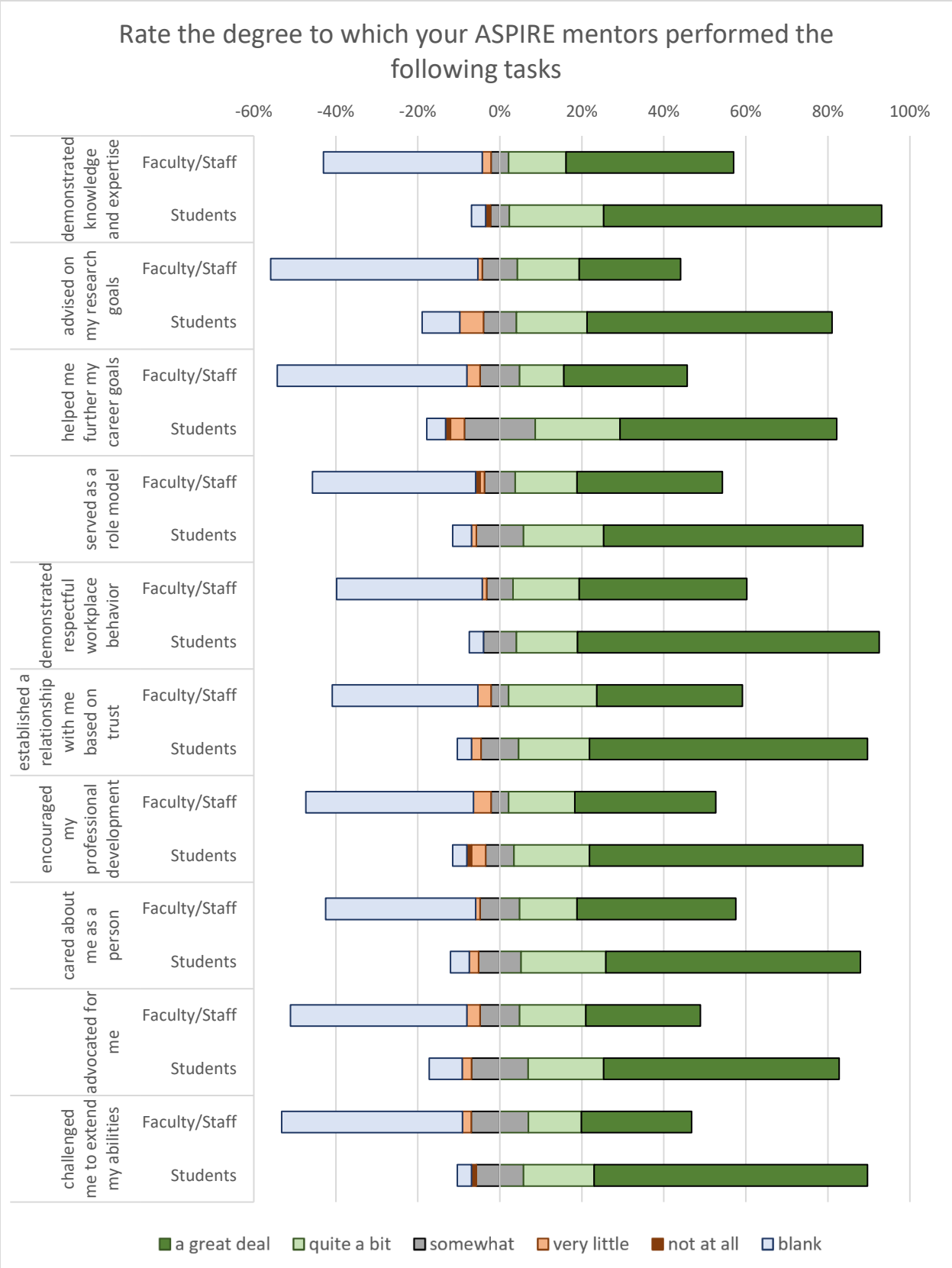


Mentoring and Skills Quantitative Questions

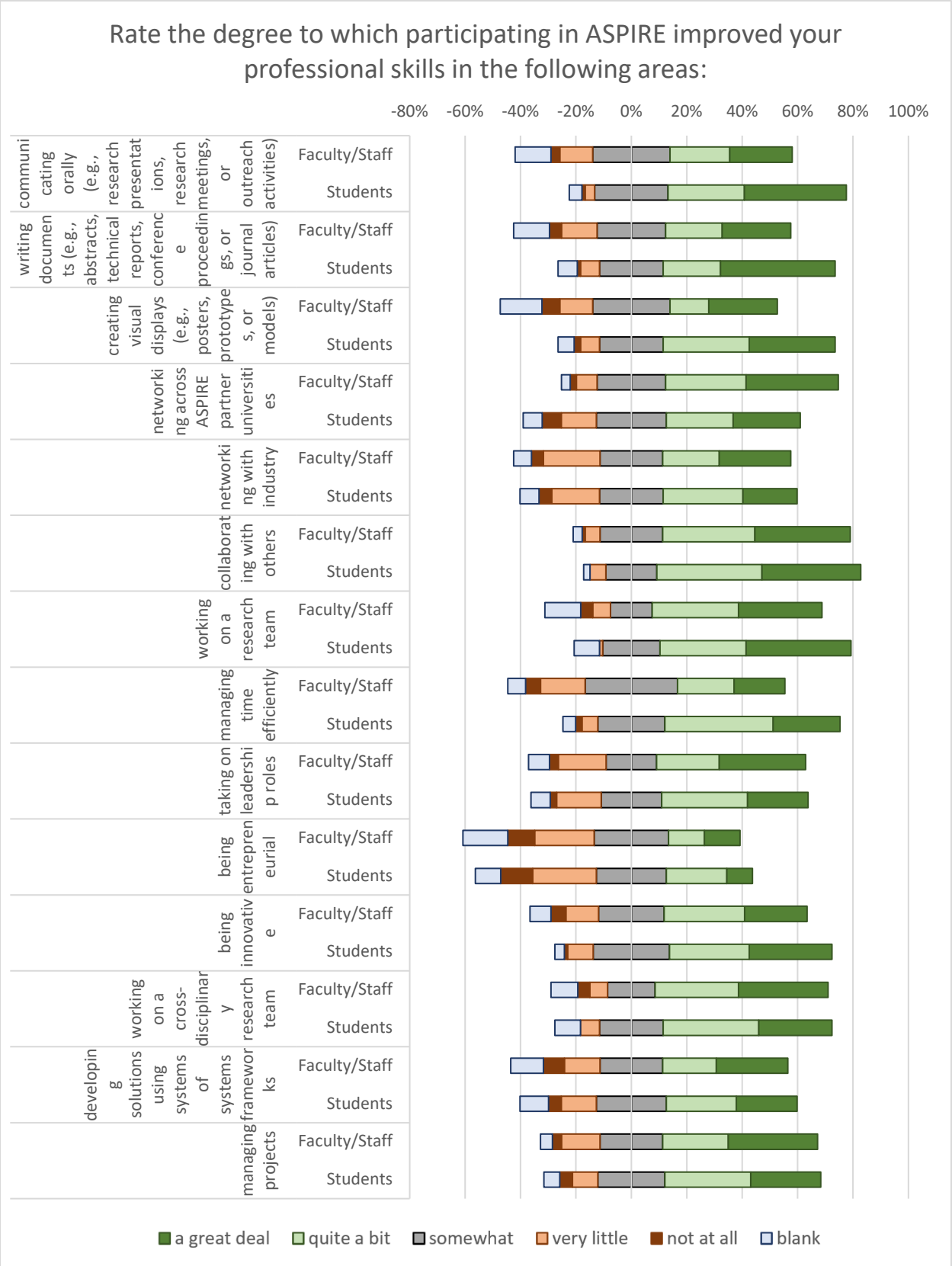
A. Mentoring Experience Questions



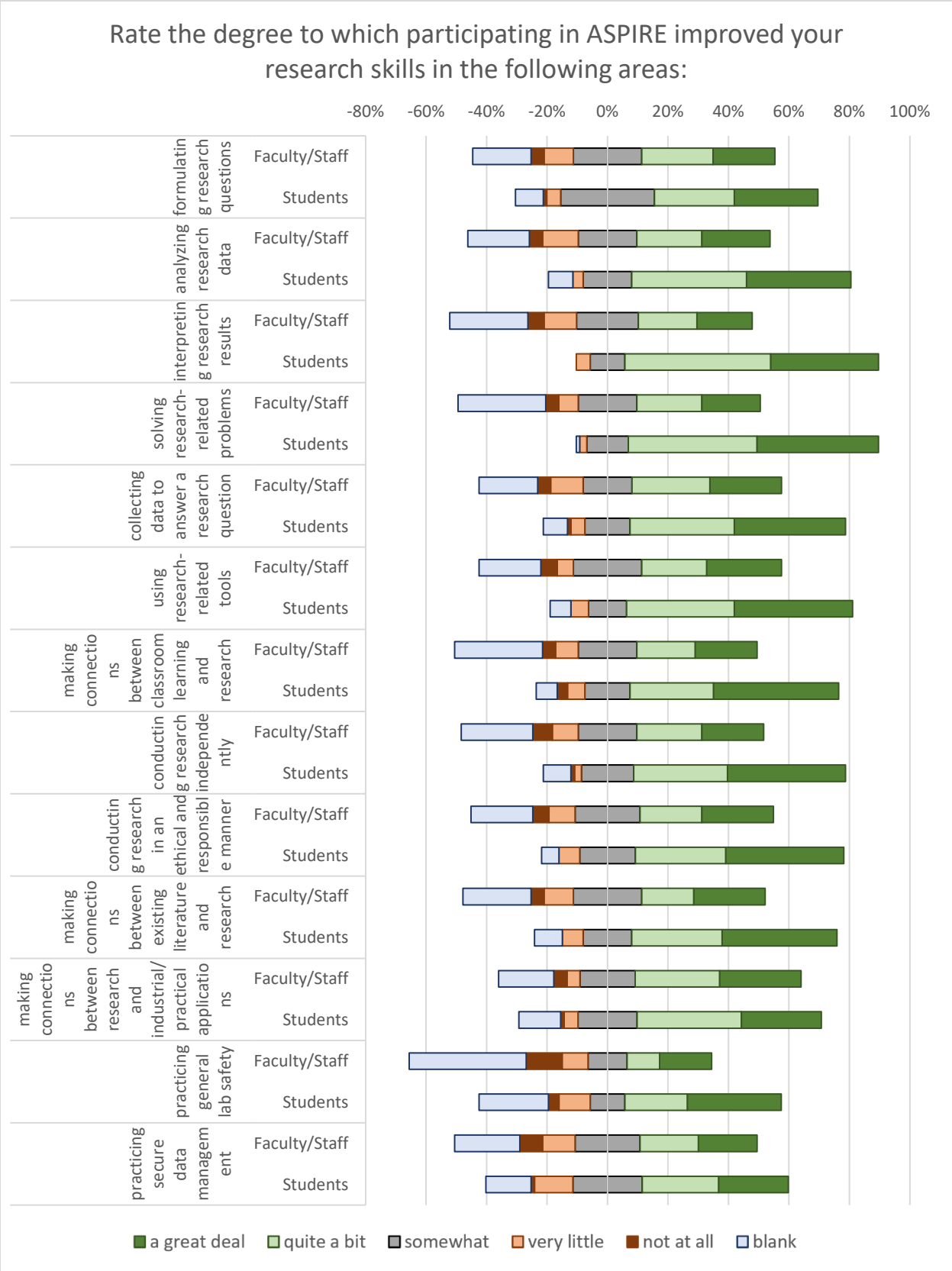
B. Mentoring Performance Questions



C. Professional Skills Questions



D. Research Skills Questions



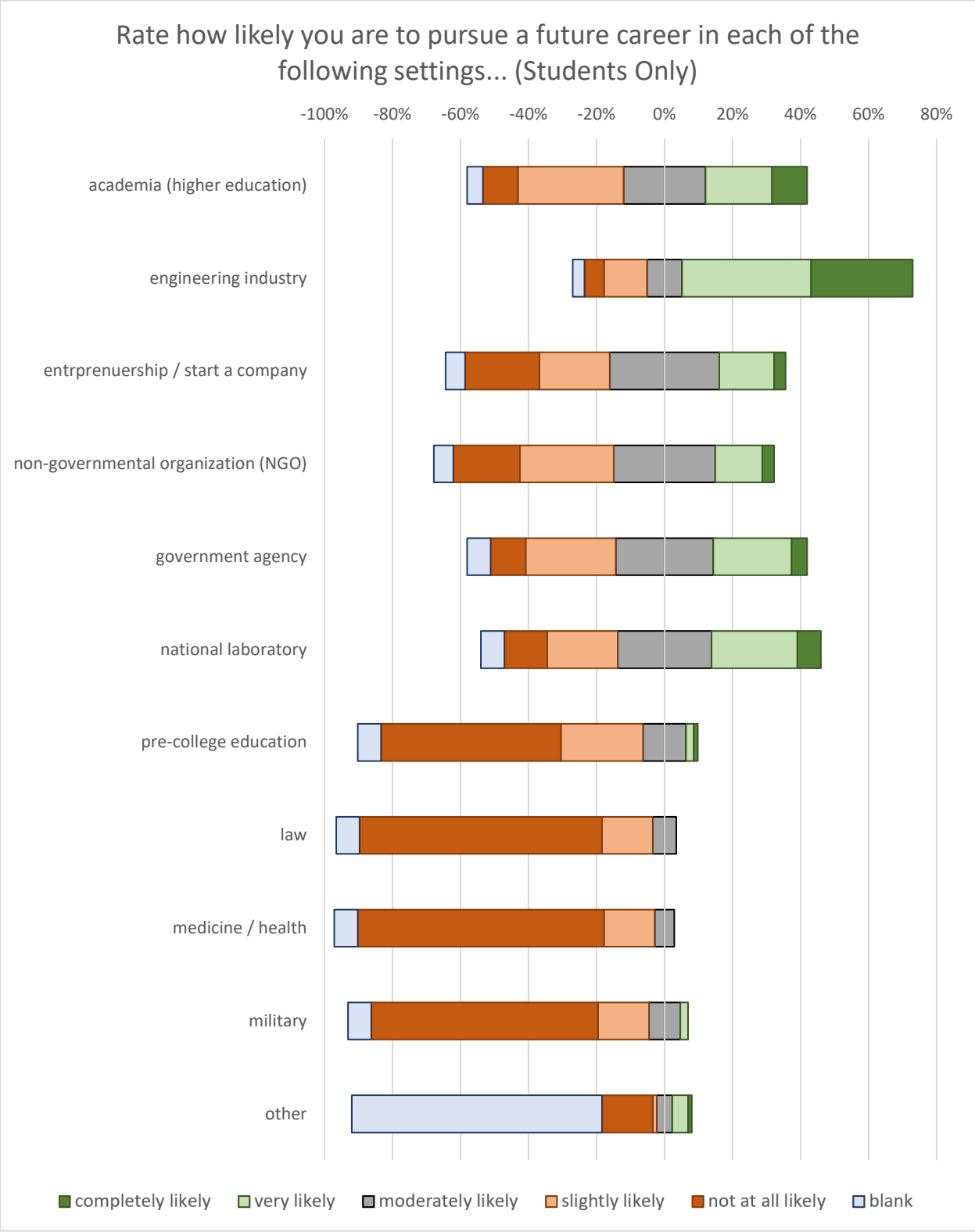
Appendix 3: 2025 Detailed Survey Results for Internship, Career and Degree Questions

Participant's Experience with Internships

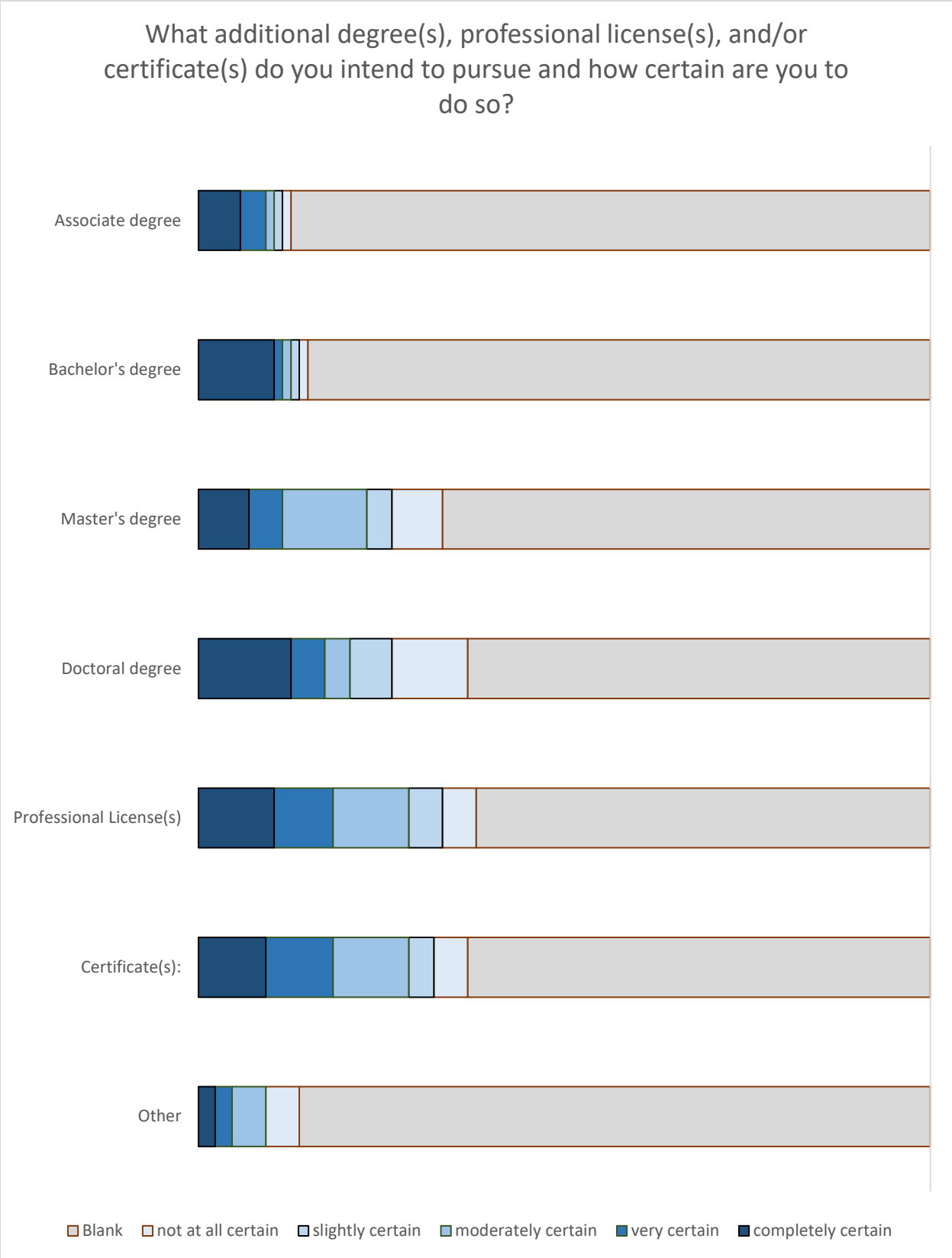
With which organization is or was your internship? If you have had more than one, please include information on them all.
Alta Planning + Design
ASPIRE
Hill Air Force Base
The Caine College of the Arts at USU
Jacobs Engineering
Los Alamos National Lab
National Renewable Energy Laboratory
Naval nuclear laboratory
Northrop Grumman
PacifiCorp
SEED through the Huntsman Business School.
Texas Instruments
USU College of Engineering
Utah Innovation Fund
Utah Transit Authority
WSP in USA

What skills did you gain from the internship?
Copywriting, Web Content Writing, Interviewing, Feature Story Writing, Communication, and a Broad Understanding of Electric Vehicles and EV Infrastructure.
Due Diligence, and investment analysis
How to coordinate working across multiple projects simultaneously; how to align goals between different projects to help me make progress on my dissertation.
Knowledge of internal utility systems; relationships with customers, suppliers, and regulators; data analysis
Leadership, public speaking, time management, and speak with industry members.
Marketing and communications skills.
Research in Industry Environment
Researching skills and the ability to read academic papers
Time management, soft skills development, Excel, communication, professionalism, critical thinking, and networking.

Future Career Questions



Future Degree Questions



ASPIRE Annual Survey 2025

Q1.1 Thank you for providing feedback on the ASPIRE Engineering Research Center. The ASPIRE Annual Survey takes 7-10 minutes to complete and includes questions about your experience with the Center. The feedback aids in our continuous improvement cycle and allows us to benchmark ASPIRE to other NSF-funded Engineering Research Centers. Please note that individual responses provided will remain confidential and only aggregate data will be shared. Your name will not be associated with your responses for anyone outside the assessment team. Your feedback is a crucial piece to improving our Center and we recognize that taking this survey is a time commitment and, as such, we encourage you to take this survey during ASPIRE hours. You will be able to provide anonymous feedback at the end of the survey.

Q1.2 What is your primary role with the ASPIRE Engineering Research Center?

- K-12 student
- Undergraduate student
- Graduate student
- Full-time staff
- Postdoctoral scholar
- Faculty

Q2.1 **Understanding of ASPIRE**

Q2.2 Rate your level of understanding for each of the following items.

* Please select the "not applicable" option if the item does not apply to you.

	not at all	very little	somewhat	quite a bit	a great deal	not applicable
the mission of ASPIRE	•	•	•	•	•	•
concepts associated with ASPIRE field(s) of study	•	•	•	•	•	•
how ASPIRE-specific research helps people address real world issues	•	•	•	•	•	•
which problems are addressed by ASPIRE	•	•	•	•	•	•
potential career pathway(s) associated with the ASPIRE specific field(s) of study	•	•	•	•	•	•
how my project/task contributes to the ASPIRE mission	•	•	•	•	•	•
the skills that will be needed in electrified transportation careers	•	•	•	•	•	•
where to go to find out about potential careers in electrified transportation	•	•	•	•	•	•

Q3.1 **Impact on skills**

Q3.2 Rate the degree to which participating in ASPIRE improved your professional skills in the following areas.
* Please select the "not applicable" option if the item does not apply to you.

	not at all	very little	somewhat	quite a bit	a great deal	not applicable
communicating orally (**e.g.**, research presentations, research meetings, **or** outreach activities)	•	•	•	•	•	•
writing documents (**e.g.,** abstracts, technical reports, conference proceedings, **or** journal articles)	•	•	•	•	•	•
creating visual displays (**e.g.**, posters, prototypes, **or** models)	•	•	•	•	•	•
networking across ASPIRE partner universities	•	•	•	•	•	•
networking with industry	•	•	•	•	•	•
collaborating with others	•	•	•	•	•	•
working on a research team	•	•	•	•	•	•
managing time efficiently	•	•	•	•	•	•
taking on leadership roles	•	•	•	•	•	•
being entrepreneurial	•	•	•	•	•	•
being innovative	•	•	•	•	•	•
working on a cross-disciplinary research team	•	•	•	•	•	•
developing solutions using systems of systems frameworks	•	•	•	•	•	•
managing projects	•	•	•	•	•	•

Q3.3
Rate the degree to which participating in ASPIRE improved your research skills in the following areas.
* Please select the "not applicable" option if the item does not apply to you.

	not at all	very little	somewhat	quite a bit	a great deal	not applicable
formulating research questions	•	•	•	•	•	•
analyzing research data	•	•	•	•	•	•
interpreting research results	•	•	•	•	•	•
solving research-related problems	•	•	•	•	•	•
collecting data to answer a research question	•	•	•	•	•	•
using research-related tools	•	•	•	•	•	•
making connections between classroom learning and research	•	•	•	•	•	•
conducting research independently	•	•	•	•	•	•
conducting research in an ethical and responsible manner	•	•	•	•	•	•
making connections between existing literature and research	•	•	•	•	•	•
making connections between research and industrial/practical applications	•	•	•	•	•	•
practicing general lab safety	•	•	•	•	•	•
practicing secure data management	•	•	•	•	•	•

Q4.1 **Center Environment**

Q4.2 As a participant in ASPIRE, I feel...

* Please select the "not applicable" option if the item does not apply to you.

	not at all	very little	somewhat	quite a bit	a great deal	not applicable
I have seen others like me succeed in ASPIRE.	•	•	•	•	•	•
I belong in ASPIRE.	•	•	•	•	•	•
I am treated fairly as an ASPIRE member.	•	•	•	•	•	•
my contributions are valued by other ASPIRE members.	•	•	•	•	•	•
my life experiences are valued by other ASPIRE members.	•	•	•	•	•	•
my voice is heard by other ASPIRE members.	•	•	•	•	•	•
welcomed by other ASPIRE members.	•	•	•	•	•	•
accepted by other ASPIRE members.	•	•	•	•	•	•
respected by other ASPIRE members.	•	•	•	•	•	•
I am given equal opportunities to fully participate in ASPIRE activities.	•	•	•	•	•	•
proud to be a member of ASPIRE.	•	•	•	•	•	•
connected to other ASPIRE members.	•	•	•	•	•	•
comfortable voicing my ideas and opinions, even if they are different from others.	•	•	•	•	•	•
I can be myself in ASPIRE.	•	•	•	•	•	•

Q5.1 Mentorship Experience

Q5.2 Who within ASPIRE do you consider to be your mentor(s)?

* Please check all that apply.

- Faculty members
- Postdoctoral scholars
- Graduate students
- Undergraduate students
- Summer program participants (RET, REU, YS, REM, REV)
- Industry partners
- Center staff
- Other, please specify: _____
- ⊗Not applicable

Q5.3 Do you have a mentor outside of ASPIRE?

- Yes
- No

Q5.4 Rate the degree to which you received the following from your ASPIRE mentors.
* Please select the "not applicable" option if the item does not apply to you.

	poor	fair	average	good	excellent	not applicable
advice that supports my future plans						
direction on my research project						
support in conducting independent work						
feedback that is constructive						
encouragement to strive for success						
inspiration to pursue a career in a STEM-related field						
support to develop my professional network						

Q5.5
Rate the degree to which your ASPIRE mentors performed the following tasks.
* Please select the "not applicable" option if the item does not apply to you.

	not at all	very little	somewhat	quite a bit	a great deal	not applicable
demonstrated knowledge and expertise.						
advised on my research goals.						
helped me further my career goals.						
served as a role model.						
demonstrated respectful workplace behavior.						
established a relationship with me based on trust.						
encouraged my professional development.						
cared about me as a person.						
advocated for me.						
challenged me to extend my abilities.						

Q6.1 **Science, Technology, Engineering and Mathematics (STEM)-related Future Plans**

Q6.2 In which program(s) are you currently enrolled? List major(s) or field(s) of study as applicable. Please check all that apply.

- I am not currently enrolled in any degree, professional licenses, or certificate programs.
- High School diploma: _____
- Associate degree: _____
- Bachelor's degree: _____
- Master's degree: _____
- Doctoral degree: _____
- Professional License(s): _____
- Certificate(s): _____
- Other: _____

Q6.3 What degree(s), professional license(s), and /or certificate(s) have you earned? List major(s) or field(s) of study as applicable. Please check all that apply.

- I do not currently hold any degrees, professional incenses, or certificates.
- Associate degree: _____
- Bachelor's degree: _____
- Master's degree: _____
- Doctoral degree: _____
- Professional license(s): _____
- Certificate(s): _____
- Other: _____

Q6.4 Do you intend to pursue any additional degree(s), professional license(s) and/or certificate(s)?

- Yes
- No
- Maybe

Q6.5 What additional degree(s), professional license(s), and/or certificate(s) do you intend to pursue and how certain are you to do so? List major(s) or field(s) of study as applicable.
* Please select the "not applicable" option if the option does not apply to you.

	not at all certain	slightly certain	moderately certain	very certain	completely certain	not applicable
Associate degree:	•	•	•	•	•	•
Bachelor's degree:	•	•	•	•	•	•
Master's degree:	•	•	•	•	•	•
Doctoral degree:	•	•	•	•	•	•
Professional License(s):	•	•	•	•	•	•
Certificate(s):	•	•	•	•	•	•
Other:	•	•	•	•	•	•

Q6.6 Rate how likely you are to pursue a future career in each of the following settings.

	not at all likely	slightly likely	moderately likely	very likely	completely likely
academia (higher education)	•	•	•	•	•
engineering industry	•	•	•	•	•
entrepreneurship/ start a company	•	•	•	•	•
non-government organization (NGO)/ non-profit	•	•	•	•	•
government agency	•	•	•	•	•
national laboratory	•	•	•	•	•
pre-college education	•	•	•	•	•
law	•	•	•	•	•
medicine/ health	•	•	•	•	•
military	•	•	•	•	•
other, please specify:	•	•	•	•	•

Q7.1 Program Satisfaction

Q7.2 Rate to what extent you agree or disagree with the following statements

	strongly disagree	disagree	neither disagree nor agree	agree	strongly agree
I am satisfied with my ASPIRE experience.	•	•	•	•	•
I would continue working with ASPIRE if given the opportunity.	•	•	•	•	•
I would recommend working with ASPIRE to others.	•	•	•	•	•
I regard ASPIRE as respected in the community.	•	•	•	•	•
My work at ASPIRE gives me a feeling of personal accomplishment.	•	•	•	•	•
In my ASPIRE team, I am comfortable discussing difficult issues.	•	•	•	•	•
In my ASPIRE team, I am comfortable highlighting problems.	•	•	•	•	•
In my ASPIRE team, it is safe to make mistakes.	•	•	•	•	•
In my ASPIRE team, I receive meaningful recognition when I do a good job.	•	•	•	•	•
ASPIRE inspires me to do my best work.	•	•	•	•	•
My work with ASPIREwill help me find a meaningful job.	•	•	•	•	•

Q7.3 What recommendations would you make to improve the ASPIRE experience?

_____

Q7.4 Please use this space to note additional comments relating to challenges you faced or successful aspects of your ASPIRE experience.

_____

Q8.1 Rate to what extent you agree or disagree with the following statements.

	strongly disagree	disagree	neither disagree nor agree	agree	strongly agree
I regularly use Box to access and share ASPIRE information.	•	•	•	•	•
Communication between campuses is well coordinated.	•	•	•	•	•
Communication between projects is well coordinated.	•	•	•	•	•
Information on ASPIRE activities is easily accessible.	•	•	•	•	•
Updates on the progress of ASPIRE are regularly shared.	•	•	•	•	•
Communication within ASPIRE is adequate.	•	•	•	•	•
I have the opportunity to provide feedback.	•	•	•	•	•

Q9.1 Have you had, or been offered, any internship since you began your current program of study?

- Yes, and I accepted the internship
- Yes, but I did not accept the internship
- No

Q9.2 With which organization is or was your internship? If you have had more than one, please include information on them all._____

Q9.3 What skills did you gain from the internship?

_____

Q9.4 Why didn't you accept the internship?

_____

Q9.5 What barriers did you encounter when trying to obtain an internship?

_____

Q9.6 What skills are you developing through your ASPIRE participation that will be helpful for your career? _____

Q9.7 What additional skills could ASPIRE help you develop in preparation for your career?

_____