NASA Ignite 2024 Phase I Solicitation

Proposal Details

Proposal Number: Ai02.24-14
Subtopic Title: Aviation-Ready Electrical Energy Storage for All-Electric or Hybrid Electric Aircraft
Proposal Title: Universal Battery Integration Module for Hybrid and Electric Aircraft Powertrains

Small Business Concern

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Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 3 - 4
Technical Abstract (Limit 2000 characters):

The proposed innovation is the development of a universal and highly versatile Battery Integration Module (BIM) designed to accelerate adoption of battery systems in future hybrid and electric aircraft. The BIM aims to address the critical challenges of power density, modularity, configurability, and ease of use, enabling seamless integration with a wide range of batteries and components for aerospace applications. Our technology focuses on creating an energy system where the BIM integrates with, monitors, and protects the battery, interfaces with key elements of the powertrain, providing crucial data for control systems. The purpose of this proposal is to secure funding to advance the BIM from TRL 3 to TRL 4, achieving validation in a laboratory environment. Phase I funding will be utilized for integrating basic technological components and conducting comprehensive tests to validate electrical performance, thermal management, fault tolerance, etc. This foundational work will establish the feasibility of our innovative architecture concept, demonstrating high-power capability while maintaining modularity and scalability. Our target markets include both the civil and defense aviation sectors. The BIM's modular and configurable nature makes it suitable for a broad range of aircraft, from small unmanned aerial vehicles to large manned aircraft. The regional aviation market, in particular, stands to benefit from our technology by accelerating the development and adoption of next-generation battery energy systems, ultimately contributing to cleaner, quieter, and more sustainable air travel. Phase I will demonstrate the BIM's readiness for integration into hybrid powertrain testbenches, paving the way for further development and commercialization in Phase II. This project will position us as a key player in the rapidly evolving electric aviation industry, offering a robust solution that bridges the gap between current battery technologies and future aerospace systems.

Duration: 6

Proposal Details

Proposal Number: Ai02.24-17
Subtopic Title: Aviation-Ready Electrical Energy Storage for All-Electric or Hybrid Electric Aircraft
Proposal Title: Next Generation, Aviation-Ready Modular Energy Storage Solution for Electric and Hybrid Aircraft

Small Business Concern

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Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 2 - 4
Technical Abstract (Limit 2000 characters):

Imperia Batteries, a division of Physical Sciences Inc. (PSI), will develop and demonstrate a modular energy storage solution for integration into large unmanned aerial vehicles in the 1500 to 5000 lbs size class. A modular solution enables straightforward integration across multiple UAV platforms and helps to keep lifecycle costs down. During the Phase I, Imperia will work closely with Raytheon to understand battery specifications and requirements for the target vehicle(s) in order to design the energy modules. Imperia will conduct a trade study on cell level components to ensure suitable battery performance as well as manufacturability, cost, and supply chain requirements. Additionally, Imperia will design electronics and packaging solutions for the designed energy module. In the Phase II, Imperia will prototype the energy module and expand validation activities to ensure form, fit, and function. Successful completion of these efforts will demonstrate the readiness of the technology for further scale-up and demonstrations.

Duration: 6

Proposal Details

Proposal Number: Hi02.24-10
Subtopic Title: Leak-Free Cryogenic Valves and Quick Disconnects
Proposal Title: E-Drive: Electromagnetic Zero-Emission Valve Drive

Small Business Concern

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Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 2 - 3
Technical Abstract (Limit 2000 characters):

This project aims to advance and commercialize an innovative electromagnetic zero-leak, hermetically sealed valve drive capable of actuating various cryogenic valves. The technology eliminates 100% of the valve stem leaks and enhances efficiency, reliability and longevity of valve systems by removing moving parts exposed to extreme, dusty or regolith environments. Additionally, it can be applied to couplings, providing a superior alternative in extreme environments. MagDrive's patented magnetic actuation, partially funded by NASA, enables zero-emission hermetically sealed valve stems, protecting valve parts from contamination and degradation. The magnetic actuation eliminates dynamic seals, preventing leak paths at any temperature or pressure. This is critical for cryogenic fluid management in diverse environments, from space to surface applications. With E-Drive actuation energy is transmitted through a solid wall from an external electromagnet to an inner magnetic cartridge. The wall encapsulates the stem eliminating dynamic seals and the leak path. E-Drive is compatible with legacy valve systems and standard valve types and sizes used in cryogenic and other target industries. Additionally, this innovation reduces overall size requirements and weight of long stem offsets in cryogenics, addressing the industry's miniaturization focus and aerospace payload considerations. Funds will be used to: 1. Incorporate NASA's performance requirements and produce a preliminary mechanical

design. 2. Develop models to predict valve performance under different conditions. 3. Deliver a 3D CAD prototype E-Drive for virtual performance testing of CV curve, speed, and power and torque requirements. And providing the foundation for the Phase II physical prototype and testing. Target markets include NASA, the commercial cryogenic industry, and sectors requiring high-reliability cryogenic fluid management, commercial aerospace, oil and gas, petrochemical, and chemical industries.

Duration: 6

Proposal Details

Proposal Number: Hi02.24-11
Subtopic Title: Leak-Free Cryogenic Valves and Quick Disconnects
Proposal Title: FuseBlox System for Robotically-Assisted Cryogenic Applications

Small Business Concern

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Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 2 - 3
Technical Abstract (Limit 2000 characters):

SpaceWorks proposes an innovative adaptation of its mid-TRL, non-cryogenic FuseBlox™ in-space fluid transfer system for cryogenic applications ("Cryogenic FuseBlox"). The Phase I effort aims to deliver a leak-free fluid transfer system that is more reliable, efficient, and enduring than current market options. The effort undertakes an in-depth technical analysis of the feasibility, including thermal modelling, valve analysis of alternatives, and potential inventions to overcome specific challenges related to cryogenic fluid management. SpaceWorks will also perform customer discovery activities to inform the product design, ensure a good product-market fit, and validate the commercial potential for follow-on development investments. The resulting innovation is expected to advance the state-of-the-art and of-the-market in robotically-assisted cryogenic fluid management systems, initially for in-space satellite servicing and consequently for the broader terrestrial markets such as launch vehicle processing and industrial applications in harsh environments.

Duration: 6

Proposal Details

Proposal Number: Hi02.24-17
Subtopic Title: Leak-Free Cryogenic Valves and Quick Disconnects
Proposal Title: Non-Leak Bi-Directional Dynamic Valve with Novel Metal Seal

Small Business Concern

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Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 3 - 5
Technical Abstract (Limit 2000 characters):

The Sherwin Valve will remove the problem of leaking valves in the space industry. It is a multi-directional, dynamic valve which was designed around a novel metal seal. The valve will yield near-zero leaks at a range of temperatures and pressures. It will save the space industry (and other industries) millions in lost schedule and budget, increase astronaut and ground personnel safety, and significantly reduce technical risks associated with valve integration and operation. The proposed project is a collaborative effort between Vivace International Corporation and Space Precision Systems. The primary purpose of this effort is to test the metal seal design by completing a series of bubble tests at room temperature in when submerged liquid nitrogen. The team will also complete thermal and structural analysis of a preliminary valve design and develop detailed valve requirements. The first implementation of the metallic seal was developed for the food industry. It held water at 87,000 psi for 24 hours. The seal design has advantages for the space industry, including increased resistance to launch loads, cryogenic temperatures, temperature deltas, and FOD. The proposal will demonstrate feasibility of the seal, and prepare for Phase 2 valve development.

Duration: 6

Proposal Details

Proposal Number: Hi02.24-18
Subtopic Title: Leak-Free Cryogenic Valves and Quick Disconnects
Proposal Title: CryoGuard PEEK-N Seals

Small Business Concern

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Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 1 - 3
Technical Abstract (Limit 2000 characters):

The CryoGuard PEEK-N Seals by Beacon Industries are an advanced cryogenic valve sealing solution designed to address key challenges in fluid management systems, including leakage, durability, and mechanical strength under extreme conditions. Utilizing natural Polyether Ether Ketone (PEEK-N), these seals offer superior mechanical properties such as high tensile strength, chemical resistance, and excellent performance at cryogenic temperatures. The innovative multi-disc sealing mechanism consists of stacked PEEK-N discs, interspersed with spacer discs, maximizing elastic deformation and enhancing conformity to the sealing surface. This design increases the contact area, evenly distributes the sealing load, and significantly reduces leakage. The seals' modular design, developed in AutoCAD, allows for rapid adaptation to various system geometries, ensuring compatibility with existing infrastructure. Comprehensive testing, including API 527 "300 K" testing, NASA's 54000GT Cryogenic "77 K" testing, and ISO 12103-1 FOD testing, validates the technology's reliability. Automated data acquisition and analysis using MATLAB guarantee precise control and accurate measurement recording. CryoGuard PEEK-N Seals are ideal for critical applications such as NASA's Artemis Program, Lunar Gateway, ISS cryogenic systems, and the Mars Sample Return Mission, providing enhanced reliability, reduced maintenance, and improved efficiency. This innovation represents a significant advancement in cryogenic sealing technology, offering robust performance in demanding environments.

Duration: 6

Proposal Details

Proposal Number: Si02.24-2
Subtopic Title: Decision Support Tools Using NASA Earth Science Data
Proposal Title: Continuous Snow Monitoring for Improved Water Supply Management

Small Business Concern

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Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 3 - 6
Technical Abstract (Limit 2000 characters):

Applied Research Team, Inc. proposes an innovative decision support tool that provides continuous snow monitoring for improved water supply management. More than 40 million people in the Western US and over a billion people globally rely on water stored high in the mountains as snowpack that melts in spring and summer. This precious resource is threatened by climate change and associated extreme weather patterns, increased demands and less dependable availability. Drinking water, irrigation and hydropower depend on the decisions by water managers for allocation and release of water when needed. Our proposal integrates ground-based weather radar and synthetic aperture radar with advanced machine learning techniques to quantify snow water equivalent accumulation. This approach offers advantages over existing methods by delivering all-weather operations, basin-wide coverage, frequent updates, cost-effectiveness, and reduced need for field collection in harsh environments. This proposal leverages NASA's unique observational assets to address critical water resource challenges while enabling commercialization opportunities in climate technology and water management sectors. It builds upon extensive snow remote sensing research and collaboration with stakeholders, incorporating robust data validation, and it aligns with NASA's strategic objectives, supporting the agency's Earth science mission. Comprehensive validation against airborne lidar, ground measurements, and streamflow data will enable diligent performance tracking, ensuring measurable achievement of objectives. The project will demonstrate technical feasibility, provide a clear pathway to an operational commercial product, conduct rigorous validation against authoritative data sources, and quantify a multi-million-dollar market opportunity with water agencies. The project goals will be realized through a subscription-based decision support tool for water managers.

Duration: 6

Proposal Details

Proposal Number: Si02.24-17
Subtopic Title: Decision Support Tools Using NASA Earth Science Data
Proposal Title: FireGPT: A Vision Language Model for Prescribed Burn Decision Support Using NASA Earth Science Data

Small Business Concern

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Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 2 - 3
Technical Abstract (Limit 2000 characters):

OpalAI proposes to develop FireGPT, an innovative prescribed burn decision-making tool that integrates NASA Earth Science Data with commercial remote sensing datasets to revolutionize wildland fire management. The key aspects include: Purpose: To create a Vision Language Model (VLM) decision support tool for prescribed burn management and wildfire impact assessment. Intended use of funding: Develop quasi-real-time, on-demand fuel maps using VLMs Translate fuel maps into actionable prescribed burn decisions Evaluate the approach through partnerships with burn managers in the FASMEE program Target markets: State Government Fire Agencies (e.g., CALFIRE) U.S. Forest Service (USFS) and Fire and Smoke Model Evaluation Experiment (FASMEE) Insurance companies and real estate developers The proposal aims to leverage recent advancements in multi-modal large language models and new remote sensing datasets (e.g., NASA's NISAR, UAVSAR, Landsat, ECOSTRESS, and commercial SAR/EO data) to provide more accurate predictions of surface fuels. This will enable better-informed decisions on prescribed burns to prevent fire propagation. The innovation addresses the critical need for timely and accurate information in wildfire management, offering potential benefits in ecological preservation, economic savings, and public safety. The proposed solution integrates various data sources with advanced AI capabilities to provide comprehensive insights for wildfire risk mitigation and post-fire recovery planning. By the end of Phase I, OpalAI aims to deliver a comprehensive technical document and a fully functional software prototype, demonstrating the feasibility and practical application of their decision-making tool for wildfire management.

Duration: 6

Proposal Details

Proposal Number: Si02.24-25
Subtopic Title: Decision Support Tools Using NASA Earth Science Data
Proposal Title: dMRV for cropland burning informatics

Small Business Concern

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Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 4 - 6
Technical Abstract (Limit 2000 characters):

Operational tracking of cropland burning emissions using Digital Measurement, Reporting, and Verification (dMRV) science and technology for GHG inventory and VCM. Benefiting from favorable developments in EU policies, COP28, the Inflation Reduction Act, and the USDA's substantial $3 billion investment in Partnerships for Climate Smart Commodities, tracking and quantification of agricultural practices have experienced rapid, dynamic expansion. Agricultural burning has remained a gap given the lack of robust, transparent, and operational data available to these different

programs; thus a point of uncertainty in quantification of soil organic carbon sequestration and GHG emissions.

Duration: 6

Proposal Details

Proposal Number: Si02.24-34
Subtopic Title: Decision Support Tools Using NASA Earth Science Data
Proposal Title: Integrated System and Predictive Model to Assess Air Quality and Rapidly Pinpoint Emerging Sources

Small Business Concern

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Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 3 - 5
Technical Abstract (Limit 2000 characters):

Natural and anthropogenic sources of pollution, according to several studies, contribute to in excess of 6 million premature deaths per year worldwide, with more than 200,000 in the US alone. The high number of deaths caused by air pollution shows the importance of making people aware of air quality at their location. Five of the components of greatest concern are listed on the National Ambient Air Quality Standard as part of the Clean Air Act by EPA: CO, NO2, O3, SO2 and PM2.5. In addition to contributing to climate change, these gases and particulate are harmful for humans and attack the respiratory system, penetrating deep into the respiratory system and damages lung tissue and the bronchial system causing pulmonary edema. Satellites are not able, on their own, to detect how high above the ground air pollution is. These systems provide an integrated measurement through the column of troposphere being measured, not readings at ground level. It is difficult to model the vertical distribution of gases and dust. Satellites are therefore often not very accurate in giving estimations for the concentrations of pollutants in the actual air humans breathe. AQ models and existing networks lack local resolution since air quality values are highly dependent on local topography and wind direction. The air quality can vary significantly over a few hundred meters in urban areas and around roads and industrial areas. Hyper-local monitoring would improve accuracy of exposure assessments and improve models. Therefore, we offer this proposal for a truly low-cost, reliable air quality system with integrated data from remote monitors and local sensor nodes.

Duration: 6