NASA SBIR 2024-II Solicitation

Proposal Details

Proposal Number: A1.02-1005
Subtopic Title: undefined
Proposal Title: Predictive Low-Cost Large Eddy Simulation Capability for Fan and Open Rotor Noise

Small Business Concern

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Summary Details

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

The modern trend towards ultra-high bypass ratio (UHBR) engines with larger fan diameters and a shorter nacelle, along with re-examination of 1960s highly fuel efficient technologies such as counter-rotating open rotors (CROR), has highlighted the need to mitigate turbomachinery-induced propulsion noise. Computational tools capable of predicting both tonal and broadband components of the generated noise with rapid turnaround times are critically needed. A wall-modeled Large Eddy Simulation method utilizing highly automated Cartesian octree grids with viscous immersed boundary description of geometries to study turbomachinery generated aeroacoustics is proposed. Phase-I of the research successfully demonstrate this capability for aeroacoustics in three different categories: a) quadrotor noise in forward flight, b) Counter-rotating open rotors in transonic cruise conditions, and c) a ducted fan at approach conditions using very modest single-node general purpose GPU resources with overnight turnaround times. Highly automated and rapid grid generation for very complex geometries as well as effective use of in-situ visualization and farfield acoustics post-processing was also highlighted. Phase II research is intended to build upon these findings in three key ways: a) Rigorous and expanded verification and validation across a large variety of operating conditions, b) substantial further improvements in time-to-solution via improvements in both the numerical algorithms and software infrastructure, and c) investigation of this capability to study propulsion-airframe integration problem with full aeroacoustic and aerodynamic analysis with overnight turnaround times. This technology will target both the existing propulsion and airframe markets, as well as the emerging eVTOL/air-taxi market.

Duration: 15

Proposal Details

Proposal Number: A1.03-1007
Subtopic Title: undefined
Proposal Title: Airborne holographic probe for small ice detection

Small Business Concern

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Summary Details

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

Contrails formed by aircraft emissions are the major component of the radiative impact of aviation, contributing more to forcing than emitted carbon dioxide and nitrogen oxides combined. Efforts to reduce the negative impacts of aviation on climate must therefore account for contrail formation and require better understanding of contrail formation and aging. The research community, including NASA scientists, currently lack an appropriate in situ measurement system capable of characterizing the small ice crystals and droplets relevant to contrail formation and aging processes. We propose development of a new cloud probe designed for operation on research aircraft and other platforms capable of measuring the properties of ice crystals, droplets, and aerosols in the size ranges relevant for contrail formation and potentially distinguishing between them. The proposed instrument would use a digital holographic approach that has been previously demonstrated for cloud measurements, but modified to measure smaller particles than is currently possible with existing instruments. Our system will be capable of delivering the measurements necessary to better understand contrail formation and related aviation impacts on climate. It will also be applicable to a wide range of commercial applications, such as the detection and classification of airborne allergens, pathogens, and other large particles that have impacts on the atmosphere, plant, animal and human health, and visibility, among others.

Duration: 24

Proposal Details

Proposal Number: A1.04-1016
Subtopic Title: undefined
Proposal Title: High Energy Density, Fast Discharge Li-S Batteries for Electrified Aircraft Propulsion

Small Business Concern

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Summary Details

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

NASA has set a U.S aviation goal to achieve net-zero greenhouse gas emissions by 2050. SOA Li-Ion batteries are limited to ~300 Wh/kg at the cell level, which is further reduced when integrated into a battery pack. To enable widespread electrified aircraft propulsion, NASA has identified the need for novel energy storage solutions which can provide high energy density (>400 Wh/kg at the system level), high-rate discharge (2C), fast charge capability, operation at 100 Â°C and the incorporation of passive safety components to prevent thermal runaway. Ginerâ€™s solution is a Li-S battery approach. These batteries have projected cell energy densities 600-700 Wh/kg. In the Phase I, Giner has paired a

novel cathode design with high temperature electrolytes and passive safety components to demonstrate safe operation at 100 Â°C (100% of room temp capacity), 2C discharge, fast charge in 15 minutes, and high sulfur loadings to enable high energy density (> 400 Wh/kg) in the Phase II. Phase II funds will be used to scale our technology to market ready size and demonstrate performance in-house. Giner will partner with Aurora Flight Sciences, an uncrewed aircraft developer, for battery pack integration and battery performance demonstration in a drone flight profile. The target market for this technology MW-class passenger aircraft. Our near-term market is uncrewed systems including Group I and II drones, as well as small passenger aircraft including air taxis.

Duration: 24

Proposal Details

Proposal Number: A1.06-1006
Subtopic Title: undefined
Proposal Title: UAM Design Space Exploration Framework with Embedded Version Control

Small Business Concern

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Summary Details

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

Aircraft design has always been a complex and multidisciplinary process but designing urban air mobility (UAM) presents additional complexity and heightens interdisciplinary effects. The early stages of aircraft design are complex and present a large design space from which a good candidate design must be found that satisfies the top-level aircraft requirements. There have been many tools developed over the years to help explore this design space, including general frameworks like OpenMDAO. General optimization frameworks are useful tools that will likely be a part of any solution to UAM MDAO, but they are not well suited as framework for managing vehicle design and analysis. The framework developed under this effort will be explicitly design around UAM concepts, including multi-model vehicles. It will also be tightly integrated with a version control system to manage and track model development. And the software will be distributed as open-source software to enable community support and collaboration. The framework consists of two parts and a version control system. The first is a Study, which is saved as a JSON-based data structure. A Study contains information about vehicle definitions, optimizations and trade studies, and a solution sequence. The other piece is the Execution Engine that steps through a user-defined solution sequence and utilizes plugins to call external analysis tools. Finally, the framework has the ability to let the user define vehicle variants by means of a branching script. The branching script contains a series of functions each defining some aspects of a vehicle or study, and each variant is defined by a combination of these functions.

Duration: 24

Proposal Details

Proposal Number: A1.08-1004
Subtopic Title: undefined
Proposal Title: Laser-Induced Incandescence Sensor for Soot Particle Size and Concentration

Small Business Concern

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Summary Details

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

An instrument will be developed to measure the mass concentration and primary particle size of non-volatile particulate (nvPM) emissions from aircraft as they are injected into an altitude chamber for contrail formation studies at NASAâ€™s PAL or similar facilities. Contrails are the main contributors of aircraft to climate change and research is needed to better understand, for example, the tendencies of various types of aviation fuel to form contrails. The technique uses a 10-ns laser pulse to heat the soot sample in situ, without the need for extractive sampling, while a detector measures the resulting incandescence signal containing information on the particle properties. Experimental studies conducted in the

Phase I effort showed that an optimized laser-induced incandescence (LII) breadboard is able to achieve a detection limit of better than 0.1 micrograms per cubic meter, corresponding to an inferred nvPM number concentration of 1000 per cubic cm, at a standoff distance of 12 inches, meeting the requirements of the PAL facility. The Phase I work also showed through model predictions that the time-resolved LII technique can measure primary particle size with excellent sensitivity over the range of 5 to 100 nm at conditions corresponding to the altitudes of commercial aviation. The Phase II effort will include development of the prototype hardware, its operating software, methods to calibrate it for particle sizing and aerosol mass concentration, and a demonstration of the system in a relevant environment. A capability to synthesize soot particles of selectable size will be developed for accurate size calibrations through a collaboration with Pennsylvania State University. Potential customers include aircraft engine manufacturers, commercial airlines, industrial processing plants (i.e., stack monitors), and manufacturers of automobiles and trucks.

Duration: 24

Proposal Details

Proposal Number: A1.08-1014
Subtopic Title: undefined
Proposal Title: Simultaneous Velocimetry, Thermometry, and Chemical Species Measurements for High-Enthalpy Flows

Small Business Concern

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Summary Details

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

NASA SBIR 2024 Phase I Solicitation A2.08 called for spatially and temporally resolved diagnostics for NASA high-speed wind tunnel flows (supersonic, hypersonic), both with and without combustion. Improved measurement capabilities are needed for velocity, temperature, density, and/or species concentrations in harsh wind tunnel environments, from short-duration (~msec) to long-duration (~min) flow facilities. Accurate inflow characterization is essential for interpreting ground test data and ensuring meaningful comparisons with simulations. Conventional methods for characterizing ground test facilities rely on intrusive probes, such as thermocouple and pressure transducer rakes, which offer limited spatial resolution, are unsuitable for the highest-enthalpy conditions, and cannot capture data during active test runs. Spectral Energies, in collaboration with Pennsylvania State University proposes to build a large-scale absorption tomography sensor capable of measuring 2D distributions of velocity, temperature, species, and pressure in high-speed reacting and non-reacting flows. The system design is capable of recording multi-beam (tomographic) measurements of unsteady flows and has a flexible, modular design, ensuring compatibility with multiple test environments. The proposed research effort will provide new instrumentation capabilities and methodologies, together with a convenient and user-friendly software package for the high-speed flow thermometry, concentration and velocimetry measurement. Potential NASA users include scientists and engineers from several large ground test facilities

at various NASA research centers, including the 8-ft high-temperature tunnel, 31â€ Mach 10 tunnel, National Transonic Wind Tunnel, 0.3-m TCT, Unitary Wind Tunnel, HYMETS Arc-jet, and Hypersonic Scramjet.

Duration: 24

Proposal Details

Proposal Number: A1.09-1012
Subtopic Title: undefined
Proposal Title: High Power Density Motors/Generators for Single and Double Aisle Passenger Aircraft using Multifilamentary High Purity Aluminum Coils at 20K

Small Business Concern

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Summary Details

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

Cutting-edge research in aeronautics is needed to overcome technology barriers and challenges in developing net-zero carbon emissions from aviation by 2050, one of the environmental goals articulated in the White Houseâ€™s U.S. Aviation Climate Action Plan, and aggressive innovations will be required to reach this goal through development of hybrid-electric machines for aircraft propulsion used for direct-drive propulsion of fans or propellers or as generators, turboprops, or turbofans. High power density propulsion motors are a driving factor for aircraft electrification especially for the larger single and double aisle passenger aircraft. In order to achieve the goal of > 25 kW/kg, it is important to have both stator and rotor high performance and probably both cryogenic. NASA has been advocating the use of all-superconducting rotating machines for electric propulsion. The problem is high AC in the stator. With lower AC losses, High Purity Aluminum (HPAL) Composites configured as multifilamentary wire and cables can out-perform superconductors above 100 Hz for some rotating machine targets. We propose in this project to develop and demonstrate stator coils using multifilamentary, low AC loss, HPAL strands for 20-25 K operation. The use of HPAL low AC loss stands will facilitate aircraft applications in the 1 to 20 MW range enabling high power density motors and generators in the 35-45 kW/kg range, with efficiencies in the range of 99%. During a Phase II effort we will fabricate and characterize HPAL stator coils in an existing 100 kW motor test bed. liquid hydrogen makes an obvious candidate for a thermal sink in the aircraft; the demonstration stator coils will be cooled using liquid and gaseous helium. After the Phase II effort, the technology demonstrated will create both a technical and business pathway for introduction of motors which include our HPAL composite cryogenic conductor for single and double aisle passenger aircraft.

Duration: 24

Proposal Details

Proposal Number: A1.09-1014
Subtopic Title: undefined
Proposal Title: SAF-compatible Hybrid-Electric Propulsion for a Fixed-Wing Aircraft

Small Business Concern

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Summary Details

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

The proposed innovation in Phase II focuses on advancing the SAF-compatible hybrid-electric propulsion system for fixed-wing aircraft, aiming to validate in-flight battery energy closure, enhance aerodynamic efficiency, and demonstrate autonomous operations through Simplified Vehicle Operations (SVO). Building upon the foundational work in Phase I, Phase II will pursue large-scale Multi-Disciplinary Design Analysis and Optimization (MDAO), uncertainty quantification, and subscale flight testing to optimize and validate the hybrid-electric propulsion system and its operational capabilities. Phase II will leverage Computational Fluid Dynamics (CFD) and use CFD results to enhance the aero-propulsive performance models (APPMs) within the Parametric Energy-based Aircraft Configuration Evaluator (PEACE) framework. The PEACE framework will be used for genetic algorithms MDAO to evaluate the RN001 configuration and an alternative pusher propeller configuration, in both cases optimizing the hybrid-electric propulsion system for maximum efficiency and reduced emissions. Additionally, a hybrid-electric test bench will be developed to allow real-world validation of propulsion control laws and energy management strategies. Finally, subscale flight testing with both all-electric and hybrid-electric propulsion architectures will demonstrate and validate performance gains and operational efficiency, setting the stage for larger-scale implementation and FAA certification pathways. Targeting regional air cargo operators, the system enables fuel savings, maintenance cost reductions, and SAF compatibility, addressing industry challenges while reducing infrastructure dependence. By validating an efficient and scalable hybrid-electric propulsion system, Phase II research lays the groundwork for post Phase II commercialization, unlocking new capabilities for cargo, passenger, and defense aviation.

Duration: 24

Proposal Details

Proposal Number: A2.02-1026
Subtopic Title: undefined

Proposal Title: Disaster Autonomous Aerial Response Technology

Small Business Concern

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Summary Details

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

Stottler Henke proposes advancing Disaster Autonomous Aerial Response Technology (DAART) into Phase II, building on a strong Phase I. DAART enables autonomous UAV operations for wildfire monitoring and disaster response, generating real-time fire progression maps while identifying critical zones with rapid changes or hazards. By combining precision mapping with real-time analysis, DAART enhances situational awareness and accelerates response strategies. The system integrates with emergency management networks, providing intelligence to responders. DAART serves as a unifying framework capable of coordinating disparate platforms into an effective response team. DAART integrates with heterogeneous UAV fleets without hardware modifications. Using multi-modal sensor fusion and deep learning, DAART processes visual, thermal, LiDAR, and radiometric sensor data for fire-front mapping, hazard localization, wind field estimation, and vegetation analysis. Onboard computing minimizes latency, ensuring timely decisions. Optimized bandwidth transmits only high-value data. A decentralized swarm coordination system allows UAVs to autonomously prioritize tasks, reconfigure coverage, and share data, enhancing resilience and adaptability. Designed for reliability, DAART remains effective in harsh conditions, including dense smoke, high winds, and degraded communication. DAARTâ€™s development pipeline integrates high-fidelity Unreal Engine 5 simulations with an in-house low-fidelity simulator for rapid prototyping and deployment. NASA SBIR Phase II funding will refine DAARTâ€™s algorithms, deployment, and scalability, targeting wildfire response, emergency management, and multi-agency coordination.

Duration: 24

Proposal Details

Proposal Number: A2.02-1029
Subtopic Title: undefined
Proposal Title: SkyAID: A Safe Autonomy Infrastructure for Disaster Response

Small Business Concern

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Summary Details

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

Phase II builds on our Phase I accomplishments by advancing the SkyAID system into a fully integrated prototype capable of addressing NASAâ€™s wildfire response challenges in complex, partially known environments. We will transition simulation-validated SkyAID functionalities into a tangible hardware platform that combines GPS, IMU, and cameras for autonomous navigation under diverse lighting and visibility conditions. This development will encompass mechanical design, the creation of a digital twin, implementation and calibration of the perception system, and comprehensive field experiments to validate overall performance. Building on the initial development of AerDETRâ€”a deep learning-based object detection system for aerial platformsâ€”we will enhance system robustness in wildfire-prone scenarios by generating high-fidelity simulated aerial datasets with labeled objects to train perception networks capable of operating under adverse conditions such as smoke, variable lighting, and seasonal changes. Concurrently, we will

develop a sensor fusion framework that integrates data from LIDAR, infrared, and optical cameras. We will perform rigorous verification and validation of the SkyAID control system. We will also develop specialized control strategies for distributed sensing of wind and fire conditions using swarms of drones by simulating a distributed sensing architecture where multiple drones collect environmental data to generate real-time fire and wind maps, and by implementing cooperative decision-making algorithms for adaptive waypoint planning and robust swarm coordination, with hardware experiments validating multi-drone fire sensing and communication. Collectively, these efforts will deliver a prototype hardware system and a comprehensive software toolbox that not only demonstrate reliable sim-to-real transfer but also provide scalable, multi-modal autonomy for effective wildfire reconnaissance, mapping, and suppression.

Duration: 24

Proposal Details

Proposal Number: A2.02-1040
Subtopic Title: undefined
Proposal Title: Target Acquisition and Guidance System (TAGS) for Wildfire Response

Small Business Concern

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Summary Details

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

TAGS (Target Acquisition and Guidance System) is an autonomous, platform-agnostic UAS navigation and coordination system that acts as a high level mission manager for operations for multi-domain autonomous vehicles. TAGS enables real-time situational awareness without continuous human intervention through a hierarchical structure where a centralized computer processes field collected data from vehicles and remotes sensors, dynamically adapts flight plans based on fire behavior predictions, wind patterns, and detected hotspots, and dynamically distributes tasks to the autonomous vehicle fleet. The system communicates via a mesh network, ensuring data relay even in areas with limited connectivity, and generates situational awareness and predictions maps that are shown to the user via TAK platform for real-time visualization by incident commanders.

Duration: 23

Proposal Details

Proposal Number: A3.01-1001
Subtopic Title: undefined
Proposal Title: Turbulence-Impact Collaborative Response System

Small Business Concern

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Summary Details

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

Atmospheric turbulence is a major hazard to all classes of aircraft. As such, airlines work to avoid turbulence encounters and seek to detect, identify hazardous regions, and route (or climb/descend) aircraft around turbulence constraints. This effort investigates an en route tactical collaborative response to turbulence â€“ including US airlines and the Air Traffic Management (ATM) system â€“ leveraging data from various sources, geofencing hazardous turbulence boundaries, as well as positively identifying areas and flight levels free of turbulence. Using this model, ATM planning can be accomplished collaboratively to minimize turbulence encounters via tactical Trajectory Options Sets (TOSs) that allow for a collaborative, coordinated solution. This effort demonstrates that turbulence impact assessments based on Automatic Dependent Surveillance â€“ Broadcast (ADS-B) surveillance data, Graphical Turbulence Guidance â€“ Nowcast (GTGN) data, convex and concave hull geofencing techniques, and a tactical 15-minute turbulence prediction model can form the basis of such a collaborative solution to turbulence risk management.

Duration: 24

Proposal Details

Proposal Number: A3.01-1015
Subtopic Title: undefined
Proposal Title: Monitor and Forecast System for Airport and Network Operational Risk

Small Business Concern

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Summary Details

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

The Monitor for Airport and Network Operational Risk (MANOR) aims to be a single source for integrating multiple sources of data to monitor and forecast combinations of conditions at major airports that generate operational risk. MANOR monitors and forecasts operating conditions at individual airports and captures interactions with other airports through an Airport Dependency Index. MANOR aims to address traffic flow disruptions from demand-capacity imbalances by focusing on factors that interrupt schedule execution and efficient operations. MANOR does not address the detailed considerations that go into flight planning, such as airport elevation, airport opening and closing times, and certification for CAT III landings. MANOR consists of two components: Airport Operational Risk Component monitors and forecasts each airport for potential exposure to disruptive factors and provides estimates of those impacts. Airport

Dependency Model Network Component addresses network effects and identifies the impacts on airport efficiency due to upstream and downstream effects from other airports. Together, these components provide operators and the FAA a comprehensive decision support system to monitor the overall operational status of the NAS and provide detailed insight into potential operational risks for individual airports. The system provides current status on the most recent data sources and forecasts up to 15 hours in advance. Different forecast models will offer different forecast periods depending on the value of an extended forecast and the accuracy of the forecast method. For example, MANOR will provide hourly arrival rate forecast probabilities 15 hours in advance. This offers an airline dispatch manager coming on duty at 0600 an extended perspective on the possible operational challenges for that day. The dispatch manager coming on duty for the overnight shift will have access to forecasts for the following day to support planning for the next day.

Duration: 24

Proposal Details

Proposal Number: A3.02-1000
Subtopic Title: undefined
Proposal Title: Aircraft-Wildlife Collision Mitigation: A Predictive Wildlife Hazard Forecast Tool for Enhanced Aviation Safety

Small Business Concern

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Summary Details

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

The Wildlife Hazard Forecast Tool (WHFT) uses near real-time data collection and analytics to predict the occurrence and movement of critical species to enhance the safety and operational efficiency of Advanced Air Mobility (AAM) aircraft. In its full development, the WHFT will map and communicate existing wildlife hazard levels and predict emergent hazards using machine learning and real-time wildlife hazard data. Phase I activities have outlined the preliminary Concept of Operations and initiated testing of the proof-of-concept to determine if it meets operator expectations. Phase II will further refine the concept and continue to ensure overall stakeholder approval with additional acceptance testing. Phase II activities will be organized using a systems engineering approach. This approach recognizes the iterative process of WHFT development with feedback loops between definition and integration stages. Each step of the WHFT progression informs the previous and next stage of development. The Phase II deliverable will be the WHFT prototype. The development and implementation of the WHFT will contribute to the modernization of current and future air mobility operations by enhancing the efficiency, safety, and scalability the National Airspace System (NAS) through provision of wildlife hazard separation information for AAM operations. The tool will contribute to NASAâ€™s Sky for All vision through safety assurance of AAM aircraft, empowerment of operators, and conservation of airborne wildlife. The WHFT will provide economic benefits such as reduced accidents, optimized flight paths and better traffic

management, and improved operational outcomes for potential customers that include AAM aircraft operators, Air Traffic Control authorities, federal, state, and local governments, and airport and vertiport operators.

Duration: 24

Proposal Details

Proposal Number: A3.02-1028
Subtopic Title: undefined
Proposal Title: GAS on Fire (Guided, Accurate Slurry drops on Fire)

Small Business Concern

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Summary Details

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

In this Phase II SBIR effort, RoGO will take our existing DropBlock technology and adapt it to support the needs of aerial firefighting applications. DropBlocks are small, portable, lightweight satellite-enabled devices that are a data portal for wildland firefighting crews. Wildland Firefighters operate in cellular-denied areas more than 90% of the time they are deployed on an average wildfire. DropBlocks provide 3 critical functions to Wildland Firefighters: 1) DropBlocks provide GPS tracking of all human & non-human fire resources 2) DropBlocks transmit fire weather data to all firefighters in an incident 3) DropBlocks allow for point-to-point text communications so crews can coordinate and align their tactical efforts at the edge. This proposal suggests adding in key software and hardware functionalities that will allow firefighters with DropBlocks on the ground to coordinate and communicate key firefighting information and efforts with aerial firefighters on their ForeFlight tablet app (or any other tablet flight app) via API integration from a DropBlock in the aircraft, whether rotor-wing or fixed-wing. This proposal suggests we modify our existing DropBlock communication device to: 1) Allow ground firefighters to mark a requested slurry drop starting point and line to drop slurry along (a vector position), and display this information to the pilot. 2) Take in ground wind information, calculate wind drift information given the aircraftâ€™s altitude and suggest a corrected flight line so slurry falls where it is intended, accounting for slurry drift. 3) Most importantly, for ground firefighter safety, we enable ground crews to signal an â€œAll Clearâ€ message up to slurry/water bombing pilots to let them know all firefighters have cleared the line and if it is safe to drop the slurry, or not. Intended use of funding is for engineersâ€™ materials and time building and testing devices in real-world settings with RoGOâ€™s many wildland firefighting contacts.

Duration: 24

Proposal Details

Proposal Number: A3.03-1016
Subtopic Title: undefined
Proposal Title: Services for Ongoing Assessment of Risk (SOAR)

Small Business Concern

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Summary Details

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

The Longbow Group, LLC (LONGBOW), with Daniel H. Wagner Associates, Inc. (DHWA) as a subcontractor, will demonstrate the feasibility of developing key components of a future In-Time Aviation Safety Management System (IASMS) and commercializing those components as IASMS Services, Functions, and Capabilities (SFCs) within one or more Supplemental Data Service Providers (SDSPs) supporting Uncrewed Aircraft Systems (UAS) Traffic Management

Duration: 24

Proposal Details

Proposal Number: A3.03-1023
Subtopic Title: undefined
Proposal Title: Airport Digital Twin for Operations & Safety Planning

Small Business Concern

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Principal Investigator

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Business Official

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Summary Details

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

The airport digital twin platform is a cloud-based Software-as-a-Service (SaaS) solution that creates a real-time virtual replica of an airportâ€™s physical and operational environment. Using AI, ML, and advanced simulations, it enhances situational awareness, efficiency, and safety by integrating a wide array of information from airfield operations, air traffic flows, taxiway status, gates/aprons, weather data, and other relevant sources. The platform provides real-time decision support, optimizing aircraft movements, delay mitigation, and operational planning through predictive analytics and AI-driven risk detection. It enables what-if scenario modeling for severe weather, infrastructure changes, and demand fluctuations, allowing for contingency planning and operational resilience. Through real-time data integration from ATC, weather, and surveillance systems, the platform improves safety management, offering automated alerts and risk mitigation tools. By combining proactive monitoring, predictive insights, and AI-driven analytics, the airport digital twin transforms airport operations, ensuring smarter, safer, and more efficient airfield management. The funding for Phase II of the proposed platform will be allocated to core development efforts of the platform, including various components such as data processing and management, AI/ML data analytics and prediction algorithms, a simulation engine, 3D visualization, as well as a robust API for external access. Phase II also includes plans for pilot programs with airports where the digital twin will be field tested and capabilities and functions validated in real-world scenarios. In addition to

NASA, the target markets for this platform are airport stakeholders in the airside domain. This includes airport management, airlines, ramp control, ATC, as well as ground surface operations.

Duration: 24

Proposal Details

Proposal Number: A3.05-1004
Subtopic Title: undefined
Proposal Title: Sensing Weather for Advanced Air Mobility

Small Business Concern

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Principal Investigator

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Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 7 - undefined
Technical Abstract (Limit 2000 characters):

Advanced Air Mobility (AAM) is a concept for safe, sustainable, and accessible aviation for local and intraregional missions with the promise to change transportation and to bring aviation into peopleâ€™s daily lives. To address a shortcoming of existing weather sensing systems, ASTM International (formerly known as the American Society for Testing and Materials) established the ASTM F38 standard to address the performance and interoperability requirements for weather data reports, analysis, and services for operations including uncrewed aircraft systems (UASs) and AAM end users. Within this standard, the Tier 2 level is unique in being the lowest performance tier that is able to measure the critical parameters for aviation: wind, ceiling, and visibility. To address the need for a commercially viable Tier 2 weather sensor suitable for AAM support, Intellisense has developed the Sensing Weather for Advanced Air Mobility (SWAAMI) system. This system will be the first commercial weather sensor specifically designed to meet all ASTM F3673-23 Tier 2 performance requirements and do so at a low cost that will promote widespread adoption and deployment and help enhance cost-effective, safe, and effective operational decision making. The SWAAMI system is based on a novel integration of existing breakthrough technologies. Specifically, Intellisense modified its existing Micro Weather Station (MWSÂ®) product to include the latest in optical precipitation and present-weather sensing technologies to form the SWAAMI system, which is the first of its kind in a product category that will become essential to AAM operations. In the Phase I NASA effort, Intellisense not only fully realized the prototype system but also successfully demonstrated its effectiveness and accuracy against larger commercial references sensors in extended outdoor demonstrations. In Phase II Intellisense proposes to ruggedize and enhance the design in preparation for commercial producibility.

Duration: 24

Proposal Details

Proposal Number: A3.05-1017
Subtopic Title: undefined
Proposal Title: Ultralow cost and size radar for AAM enhanced mobile weather station

Small Business Concern

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Principal Investigator

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Summary Details

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

The emerging AAM market presents a new infrastructure need not addressed by todayâ€™s commercial sensors or existing infrastructure. Todayâ€™s infrastructure provides remote sensing of the atmosphere largely above 10000 ft. Deployed radar networks, NEXRAD, were configured to support long range forecasting and severe weather alerts. Wind speed sensing is achieved using high-cost LiDAR sensors; however, these become ineffective with low visibility and precipitation. Agile RF Systems (ARS) (through extensive customer discovery) has identified three critical sensors to facilitate safe and efficient AAM operations. These are a wind profiler implemented at S-band to reduce size and cost, a cloud radar implemented at Ka band for high sensitivity and small size, and a precipitation radar capable of high-speed volumetric observations to 20 km under heavy rain. Each radar type, ARS has architected sensors that enable low recurring cost with high reliability to ensure a long useful life. The wind profiler is a conventional phased array implemented using very low-cost commercial parts and is built to be modular and scalable. The cloud radar is a traditional 2-axis gimballed dish based on high reliability consumer appliance direct drive mechanisms and solid-state active feed to maximize transmit power at very low cost. The precipitation radar applies 2D AESA breakthrough technology. This radar is implemented at C-band using commercial parts and mounts to a common azimuth rotator assembly used for the cloud radar. Low cost is assured by the low-cost Software Defined Radio proven adequate in Phase I for all three sensors. The BOM for each sensor is about $10K in quantity. The financial path to commercialization is minimized by building on investments to date by USAF in ARS for our Portable Weather Radar product software and technology innovations demonstrated on past SBIR funding. Functional prototypes for each are planned in Phase II with outdoor comparison testing with TruWeather.

Duration: 24

Proposal Details

Proposal Number: H3.11-1012

Subtopic Title: undefined
Proposal Title: Reliable, simple, and lightweight water recycling using pressure-driven distillation

Small Business Concern

Firm: OsmoPure Technologies, Inc
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Summary Details

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

OsmoPure Technologies proposes a new class of simple, reliable, and lightweight water recovery system for humidity condensate and urine treatment. The core of this water recovery system is the OsmoPure pressure-driven distillation (PD) membrane module. In the PD module, applied pressure is used to drive water flow through a highly selective, chemically robust membrane. The PD module offers high removal of total organic carbon (including dimethylsilanediol), ions, and other contaminants. PD is also chemically robust, allowing the membrane to be used in direct contact with chemicals used to stabilize urine. The chemically resistant nature of PD membranes also permits membrane cleaning with hydrogen peroxide after extended periods of dormancy. Because PD only requires a small high-pressure pump, operation is simple and low energy. The selectivity, robustness, and ease of implementation of PD make it appealing for applications requiring high-purity treated water including water recycling systems used in short- and long-term space travel. In the proposed treatment train, PD is followed by an activated carbon module (to polish product water) and ultraviolet irradiation (to provide final disinfection). The proposed process will weigh 11.7 kg and produce 285 kg of potable water from humidity condensate over the course of a 30-day mission. Overall, the OsmoPure Water Recovery System offers dramatically decreased mass and simplified operation compared to current water recycling processes. Funding will be used to further optimize the PD membrane module design, improve process control integration, and create a full-scale, integrated prototype to be delivered to a NASA facility. In addition to space-based water recovery, OsmoPure is positioned to enter key terrestrial markets where high-purity water is critical. This include ultrapure water production for semiconductor fabrication, where stringent contaminant removal is required to prevent defects in microchip manufacturing.

Duration: 24

Proposal Details

Proposal Number: H3.11-1013
Subtopic Title: undefined
Proposal Title: On-demand novel electrochemical device for wastewater reclamation

Small Business Concern

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Principal Investigator

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Summary Details

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

As NASA begins to return crews to the lunar surface, new types of environmental control and life support systems challenges have emerged, requiring innovative solutions including the need for new methods to recycle wastewater. This need arises because new mission scenarios are projected to require small water recycling systems that can sustain a limited number of crew for durations ranging from days to several months. For these missions, new wastewater recycling methods are needed with low system complexity, low mass characteristics, and improved reliability. New technologies should function in partial gravity and should be compatible with periods of dormancy followed by a return to full service.

During Phase I study we successfully demonstrated the feasibility of novel electrochemical device for wastewater recycling, including both extended urine stabilization and TOC (total organic carbon) reduction of the humidity condensate to below the required level. The new device operates at low temperatures and pressures, eliminates the need for expendables and is uniquely compatible with a fully closed loop life support system. Test results and engineering analysis indicate the device has favorable mass and power consumption characteristics. A key feature of the device is that it is constructed from highly stable electrochemical materials, so the device operates long term without degradation of performance. Results also show that the device can be readily cycled on or off (even for extended dormancy periods) and can be easily scaled as mission requirements evolve. During Phase II, we will develop a prototype capable to address wastewater recycling from urine and humidity condensate, for a four-crew members. The Phase II study will demonstrate the deviceâ€™s function as both a pre-treatment method and a post-treatment method, with the goal of achieving high efficiency water recovery.

Duration: 24

Proposal Details

Proposal Number: H3.12-1012
Subtopic Title: undefined
Proposal Title: Design of an Ultra-low Noise Ventilation Fan for Space Applications

Small Business Concern

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Summary Details

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

Ventilation fans play a critical role in spacecraft and space habitats, functioning as a key component in environmental control and life support systems. However, these fans have been grappling with operational noise issues, causing significant annoyance to astronauts and interfering with communication equipment. Over the past decade, NASA has actively engaged in noise mitigation efforts, particularly focusing on reducing noise related to rotor-stator interaction using techniques commonly employed in turbofan engines. In this program, Whisper Aero proposes maturation of a solution that leverages their novel ultrasonic fan design to create a highly efficient and ultra-quiet fan. The intended benefits include alleviating the production of annoying blade passing frequency tones, reducing structural-borne vibratory noise, cutting down fan weight and associated imbalance noise, and simplifying the mechanical layout for an extended operational lifecycle. Phase I activities involved sizing and designing the fan based on NASA's requirements, utilizing Whisper's multidisciplinary optimization software toolkit. Further, Whisper conducted testing across a large experimental test matrix exploring the effect of discrete single design variable sweeps along the most critical directions in the design space, resulting in testing on over 10 unique fan designs. Under this Phase II effort, Whisper will conduct testing on an

even broader design space with additional instrumentation, will perform targeted technology infusion into a chosen design point, will mature the design through preliminary design, will build a functionally conforming engineering verification prototype, and will conduct extensive testing in a representative environment.

Duration: 24

Proposal Details

Proposal Number: H4.09-1008
Subtopic Title: undefined
Proposal Title: Gravity Independent Condensing Heat Exchanger

Small Business Concern

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Summary Details

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

We demonstrated that heritage Condensing Heat eXchangers (CHXs) for spacesuits and spacecraft have exhibited both successes and failures when relying on hydrophilic coatings, which degrade over time (i.e., beyond 10 years). In our Phase I research, we designed, fabricated, and successfully tested novel Capillary-dominated CHXs (CCHXs) that leverage recent advancements in capillary fluidics, integrating surface tension, wetting, and system geometry effects. These innovations result in a robust CCHX that eliminates the need for coatings, imposes no material constraints, performs passive condensate-air separation, prevents slurping, achieves high-efficiency dropwise condensation, operates independently of gravity, and incorporates physical barriers to prevent condensate carry-overâ€”all without compromising mass, volume, or performance. More than 10 single-piece devices were printed and tested, with four prototypes representing distinct geometric families selected for further development in Phase II. With NASAâ€™s concurrence, our Phase II plan focuses on fabricating flight-fidelity devices for advanced Technology Readiness Level (TRL) testing using drop towers, aircraft, the ISS, or commercial low Earth orbit (LEO) platforms for Technology Demonstrations. We anticipate producing up to four novel commercial off-the-shelf (COTS) CCHX devices, accompanied by benchmarked design guidelines, to support the development of advanced, cross-cutting Custom COTS solutions for spacecraft beyond the ISS. These applications extend across LEO, Lunar, and Martian transit, orbit, and surface operations, including CHXs for cabin and extravehicular mobility unit (EMU) systems, distillation, CO2 scrubbing, plant and animal habitats, and more.

Duration: 24

Proposal Details

Proposal Number: H4.09-1023
Subtopic Title: undefined
Proposal Title: Innovative Method for Water and CO2 Sequestration and Reclamation in Long Duration PLSS

Small Business Concern

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Summary Details

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

NASA has a clear need to develop new technology to meet the challenging objectives of long- term space missions included in the Artemis Program. New objectives include sending astronauts to the surface of the Moon and then embarking on missions to Mars. Many of the missions exploring the lunar surface and Martian environment will be longer than current extravehicular activity (EVA) time frames, and therefore the development of new, robust, and lightweight life support systems will be required. In these EVA applications, the control as well as conservation of CO2 and water is critical. Previously developed technologies, such as the Metox and RCA suffer from high volume and mass allocations as well as the inability to reclaim removed resources, and are thus, not suitable for advanced environments. In this SBIR Phase I project, Reaction Systems developed a new method to control CO2 and H2O in EVA missions that will maintain CO2 at low levels, accommodate extended mission times, and recover both CO2 and water. Reaction Systemsâ€™ approach is to utilize a high-capacity liquid sorbent and a high surface area contactor to control the compounds of interest. Once collected, the CO2 and H2O can be separated from the liquid sorbent for repurpose in a method that also regenerates the sorbent. Test results obtained in the project show that this approach is very promising. Reaction Systems has identified a liquid sorbent that has a higher capacity for CO2 compared to the silver oxide used in the METOX, which results in a reduction of the required sorbent weight. In addition, tests carried out under realistic conditions show that the system can maintain CO2 levels well below the 2.5 mm Hg limit even at the higher metabolic rates.

Duration: 24

Proposal Details

Proposal Number: H4.10-1010
Subtopic Title: undefined
Proposal Title: Space Suit Materials for Use in Cryogenic Cold

Small Business Concern

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Summary Details

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

One of the greatest challenges to conducting exploration and long-duration missions on the Moon or Mars is the development of space suit materials that can operate in these austere environments, including the Artemis target of Permanently Shaded Regions (PSRs) of the Moon's south pole. Operating in extreme cold without fracture is particularly challenging for polymeric materials, especially when experiencing strain from flexing. Several crosscutting materials solutions will be advanced in this program to establish materials solutions that meet the required performance metrics for application in boot outsoles, glove TMG palm pads and knee/elbow pads. Processing techniques for converting these materials into components will be studied and verified through component fabrication and test. The material solutions are able to support high strain without cracking in extreme cold, survive thermal shock and abrasion, resist puncture, and are readily adaptable to space suit component configurations and manufacturing technologies at commercial space suit manufacturing companies. Component design and manufacturing modifications will also be studied to reduce mass, improve penetration resistance, and improve space suit mobility. Testing will be conducted at the materials level, sub-component level, and component level to verify performance to requirements. Materials solutions will be applicable to Mars space suits, lunar space suits, and other flexible structure technologies intended for use in extreme cold.

Duration: 24

Proposal Details

Proposal Number: H4.10-1012
Subtopic Title: undefined
Proposal Title: Ambient Pressure-Dried Ormosil Hybrid Aerogel Composite Blankets for Advanced Space Suit Insulation

Small Business Concern

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Summary Details

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

NASA is seeking innovative thermal insulation solutions for extravehicular activity (EVA) suits on the Martian surface. To satisfy NASAâ€™s requirements, Optowares proposed to develop ambient pressure (AP)-dried Ormosil hybrid aerogel composite blankets for advanced space suit insulation by incorporating flexible organically-modified silicate (ï‚» Ormosil) matrix, nano-opacifiers, and aerogel processing methods. In Phase I, we successfully demonstrated the synthesis of different AP-dried Ormosil hybrids and their opacified aerogel composite products, which exhibited significantly reduced dust generation, good cycling performances at vibration cycles, good flexibility, and better thermal insulation

compared to commercial AP-dried silica aerogel composites. Specifically, we prepared AP-dried polyvinyl silane (PVSil) Ormosils hybrid composites and their TiO2/CB-opacified coupons by radical polymerization, followed by hydrolytic polycondensation. These Ormosils composites demonstrated their enhanced flexibility, lower dustiness of ï‚³ 5 times, lower TC values of 15.0 ï¾ 17.0 mW/m K, and their stable TC valuesâ€™ behaviors after the cycling test compared to commercial AP-dried silica aerogel blankets. Further investigation of the AP drying method, Ormosil synthesis process, and optimum formulation developments can improve thermal resistance, less/no dustiness, and good mechanical/thermal cycling performances at medium vacuum and ambient conditions that are required for advanced space suit insulation applications. As a result, Optowares proposed AP-dried Ormosil hybrid aerogel composite blankets will provide superior thermal insulation and inherent radiation protection suitable for NASA advanced EVA suits, space hardware, and vehicles, other military and commercial applications while offering economic viability of the scaled-up commercial manufacturing without using the expensive CO2-supercritical drying or freeze-drying (FD) equipment, and the excessive hydrophobicity agents.

Duration: 24

Proposal Details

Proposal Number: H5.01-1007
Subtopic Title: undefined
Proposal Title: 50kW Pneumatic Relocatable Solar Array (PRSA)

Small Business Concern

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Summary Details

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

NASA developed a state-of-the-art scalable conceptual design of a high-performance 60kW/m3 deployable solar array with very low mass, compact stowage, and reliable deployment, called the Compact Telescoping Array (CTA). The CTA consists of a slender telescoping mast that deploys vertically and supports a large area flexible photovoltaic array, or communications / navigation systems. A retractable and relocatable (5-10x) CTA configuration was developed by NASA for use in lunar gravity at the south pole to harvest the sunâ€™s energy and generate power to support activities in and near Permanently Shaded regions (PSRs) where water-ice is present. This program is building upon NASA concepts to establish a 50kW class Pneumatic Relocatable Solar Array (PRSA) system design that leverages simple mechanical systems to create an extremely robust lightweight system. Pneumatic deployment of telescoping masts is commonplace in terrestrial military and commercial applications that operate in austere environments. High modulus carbon-epoxy tubes will be designed and fitted with a bladder to facilitate simple deployment and retraction requiring very little power or complex mechanical systems to operate. The automatically locking mast sections will be depressurized between relocation events and are not reliant on pressure maintenance for structural rigidity. The PRSA mast uses robust

cryogenically capable materials and can be deployed from a PSR and can function in cryogenic cold (-213C) and can withstand constant exposure to lunar dust over its >10-year life. Mast scaling will be studied using added features that facilitate the fabrication of extremely tall towers (100+m) or extensions above the PRSA array. The system design will be matured, supported by analysis, and a demonstration mast will be fabricated and tested in preparation for detailed development and transition into operation.

Duration: 24

Proposal Details

Proposal Number: H5.01-1018
Subtopic Title: undefined
Proposal Title: Extra Large Vertical Solar Array Technology (VSAT-XL)

Small Business Concern

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Summary Details

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

Astrobotic proposes to continue the development of an Extra-Large Vertical Solar Array Technology (VSAT-XL) system that will serve as a large-scale power solution to meet the growing energy demands of Lunar missions. Over the next six years, 26 Lunar missions are planned for launch, many with a shared fundamental objective of establishing a sustained presence on the Moon. Lunar missions are currently constrained by power requirements to survive the Lunar night, as well as the mass and cost of power systems to provide sufficient energy for long-duration operations. As a result, accessible power is a vital commodity for all planned science, exploration, and commercial activity on the Moon and will be the key enabler for long-term Lunar missions of the future. The Phase II contract will be used to mature Astrobotic's 50 kW VSAT-XL system to TRL 4, begin validating our system performance predictions, and refine our vertically integrated manufacturing processes for large deployable power systems. By completing these critical development activities for VSAT-XL, Astrobotic will expand LunaGrid's capabilities to service customers with higher power requirements and meet the energy demands of the growing Lunar market. The total addressable market for Lunar services from 2021â€“2030 is $105B according to the NSR Moon Markets Analysis published in 2022. Astrobotic used this analysis to conduct a top-down estimate of LunaGridâ€™s projected market size. Within Lunar services, Lunar infrastructure makes up 12 % of the market and encompasses six categories: power, comms, PNT, SDA, landing pads, and shelter. Because power is one of six categories within Lunar infrastructure, Astrobotic projects that 2 % or $2.1B of the Lunar services market will be for Lunar power by the year 2030. The NSR Market Analysis is the latest report, so if we assume a similar total addressable market (TAM) over a ten-year period and adjust to beginning this year, we are assuming a $105B TAM from 2025â€“2035.

Duration: 24

Proposal Details

Proposal Number: H5.05-1005
Subtopic Title: undefined
Proposal Title: An Adjacent Inductive Coil Sensor (AICS) System for Structural Health Monitoring of the Restraint Layer

Small Business Concern

Firm: X-wave Innovations, Inc.
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Summary Details

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

For long-duration missions, one of the primary concerns is the potential for structural material failure of the inflatable softgoods restraint layer due to creep. Creep is a phenomenon where deformation occurs under sustained loading. Structural health monitoring (SHM) of the restraint layer in inflatable systems is essential to ensure the safety of crew members and the continued operation of NASA missions. To address this issue, there is a need to develop a new SHM approach to accurately and actively measure creep of the restraint layer. The current methods include adhesive foil strain gages, fiber optics, accelerometers, and acoustic sensors which all have their potential drawbacks and require extensive wiring which must survive deployment. To address this critical need, X-wave Innovations, Inc. (X-wave) proposes to develop an Adjacent Inductive Coil Sensor (AICS) system to monitor the creep of the restraint layer in multilayer systems. The proposed AICS system improves upon the current state of the art sensors by not requiring any electrical cabling or wiring to the restraint layer. The proposed sensor system is also advantageous over other types of SHM sensors such as fiber optics or other flexible materials in that the proposed sensor does not need to withstand significant elongation during deployment or while in operation. The AICS system will use non-contact interrogation of the restraint layer from the interior of the inflatable softgoods structure, therefore interference from the thin metallic depositions of the outer layer will have no effect on the performance of the sensor system. The AICS system will include a prognostication algorithm that will predict the creep behavior of the restraint layer and notify the crew members of any anticipated failures.

Duration: 24

Proposal Details

Proposal Number: H6.22-1008
Subtopic Title: undefined
Proposal Title: Radiation Hardened Power Efficient Artificial Intelligence and Machine Learning (AIML) Processor

Small Business Concern

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Summary Details

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

Radiation Hardened Artificial Intelligence and Machine Learning (AIML) processors are essential to NASA applications due to unavoidable evolution in technology that brings computational complexity. Traditional radiation hardening methods incur high size, weight, and power (SWaP) cost. We propose a radiation hardening scheme that employs intelligent analysis of vulnerabilities in the AIML processor that enables hybrid selective redundancy implementation to allow self-healing from radiation effects. The proposed radiation analysis method will use statistical and probabilistic models that can capture the stochasticity of AI, ML and Neural net inference. In Phase I, we designed and validated the radiation analysis model to study the vulnerabilities in a generic AIML circuit-under-test (CUT). This was followed by design and validation of selective redundancy based radiation hardening scheme for AIML CUT. In Phase II, we will optimize the design to meet NASA requirements, build a prototype, and experimentally verify the performance of radiation hardened AIML processor.

Duration: 24

Proposal Details

Proposal Number: H6.22-1015
Subtopic Title: undefined
Proposal Title: ASICS â€“ Adaptable, Scalable, Intelligent Computing for Space

Small Business Concern

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Summary Details

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

As increasingly ambitious missions are planned for Earth orbit, the Moon, and beyond, the need to leverage the cutting edge of computer technology â€“ advanced artificial intelligence and machine learning (AI/ML) capabilities â€“ becomes ever more apparent. AI/ML applications that can efficiently utilize sensor inputs to rapidly analyze the environment and make decisions autonomously will greatly reduce the risk of many uncrewed mission operations, improve spacecraft safety by elevating situational awareness, and enable high-complexity maneuvers including rendezvous proximity operations and docking (RPOD) operations that rely on the ability to rapidly respond to changes in the environment. On Earth, AI/ML technologies rely on massive cloud computing resources or specialized commercial-grade chipsets. This proposal seeks to develop a new rugged, radiation-tolerant computing solution using a processor tailored specifically for

Size, Weight, and Power (SWaP) constrained AI/ML applications: the AMD Versal Adaptive System on Chip (ASoC) Edge Series. The Versal Edge Series is a new space-grade processor with dedicated on-chip AI engine resources that are optimized for power efficient, high bandwidth AI/ML computations. By leveraging this state-of-the-art processor, we can meet the demanding SWaP requirements that are critical for maximizing the efficiency, reliability, and performance of spacecraft. This innovation will overcome the current limitations in AI/ML applications that require significant computational resources, enabling space missions to achieve higher levels of autonomy and performance.

Duration: 24

Proposal Details

Proposal Number: H8.01-1002
Subtopic Title: undefined
Proposal Title: nVasive: An AI and Machine Learning Approach for Metastasis Prediction Using nVasive and Microgravity

Small Business Concern

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Summary Details

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

Cancer is a leading cause of global morbidity and mortality, with metastasis responsible for 90% of cancer-related deaths. Predicting metastatic behavior remains a critical challenge in oncology. Encapsulateâ€™s nVasive is an automated tumor-on-a-chip (TOC) platform that grows patient-derived microtumors ex vivo, preserving their native tumor microenvironment. By enabling high-throughput imaging and real-time monitoring, nVasive provides a unique approach to studying cancer invasion dynamics under both normal gravity and microgravity (ÂµG) conditions. ÂµG offers an unparalleled environment for metastasis research by minimizing external mechanical forces, allowing cancer cells to retain native phenotypic and genotypic properties. Our proprietary biochip uses degradable hydrogels to track tumor invasion as cells migrate into a secondary chamber, where their motility and behavior are analyzed. Our SpaceX CRS-30 experiments validated nVasiveâ€™s capability to distinguish metastatic from non-metastatic cells in ÂµG, revealing measurable differences in motility and genetic responses. Following our 2020-2023 ISS National Lab project with Space Tango (ISSNL CASIS #: GA2019-7750), we secured approval for two additional NASA missions and now seek funding to expand nVasive through: 1. AI-Driven Image Processing and Clinical Integration: Develop machine learning algorithms to analyze tumor motility patterns and correlate ÂµG-derived invasion data with patient clinical and genetic profiles for real-time metastasis risk assessment. 2. Metastasis Simulation: Build computational models to simulate metastasis in ÂµG, offering predictive insights for oncology research and experimental design. By combining ÂµG experimentation, AI-driven analytics, and biophysical modeling, nVasive aims to become the first clinical diagnostic tool for metastasis prediction, applicable as both a lab diagnostic test (LDT) for precision oncology and a pharmaceutical

platform for metastasis-focused drug discovery.

Duration: 24

Proposal Details

Proposal Number: H8.01-1017
Subtopic Title: undefined
Proposal Title: Physical vapor deposition reactor design and validation for in-space manufacturing of aluminum nitride single crystals

Small Business Concern

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Summary Details

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

AlN is an emerging wide bandgap semiconductor with significant potential to outperform silicon carbide (SiC) and gallium nitride (GaN) in power electronics and optoelectronics. However, current terrestrial production faces major challenges, including high dislocation densities, point defects, and limitations in wafer size. To enable large-scale commercial adoption, AlN substrates must achieve a 10-100x reduction in dislocations, improved point defect control, and increased wafer diameter. Microgravity offers a unique environment to overcome these barriers by: 1. Ensuring Uniform Mass Flux â€“ Eliminating thermally driven convection stabilizes the crystal growth front, reducing defects. 2. Controlling Thermal Gradients â€“ Microgravity minimizes stress-induced defects, improving crystal uniformity and scalability. 3. Accelerating Seed Development â€“ Producing ultra-high purity seeds in space can significantly shorten the decades-long terrestrial improvement cycle, advancing wafer quality by generations within months. Building on Phase I progress, the Phase II project aims to develop a flight-ready prototype of the PVD reactor for AlN crystal growth aboard the ISS. The reactor will also support additional high-temperature material research, such as silicon carbide and oxide crystals, with potential future applications on Axiom Spaceâ€™s commercial LEO platform. The key objectives of Phase II include: 1. Refining Reactor Design â€“ Modifying the reactor to meet ISS middeck locker size requirements and integrating all system components. 2. Optimizing AlN Growth â€“ Conducting system modeling and empirical testing to refine the crystal growth process. 3. Safety & Mission Integration â€“ Completing NASAâ€™s Phase I Safety Review, securing payload integration approval, and preparing for deployment. By leveraging space-based manufacturing, this project aims to revolutionize AlN production, positioning the U.S. as a global leader in next-generation semiconductor technology.

Duration: 24

Proposal Details

Proposal Number: H9.03-1021
Subtopic Title: undefined
Proposal Title: Missfit: Statistical Multi-Event Missed-Thrust Optimization for Low-Thrust Trajectories

Small Business Concern

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Summary Details

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

We are developing a program, called Missfit, to design trajectories that accounts for unplanned thrust outages. These thrust outages result from routine and unavoidable anomalies that send a spacecraft into safe mode. While missed thrust events cannot be predicted, we do have statistical models that describes how likely they are to occur, which indicate that missions of significant length are likely to experience multiple MTEs. Using a novel approach that considers multiple events occurring during a mission, Missfit will give a mission designer the ability to set a desired probability of success and see the cost to the mission in terms of propellant or time. Equivalently, the user may optimize a probabilistic function, such as the 99th percentile propellant or time-of-flight. This approach directly targets mission risk---a topic of great importance to customers and review boards---rather than an arbitrary metric. Demonstrating that the risks to a mission are well-characterized and managed will help a project as it moves through its design phases, ultimately saving time and cost. Phase II funding will be used to continue development of Missfit, bringing it from a proof-of-concept state to a robust, tested, and documented software package that can be distributed to users. Target markets for Missfit include any entity planning a low-thrust electric propulsion mission. This includes the civil, commercial, and defense sectors.

Duration: 24

Proposal Details

Proposal Number: H9.08-1006
Subtopic Title: undefined
Proposal Title: Future Lunar surface comms using Cognitive 3gpp Radio Access Networks for Ubiquitous Mission success (FULCRUM)

Small Business Concern

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Summary Details

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

AiRANACULUS, a developer of NASA sponsored CLAIRE and INSPiRE technologies, along with, Reed Engineering (Prof. Jeff Reed, Virginia Tech, IEEE Fellow and Dr. Nishith Tripathi, IAB/NTN experts) and Prof. Ricardo Lent (DTN Expert, U. of Houston) propose Future Lunar comms architecture using Cognitive 3gpp Radio Access Networks for Ubiquitous Mission success (FULCRUM), that provides cognitive delay tolerant Networking leveraging disparate technologies such as 4G / 5G / 5G-NTN, Wi-Fi, and Legacy NASA Radios. This enables resilient communications and reduces the probability of outage. Shackleton crater on the Lunar South Pole has an area of approximately 346 Sq. km. NASA astronauts may perform variety of activities within that area ranging from descent, docking, exploration, mining, scientific experiments, astronomy etc. It is imperative to provide pervasive connectivity to NASA astronauts and support their missions. Due to the challenging terrain even within the Shackleton crater, providing outage free communications is extremely challenging. Coverage may be expanded by using more 4G/5G Base Stations / gNodeBs (gNBs). However, providing optical fiber backhaul connectivity to various gNodeBs is extremely challenging. 3GPP specified Integrated Access and Backhaul (IAB) and Non-Terrestrial Networks (NTN) can significantly help in expanding 4G/5G deployment on the Lunar surface. During Phase II, FULCRUM will focus on design, development, implementation and prototyping of IAB and NTN capabilities to expand the 4G/5G coverage on the Lunar surface. FULCRUM will reduce the mission and network operations burden, increase mission science data return, improve resource efficiencies for NASA missions and communication networks, reduce power consumption, and ensure resilience in the unpredictable space environment. FULCRUM will be enhanced by the NASA sponsored CLAIRE and INSPiRE technologies, which are protocol agnostic and provide heterogeneous multi-vendor network optimization.

Duration: 18

Proposal Details

Proposal Number: H15.01-1014
Subtopic Title: undefined
Proposal Title: Modular Software Architecture and Algorithms for Fast and Efficient Lunar Mobility (M-SAFE)

Small Business Concern

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Summary Details

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

ProtoInnovations, LLC proposes the continued maturation and development of the The Modular Software Architecture and Algorithms for Fast and Efficient Lunar Mobility (M-SAFE) for autonomous mobility solutions tailored to meet the demanding high-progress-rate driving, speed-made-good, and reliability requirements during challenging semi-

autonomous NASA lunar missions. Building upon ProtoInnovationsâ€™s previous successful experience in developing reconfigurable and modular mobility software architectures and robotic systems for autonomous rover operations, we propose an optimized mobility software architecture for high-speed and high-cadence missions in dynamic lunar operating conditions. The software architecture provides onboard autonomy capabilities for high-speed mobility systems through computationally efficient, power-efficient, and real-time supervisory and coordinated mobility control. Factoring in the need for speed, traction in mixed terrain, robustness to known terrain hazards, and minimizing energy consumption, we propose a high-speed mobility optimization algorithm with recovery mechanisms powered with intelligent decision-making with predictive situational awareness. The software architecture operates while the mobile system is in motion, continually responding to the state of the rover, current and predicted lunar terrain conditions, and mission-level mobility performance needs to make the best controlled decision during long-traverse missions. As NASA and the space industry prepare for progressively more complex and longer lunar surface missions, such as the Lunar Terrain Vehicle (LTV) and Extravehicular Activity and Human Surface Mobility (EHP) missions, our software architecture aims to provide the necessary functionality and performance to meet evolving requirements for faster and more autonomous lunar operations.

Duration: 24

Proposal Details

Proposal Number: H15.01-1024
Subtopic Title: undefined
Proposal Title: A low-power, high-dynamic range sensor system for long-term autonomy, navigation, and mapping on the lunar surface

Small Business Concern

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Summary Details

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

This work proposes a stereo event camera rig for robust mapping and navigation on the lunar surface. Initial testing in Phase I validated our systemâ€™s ability to generate accurate depth maps from event data alone. New calibration techniques specific to event cameras were developed, adapting traditional computer vision approaches to handle asynchronous event data streams. In sum, this configuration shows great promise for use on autonomous and teleoperated systems operating on the lunar surface, where harsh lighting conditions are common and information is sparse. Phase II development will introduce a self-calibration regime for all sensors on the rig, allowing the system to produce accurate data over longer periods of time. Tangram Vision will also test the abilities of the proposed sensor system extensively on autonomous platforms in harsh terrestrial conditions as a proxy for the lunar surface. Tangram Vision intends to use the funding largely to develop and refine these novel self-calibration routines, depth synthesis algorithms, and odometry

algorithms for the purpose of long-term autonomy. By the end of Phase II, our sensor system will have been tested on an autonomous platform in a lunar-like environment (the deserts of California). The majority of the grant will be devoted to algorithmic development, alongside integration testing with deployed platforms. Target markets for this innovation include any terrestrial or extraterrestrial system that is expected to behave autonomously for long durations and/or in changing environments. This includes space exploration systems (lunar rovers, autonomous landing systems, and other forms of space robotics), defense and military robotics (autonomous ground vehicles, systems operating at night, and high-speed platforms), and commercial autonomous systems (industrial robotics, mining, construction, humanoids, last-mile delivery, mobility, etc.).

Duration: 18

Proposal Details

Proposal Number: H15.01-1025
Subtopic Title: undefined
Proposal Title: Long Range Navigation Capabilities for Autonomous Mobile Manipulation

Small Business Concern

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Summary Details

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

Autonomous mobile robotics are highly important to lunar surface exploration and development; both to prepare for the arrival of astronauts and as a major enabler of a sustained presence on the surface. Historically, robotic usage necessitated teleoperation or more localized command and control. While this may have been useful for early applications, the Cislunar communication presents unique challenges - low data bandwidth, communications latency, and communications dropout. This motivates a more autonomous approach to enable robots to reliably perform more sophisticated and mission critical tasks. In Phase I we integrated an established navigation framework into our robotic runtime engine and developer platform, MoveIt Pro. We successfully utilized navigation algorithms developed for terrestrial applications to perform semi-autonomous robotic navigation tasks in simulation. We will build upon this work in Phase II to develop our own advanced navigation algorithms that go beyond terrestrial needs and meet the unique challenges of the lunar environment. Through this Phase II we will expand MoveIt Pro to include a tested and validated algorithm suite capable of supporting real-time navigation on low-power compute devices, with broad applicability to future lunar and planetary exploration missions. PickNikâ€™s MoveIt product line is multi-use and has had extensive deployments for terrestrial markets such as oil & gas, warehouse logistics, agriculture, healthcare, food preparation, construction, and advanced manufacturing. In the space industry, we are targeting various applications of robot arms and mobile manipulators from

Intra Vehicular Robotics (IVR) needs, to In-Space Servicing, Assembly, and Manufacturing (ISAM) applications.

Duration: 18

Proposal Details

Proposal Number: S11.01-1022
Subtopic Title: undefined
Proposal Title: Advanced Precision Design of Origami Inspired Deployable Metaoptic LiDAR Aperture

Small Business Concern

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Summary Details

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

This proposal aims to advance the Foldable Origami-Inspired LiDAR (FOIL) Aperture, a lightweight, deployable optical system designed for high-precision space-based remote sensing and Earth observation missions. The FOIL aperture leverages wafer based meta-optic technology to replace traditional, bulky optical systems, significantly reducing size, weight, and cost while maintaining high optical performance. The proposed Phase II effort will focus on maturing the technology from TRL 3 to TRL 5, validating key engineering aspects such as precision deployment kinematics, hinge reliability, structural stiffness, and optical alignment stability. A critical component of this work involves gravity offload deployment testing and mirror-based optical surrogate evaluations to measure panel alignment distortions. The funding will support design optimization, full-scale prototype fabrication, and deployment testing to ensure readiness for space qualification testing

Duration: 24

Proposal Details

Proposal Number: S11.02-1004
Subtopic Title: undefined
Proposal Title: Conductive Solid Surface Deployable Antenna for Space-based Remote Sensing

Small Business Concern

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Summary Details

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

The proposed Phase II effort aims to improve the surface accuracy of Opterusâ€™ Spiral Wrapped Antenna Technology (SWATH) reflector to enable operational frequencies greater than 200 GHz. Currently no spaceflight heritage solution exists for large aperture, high frequency, deployable reflectors for SmallSats or CubeSats. A proliferated constellation of CubeSats or SmallSats performing passive remote-sensing operations would improve weather forecasting capabilities by increasing understanding of current conditions over a larger area to inform predictive models. The proposed Phase II effort will consist of design, analysis, prototype, and test efforts to improve the RF performance and survivability of mm-band SWATH deployable technologies with an emphasis on hinge and reflector surface material selection, design, and manufacturing. Building on Phase I results, the project will integrate novel conductive hinge and surface materials into the reflector design, with an emphasis on advanced materials and hinges. Multiple hinge prototypes will be fabricated and tested iteratively through the program. Results from these coupon prototypes and a parallel finite element analysis effort will inform the detailed design of full scale 2.5m reflector prototypes for high frequency operation. Following the production of the 2.5m reflector, stow/deploy cycling and thermal cycling testing will take place to characterize repeatability in surface accuracy. Based on test results, the design will be iteratively refined, with key focus areas being surface accuracy, hinge performance, and antenna efficiency. Because of its primary application as a weather forecasting technology, SWATH is marketable to several NASA missions; however, SWATH is also particularly marketable for the large number of commercial entities that are launching high volume constellation systems for communications and remote sensing applications.

Duration: 24

Proposal Details

Proposal Number: S11.03-1006
Subtopic Title: undefined
Proposal Title: Noise Sources for 0.1 - 1.0 THz

Small Business Concern

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Summary Details

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

This research is responsive to NASA SBIR Subtopic S11.03: Technologies for Passive Microwave Remote Sensing (SBIR), Scope Title: Components or Methods to Improve Sensitivity, Calibration, or Resolution of Microwave/ Millimeter-Wave Radiometers; specifically, the bullet item â€œNoise sources from G-band up to 1 THz with >6 dB ENR

(excess noise ratio).â€ VDIâ€™s primary goal is the development of noise sources with sufficient stability for radiometry that can be extended throughout the 0.1 â€“ 1 THz range for scientific and commercial applications. This goal is being achieved by initially focusing on the frequency bands that will enable NASAâ€™s remote sensing programs, such as V-WiSHeS and PolSIR, as well as weather monitoring programs. The project has four objectives â€“ â€¢ The development and fabrication of noise diodes, using new materials and designs. â€¢ The packaging of the noise diodes into noise sources, for specific frequency bands of interest to NASA and to demonstrate and develop the technology. â€¢ The development of noise source characterization methods and specifications for the noise sources that ensure performance and quality. â€¢ An evaluation of the noise sources for use in Waveguide-based Internal Calibration, which can enable radiometer system simplification. NASA funds will be used for personnel (design, diode-IC fabrication, assembly, testing, and evaluation) and procurement of custom machined waveguide housings. The initial target market is atmospheric remote sensing and weather monitoring. Additional markets include laboratory measurements of receivers, radiometers, and LNAs. The noise sources developed will be immediately available to the scientific community and commercial markets.

Duration: 24

Proposal Details

Proposal Number: S11.03-1009
Subtopic Title: undefined
Proposal Title: AN ULTRA-FAST SAMPLING ADC ASIC INTERFACING WITH FPGAS

Small Business Concern

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Summary Details

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

Pacific Microchip Corp. proposes to develop an ultra-fast (56GHz) 8-bit ADC ASIC with an enhanced data rate JESD204B interface, designed for efficient and convenient data transfer to FPGAs. This ADC ASIC is primarily intended for spectrometer applications, particularly those requiring the use of FPGAs for digital signal processing instead of ASICs. Such applications include specialized signal processing functions needed in instruments used for microwave remote sensing of Earth from space, or in scenarios where hardware-based evaluation is necessary before transitioning spectrometer solutions to ASICs. The proposed ADC ASIC builds upon a previously developed and silicon-proven 8-bit 56 GS/s ADC IP block, developed under a DARPA award (D17PC00116). This ASIC will incorporate an enhanced rate JESD204B standard-compliant output data interface for bandwidth-efficient data transmission over 20 lanes of 28 Gb/s, ensuring seamless data interfacing with off-the-shelf FPGAs. The ASIC will also include a CPU running new ADC calibration algorithms to achieve a 6-bit Effective Number of Bits (ENOB) and 28 GHz bandwidth. In Phase I, we demonstrated the feasibility of the ADC ASIC achieving a 28 GHz bandwidth, 8-bit resolution, and 6-bit ENOB value at a 56 GS/s sampling rate. Phase II will result in the production of a deployable ASIC for NASA instrumentation.

Duration: 24

Proposal Details

Proposal Number: S11.04-1014
Subtopic Title: undefined
Proposal Title: Plasmonic-Enhanced Type II Superlattice (T2SL) for High-Performance, High-Temperature LWIR/ VLWIR Imaging

Small Business Concern

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Summary Details

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

We propose to develop and demonstrate high-operating-temperature (HOT) LWIR and VLWIR focal plane arrays (FPAs) based on a plasmonically enhanced Type-II superlattice (T2SL) detector architecture. By integrating a highly doped n++ InAsSb â€œplasmonicâ€ layer and an optimized grating, our ultra-thin (~0.2 Âµm) SLS absorber can achieve strong optical absorption without the performance drawbacks of thick conventional T2SLs. This design offers significantly lower dark current, enabling operation at elevated temperatures and reducing bulky cryocooling requirements. During Phase I, we validated the core plasmonic concept at 10.5 Âµm cutoff, demonstrating both feasibility and high quantum efficiency (QE) potential. In Phase II, we will refine the detector structure, optimize material growth (MBE), and fabricate a 640 Ã— 512 FPA in collaboration with Attollo Engineering, who will provide the advanced DROIC with in-pixel digitization. Our integrated supply chainâ€”spanning Amethyst Research (prime), the University of Oklahoma, Lancaster/IntelliEPI for epitaxial wafers, and Attollo for ROIC hybridizationâ€”ensures a complete pathway from wafer growth to camera-level performance validation. This effort will yield the first HOT LWIR/VLWIR FPA for NASA, DoD, and commercial markets, delivering high-sensitivity IR imaging with simplified thermal management and versatile applicability from Earth observation and space exploration to environmental monitoring and defense systems.

Duration: 24

Proposal Details

Proposal Number: S11.04-1017
Subtopic Title: undefined
Proposal Title: ALOHA - Adaptive Large-capacity Optical-infrared High-dynamic-range Array

Small Business Concern

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Summary Details

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

The ALOHA (Adaptive Large-capacity Optical-infrared High-dynamic-range Array) project addresses the limitations of current infrared (IR) imaging systems for Earth observation, wildfire detection, and remote sensing. Traditional Readout Integrated Circuits (ROICs) struggle with limited charge capacity, high noise at low flux, and excessive power dissipation at high flux, making it difficult to capture high-temperature scenes (300Kâ€“1600K) without saturation or image degradation. ALOHA introduces an innovative Residue Digital Pixel ROIC with in-pixel digital counters, achieving orders of magnitude larger well depths and per-pixel autonomous gain control to optimize signal-to-noise ratio (SNR). Key innovations include: â€¢ Per-pixel autonomous gain control, dynamically adjusting gain for optimal noise performance across varying flux levels. â€¢ Per-pixel autonomous anti-saturation control, preventing saturation without external adjustments. â€¢ Overflow bit monitoring, extending dynamic range indefinitely. â€¢ Low-voltage detector shunt circuitry, significantly reducing power dissipation from high-flux pixels. A preliminary 20Âµm pixel layout with 24 counter bits demonstrates a 16Teâ» well capacity, achieving an unprecedented 230dB dynamic range. Power consumption remains below 100mW for a 2048 Ã— 1024 array at low flux and under 400mW for high flux, making it suitable for low-SWaP (Size, Weight, and Power) spaceborne and UAV applications. Under SBIR Phase II, ALOHA will complete ROIC design, fabricate a test chip at a CMOS foundry, and conduct performance characterization. This technology is positioned for NASAâ€™s FireSense, NOAA wildfire monitoring, and DoD ISR applications, with commercial potential in remote sensing and industrial monitoring.

Duration: 24

Proposal Details

Proposal Number: S11.05-1004
Subtopic Title: undefined
Proposal Title: Airborne Spectroscopic Static Temperature Sensor

Small Business Concern

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Summary Details

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

We will develop a high speed, high accuracy method to measure the static air temperature outside an airplane using open path, infrared spectroscopy. We will project a laser beam outside the aircraft and reflect it back to its source obtaining the infrared spectrum outside the aircraft. The laser will primarily probe undisturbed air which has not yet been affected by

the aircraft. Static air temperature will be extracted from the spectrum from the relative intensity of two spectral lines with dramatically different temperature dependence. This provides a static temperature measurement which is dramatically better than existing methods. Phase I results show that we will improve measurement precision by a factor of 100 (to 5 mK) and time resolution by a factor of 100 (to 10 ms). We are hopeful that accuracy can also be improved by a factor of 5 (to 0.1 K). Temperature data are critical to improved weather and radiative forcing prediction. Of particular interest are Ice Super Saturated Regions (ISSRs) that occur in the upper troposphere. ISSRs are regions where contrails form when aircraft fly though them. Contrails are a key environmental impact of commercial aviation, representing roughly 2/3 of the radiative impact of the commercial fleet. Better temperature data can address these concerns. Current temperature measurements are not sufficiently accurate. During Phase II we will execute a detailed design for a prototype instrument. The instrument will consist of two sub-units: 1) a small chassis containing the electronic control and data acquisition systems and 2) a compact optical system containing the laser and the infrared detector ready to be mounted in an aircraft pylon. The prototype instrument will be constructed and tested extensively at Aerodyne. We will also pursue opportunities to flight test the prototype during Phase II. Our first market will be the aviation research community. There may also be a larger market in commercial aviation.

Duration: 24

Proposal Details

Proposal Number: S11.05-1006
Subtopic Title: undefined
Proposal Title: In-Situ Hyperspectral Transmissometer for Ocean IOP Closure

Small Business Concern

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Summary Details

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

The objective of this Phase II project is to build upon the success of our Phase I project developing a compact wavelength-scanning hyperspectral transmissometer to measure in-situ beam attenuation, a critical ocean inherent optical property (IOP), from ultraviolet to near infrared (approximately 360-750 nm) wavelengths at a resolution that meets the needs of NASA remote sensing missions such as PACE, GLIMR, and SBG for ocean color model development and data product validation. The sensor will utilize a broadband light source coupled to a linear variable filter to selectively scan through source wavelength ranges to transmit to the sample, with a reference detector incorporated to monitor the source

output and correct for instability and drift. The light transmitted through the sample will be coupled to a spectral detector for measurement. By utilizing a wavelength-discriminating detector, we can measure both transmitted light (at the same wavelengths as the source wavelengths entering the sample volume) and inelastically-scattered light (at wavelengths greater than the source wavelengths entering the sample volume), increasing the scientific capabilities of the instrument. In Phase II, we will (1) continue our Phase I measurement R&D to refine and characterize the performance of an advanced breadboard, (2) design, build, and test a submersible prototype of the sensor, and (3) design, build, calibrate, and test two pre-commercial units. One pre-commercial unit will remain with Sequoia for local field testing and TRL 6 validation, while the other unit will be delivered to NASA at the conclusion of the project for evaluation.

Duration: 24

Proposal Details

Proposal Number: S11.05-1012
Subtopic Title: undefined
Proposal Title: Hyperspectral Optical Profiling System with Advanced Dynamic Vertical Sampling Resolution (Hy-OPS ADVSR)

Small Business Concern

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Principal Investigator

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Summary Details

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

The principal innovation proposed by the Hyperspectral Optical Profiling System with Advanced Dynamic Vertical Sampling Resolution (Hy-OPS ADVSR) project is the development of a thruster-driven dynamically stabilized in-water hyperspectral profiler utilizing a harmonized Compact Optical Radiometric Element (CORE) and a modular design to support the collection of optical and ancillary data capable of meeting PACE mission spectral resolution and data product uncertainty requirements. This is in response to the solicitation S11.05 request for innovative, high-value sensors directly targeting the stated NASA need for ocean hyperspectral UV-Vis-NIR water-leaving radiance. The profiler will be optimized to address a critical gap in existing technology which is that no commercially available profiling package is available that can obtain hyperspectral measurements of the ocean upwelling radiance within the upper 1 m of the ocean with the high Vertical Sampling Resolution (VSR) necessary for compliant in-water profiling. The Hy-OPS ADVSR project is based on a modular concept to support a diverse Community of Practice (CoP), with multiple optical geometries and configurations to maximize the applicable sampling scenarios and simultaneously support scaling of system cost with science goals. Phase I successfully developed the modular CORE component with radiance entrance optics and demonstrated the ADVSR deployment architecture, proving feasibility. The Phase II effort will advance the accomplishments of Phase I to build the envisioned hyperspectral prototype profiling system and exploit the modularity

of the CORE, leading to a radiometrically compatible solar irradiance sensor. Target markets include Calibration, Validation and/or Research activities as well as environmental monitoring and sampling for Case II and spatially constrained water masses, taxonomic identification and phytoplankton diversity studies, and Harmful Algal Bloom (HAB) detection algorithm development.

Duration: 24

Proposal Details

Proposal Number: S12.01-1009
Subtopic Title: undefined
Proposal Title: Serpentine Integrated Grating Spectrometer for Extreme Precision Radial Velocimetry

Small Business Concern

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Summary Details

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

We propose a novel ultra-high-resolution Serpentine Integrated Grating Spectrograph (SIGS) for use in Precision Radial Velocimetry (PRV) measurements of minute Doppler shifts gravitationally imparted on stellar spectra by orbiting Earth-size exoplanets. Detecting such small spectral shifts is extremely challenging, requiring exquisite instrument and spectral reference stability and spectral resolving powers exceeding 100,000 to maintain few cm/s precision for year(s). To overcome atmospheric limits on ground-based PRV, planned space missions require precision spectrographs with low size, weight and power (SWaP). SIGS generalizes photonic gratings to two dimensions, and relies on the exquisite manufacturing fidelity of photonic integrated circuits (PICs), instead of grating ruling machines, to produce PIC gratings with record resolution. These folded gratings form the basis of a new class of miniature spectrographs with comparable resolutions to spectroscopic instruments thousands of times larger and more expensive. SIGS requires only a few small optical components and can be readily integrated with emerging astrophotonic photonic lantern and microcomb technologies to implement a low-SWaP instrument suitable for space-based PRV. We have previosuly demonstrated a proof-of-concept SIGS combining a 5.2 cm (equivalent to 14.8 cm in free space) folded delay line with grating couplers in a footptint of just ~0.4 mm^2 to attain a resolving power of ~100,000 in the 1540-1650nm regime. During Phase I we for the first time obtained a spectrum using a more recent test chip, clearly resolving spectral lines in an acetylene gas

cell, while attaining a total photon loss below 10dB. During this effort we will continue improving SIGS efficiency and extend the design to NIR and VIS wavelengths through 4 fabrication iterations. We will also calibrate SIGS using an EO comb, build several SIGS prototypes, and measure solar and stellar spectra to attain TRL4.

Duration: 24

Proposal Details

Proposal Number: S12.02-1000
Subtopic Title: undefined
Proposal Title: Biomimetic Zero CTE Lightweight Optical Structures

Small Business Concern

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Summary Details

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

This NASA SBIR Phase II proposal presents an unprecedented method to make zero CTE lightweight optical structures such as optics mounting structures, brackets, optical benches, and metering structures. With our successful history in a variety of AM processing for TPMS structures, this proposal has a great potential to succeed. A proof-of-concept demonstration has been carried out at the end of Phase 1. Detailed investigation on mechanical and thermal properties will be done, and prototypes of multi-functional optical structures will be delivered at the end of Phase II.

Duration: 24

Proposal Details

Proposal Number: S12.02-1006
Subtopic Title: undefined
Proposal Title: Quasistatic Release Mechanism

Small Business Concern

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Summary Details

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

Heliospace is developing the next generation of release mechanisms that generate "nearzero" shock upon actuation. When integrated into a deployment assembly, the Quasi-Static Release Mechanism'â„¢ (QSRM"â„¢) can be utilized for a multitude of applications, including state-of-the-art optical systems, avionics, sensors, or any application where

mitigating shock is of paramount importance. The proposed release mechanism has several key advantages: (1) Relative to the current state-of-the art, development testing has demonstrated a two order of magnitude reduction in exported shock during actuation, as described in Section 2.2; (2) The unit's field reset-ability helps mitigate project cost and schedule risk by enabling technicians to reset deployables in a matter of hours; (3) Verification and Validation activities are significantly improved as shock becomes less of a design driver for qualification of associated hardware. Phase 2 funding will be used to increase the TRL of the Quasi-Static Release Mechanism from TRL 4 to TRL 6 . Broadly speaking, this will be achieved by fabricating a fully integrated system model and conducting testing in dynamics and thermal vacuum environments, among others. Qualification testing will be conducted utilizing the guidelines for environmental testing in General Environmental Verification Standards, GSFC-STD-7000B (GEVS). In addition, Heliospace will scale the device for a range of applications. The near-term objective is to develop a unit capable of releasing a 25kN and 10kN preload as well as the 2kN unit. Heliospace will also be conducting further research and development on state-of-the-art shape memory alloys that will increase the temperature range in which the unit can be operated from the current 90C up to ~140C. From a non-technical standpoint. Target markets are government and commercial space missions requiring deployment of both large- and small-scale deployable structures, mechanisms, and sensors.

Duration: 24

Proposal Details

Proposal Number: S12.03-1012
Subtopic Title: undefined
Proposal Title: Retardation Mapping System for Astronomical Mirrors

Small Business Concern

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Summary Details

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

NASAâ€™s next-generation space telescopes, including the Habitable Worlds Observatory (HWO), require ultra-low polarization aberrations, but existing metrology tools cannot fully characterize polarization effects on large, curved astronomical mirrors over a broad spectral range. This project will advance Axometricsâ€™ AxoScan Mueller matrix spectropolarimeter (MMSP-UW) into a fully commercialized system, enabling full Mueller matrix mapping from 250â€“2100 nm. Phase II funding will support the development of an integrated measurement system for 1-meter-class mirror segments, incorporating key advancements from Phase I, including a dual-detector architecture and hyper-achromatic retarder for extended spectral coverage and improved accuracy. The system will be delivered to NASA within a VVRM-1000D industrial ellipsometer platform for direct use in mirror validation and polarization control, supporting HWO and future space observatories. Beyond NASA, this technology has strong commercial applications in aerospace,

semiconductor manufacturing, and precision optics, where high-accuracy polarization metrology is essential.

Duration: 12

Proposal Details

Proposal Number: S12.04-1005
Subtopic Title: undefined
Proposal Title: Creating Blazed Gratings for Freeform Mirror Surfaces

Small Business Concern

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Summary Details

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

Spectrum Scientific proposes the fabrication of FUV blazed diffraction gratings using reactive ion beam etching (RIBE) on freeform surfaces. The primary advantage of this method over traditional techniques like ruling and holography is its ability to create high-efficiency, low-stray-light, gratings with a broad range of blaze wavelengths. This flexibility is crucial for various applications, especially in the support of NASA spaceborne instrumentation. By applying reactive ion beam etching to freeform surfaces, the technique has the potential to significantly reduce the number of optical components needed, leading to more compact and cost-effective systems. This is particularly relevant for small-scale space missions, such as those using CubeSat and SmallSat platforms, where payload weight is a crucial factor in launch costs. This work has the potential to revolutionize the design and manufacturing of diffraction gratings for space instrumentation, offering not only cost and weight savings but also the possibility of more versatile optical components. While the immediate focus is on aerospace applications, the impact of this technology could extend to other sectors, including life sciences, photonics, and telecommunications, where diffraction elements are critical for a wide range of applications. By using the successful Phase 1 RIE FUV Grating development as a launch point In Phase II SSI will: - Continue advancing the development of the reactive ion etching (RIE) process for FUV blazed grating fabrication. - Transition the technology for application on both planar and curved grating surfaces. - Address further development of the RIE process for grating fabrication on Freeform surfaces.

Duration: 24

Proposal Details

Proposal Number: S12.06-1001
Subtopic Title: undefined
Proposal Title: Large Silicon Carbide Grids for X-Ray Microcalorimeter Blocking Filters

Small Business Concern

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Summary Details

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

Our SiC grids address a NASA Tier 1 technology gap, Microcalorimeter Optical Blocking Filters. Phase II SiC grids will reduce blocking filter contamination rate by 100X and increase filter strength by 2X. The performance advantages we identify for SiC microcalorimeter grids have analogs for AXIS, and for X-ray instrumentation. Our fabrication technology will be used to make precision parts and micro-electrical mechanical systems (MEMS). We can create silicon carbide components with exceptional thermal properties, strength, and dimensional tolerance. The requested Phase II funding primarily advances the TRL of SiC grids by increasing their vibration strength 4-20X. This strength increase enables SiC grid implementation into X-ray telescopes, most notably AXIS and X-IFU. It will provide SiC grid durability test data to the AXIS team. The Phase II prototypes will allow us to bridge the gap from laboratory samples to prototypes for planned missions. The test data obtained in Phase II will reduce the OBF technical risks for other upcoming X-ray telescope missions. The Phase II funding assists our cost reduction goals by allowing us to make purchases of newly available higher performance components. To achieve the best results, we purchase factory lots of components and build these into our custom process tools. Our Phase II plan calls for purchasing three such factory lots, and will demonstrate a 6X cost reduction. Phase II will make fundamental advances in SiC component strength and materials damping. For example we will deposit a metal multilayer damping coating, a structure which never before been tested. This multilayer is expected to provide more damping than any previous deposited metal coating. Phase II will increase ceramic strength to a level which has never previously been demonstrated for large components.

Duration: 24

Proposal Details

Proposal Number: S12.06-1007
Subtopic Title: undefined
Proposal Title: High-Sensitivity UV Solid-State Photon-Counting Devices and Arrays

Small Business Concern

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Summary Details

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

In Phase II of this SBIR project, Magnolia Optical Technologies in collaboration with research partner Georgia Institute of Technology, propose to advance the development of AlGaN-based ultraviolet deep-UV (DUV) and far-UV (FUV) single-photon avalanche detectors (SPADs) using the well-developed Si photomultiplier (SiPM) concept and then, in future SBIR Phases, to commercialize practical devices. Our team has collaborated on the development of III-N avalanche photodiodes (APDs) in the past. Our overall innovation in this SBIR will be to ultimately create the III-N analog of the SiPM: a back-illuminated hybrid FUV SPAD-focal-plane array (FPA) device coupled to a Si CMOS read-out integrated circuit (ROIC). This Phase II funding will allow our teams to further develop unique concepts that will greatly improve the UV and FUV performance of critical sensor systems based on the III-N materials. We will demonstrate improved performance UV APDs operating in both photovoltaic and Geiger Mode. This work will create the next technology readiness level for â€œsolar-blindâ€ III-N SPADs and III-N photomultipliers (PMs) following the concepts employed in the successful commercial development of Si-based PMs operating in the longer-wavelength regions. We expect that the NASA programs Explorers, Discovery, Cosmic Origins, Physics of the Cosmos, Habitable World Observatory, Solar-Terrestrial Probes, Vision Missions, and Earth Science Decadal Survey missions will all benefit from our technology development. In addition, such III-N UV SPADs will have an impact in related research areas, and many applications outside the realms of basic research, e.g., defense systems, biological applications, and medical imaging. Any new development is thus likely to have an impact in a broad range of applications within NASA, and in other defense, scientific and commercial application spheres.

Duration: 24

Proposal Details

Proposal Number: S13.01-1002
Subtopic Title: undefined
Proposal Title: Robotic Actuators for Cryogenic Environments (RACE)

Small Business Concern

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Summary Details

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

Motiv Space Systems is proposing the Robotic Actuator for Cryogenic Environments (RACE) to address the growing need for precision, high specific-torque robotic arm actuators for operations in extreme temperature environments such as permanently shadowed regions (PSRs), Enceladus, or other icy moons. For such missions, a premium is placed on low

energy consumption, and RACE decreases actuator energy usage by improving efficiency and eliminating the need for actuator heaters. RACE is a novel approach to cryogenic actuators that is easily scalable and modular by design. RACE leverages Motivâ€™s work developing BMG material components for planetary gearboxes with the Distributed Extreme Environments Drive System (DEEDS) SBIR Phase II Sequential program and will implement a single-pass cycloidal reducer as the output stage. RACE is a heater-free, BMG material-based actuator with a small cycloidal output stage driven by a brushless DC gearmotor. Motiv and the PI have extensive experience with the design, analysis, assembly, integration, and qualification of rotary actuators for space robotics. Motiv developed and delivered all the joint actuators for the Mars 2020 Perseverance Rover robotic arm and, most recently, the COLDArm system. Construction of the motor and planetary gearbox is based on that developed for the Cold Operable Lunar Deployable Arm (COLDArm). Both COLDArm and DEEDS feature BMG material components to enable operation at -180Â°C, and both programs introduced BMG material elements as â€œdrop-inâ€ substitutions for mechanism components typically made of standard materials that comprise Motivâ€™s designs. Bulk Metallic Glass is an amorphous metal which has properties of high strength and low wear under load without the supplement of lubricants. Motiv is in a unique position to apply BMG substitutions to the cycloidal architecture to improve manufacturability of extreme environment rotary actuators and develop a scalable family of actuator products.

Duration: 24

Proposal Details

Proposal Number: S13.01-1012
Subtopic Title: undefined
Proposal Title: Boom-Enabled Actuating Manipulator (BEAM)

Small Business Concern

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Summary Details

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

The Boom Enabled Actuating Manipulator (BEAM) system delivers a novel extended-reach deployable robotic manipulation system, answering NASAâ€™s call for innovative solution to overcome challenges of exploring increasingly scientifically challenging and important terrains. In Phase II, the BEAM subsystems will be demonstrated at TRL 5 via operation in a simulated planetary environment. The critical subsystems will then be integrated for a system operational demonstration, validating the BEAM design at the system level. Dynovas has aligned strategic partnerships within the Phase II effort to enable delivery of BEAM system designed for a specific mission integration target â€“ such as CLPS, rovers, or VSAT â€“ that supported by mechanism designs with flight heritage. The BEAM system utilizes a deployment boom capable of extending up to 10m in length with integrated smart material actuators to enable articulation along the length of the boom, achieving up to 10Â° of deflection at the tip of the boom. The bistable deployable boom is

supported at the root by the deployer housing structure, in which it coils up for compact packaging when stowed. The boom deployer is mounted on a rotating gimbal platform, enabling Â±90Â° of rotation in elevation and azimuth for both vertical and horizontal deployment. The gimbal mechanism in combination with the articulation along the length of the deployable structure unlocks extra degrees of freedom, providing a modular and adaptable arm capable of reaching locations previously inaccessible without astronaut intervention. The BEAM systems are configurable to deliver a robotic manipulation system solution for not only sample collection and handling, but also inspection via cameras or probes. The BEAM system is scalable for each application, enabling its integration and commercialization on platforms from micro-rovers to MER-class rovers, CLPS, or LTV for Lunar and Mars exploration and future deep space missions for other celestial bodies.

Duration: 24

Proposal Details

Proposal Number: S13.03-1012
Subtopic Title: undefined
Proposal Title: Radiation Shielding for Space Electronics in Severe Environments

Small Business Concern

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Principal Investigator

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Summary Details

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

NASA has identified a need for radiation shielding for electronics in extreme environments. NanoSonic is a small, advanced materials company with expertise in the development of advanced shielding and protective materials for use in cryogenic through thermonuclear conditions. In this program, we have developed extremely low glass transition temperature polymer matrix resins (< 125 ï‚°C) fortified with new MXene materials (at right) as electronics shielding for use in harsh Europa and Lunar missions. These durable materials are designed to outperform 0.1 in thick aluminum for 10-years of service and radiation levels of 2.9 Mrad TID (total ionizing dose). Mechanical properties for our filament wound structures are maintained upon exposure to 1 GeV Fe and 1 GeV proton, and the matrix constituent survives extremely high secondary neutron flux of 114.26 hr, 117 MeV, under a 150 uA primary proton beam. Dual-use X-ray attenuation of 100% has been achieved and can be tailored for mechanical resiliency as a function of mass density. Commercialization is ongoing as these special radiation shields are being used in two CubeSat launches planned for the next calendar year. NanoSonic is producing these shielding boxes with the new materials tailored here for cryogenic durability. During Phase II, microelectronics from our partners and from NanoSonicâ€™s Quantum Electronics and Sensors Division will be used in test scenarios at the Brookhaven National Laboratory NASA Space Radiation Laboratory.

Duration: 24

Proposal Details

Proposal Number: S13.04-1004
Subtopic Title: undefined
Proposal Title: GRIND: Genomic Rapid Inspection of Non-abundant bacteria after Decontamination

Small Business Concern

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Summary Details

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

This Phase II proposal advances NASA's planetary protection mission by developing an innovative lysis-based sample collection tool that significantly enhances current swab-based procedures. While NASA's existing protocol uses swabs for microbial collection followed by the NASA standard assay, this method struggles to detect low biomass, unculturable species, and microbial dark matter. Spores are resilient to the extreme conditions of space, and though culturable, often remain undetected in metagenomic sequencing and other nucleic acid-based analyses, creating a critical gap in planetary protection protocols. Our solution builds upon our successful automated grinding lysis system developed in Phase I. This integrated platform combines traditional swab collection with novel mechanical disruption to effectively release genomic material from difficult-to-lyse, low-biomass samples. By automating and optimizing the lysis process through precision grinding mechanisms, our system overcomes the limitations of conventional techniques, ensuring more comprehensive nucleic acid extraction for planetary protection applications. The Phase II work will rigorously evaluate our technology against industry-standard bead beating methods through metagenomic sequencing. Our testing protocol encompasses diverse NASA-relevant surfacesâ€”including steel, aluminum, and polycarbonateâ€”and a broad spectrum of challenging-to-lyse, NASA relevant microbial species. We will demonstrate system effectiveness using Nanopore sequencing with Carrier-Seq, a method to enable low biomass sequencing. This innovative system promises to enable detecting and analyzing low biomass, resistant spores that currently evade standard detection methods. By enhancing the reliability and comprehensiveness of microbial detection, our technology will strengthen NASA's planetary protection capabilities, helping safeguard both Earth and celestial bodies from cross-contamination during space exploration.

Duration: 24

Proposal Details

Proposal Number: S13.05-1006
Subtopic Title: undefined
Proposal Title: CHESS: Compact High-Entendue Spectrometer for Space

Small Business Concern

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Summary Details

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

Leiden Measurement Technology (LMT) proposes to design and construct the Compact High-Entendue Spectrometer for Space (CHESS), a highly-sensitive and compact spectrometer designed for emission spectroscopy applications such as fluorescence and luminescence. CHESS fits into a bounding box of 90mm x 108mm x 200mm and is especially well-suited for applications including hyperspectral fluorescence microscopy, the detection of aromatic biosignatures and other analytes including PAHS, and water monitoring applications for the detection of many classes of organic pollutants. It can serve as a detector in many different existing instrument technologies including liquid chromatographs, flow cytometers, plate readers, and point-of-care diagnostic devices. CHESS boasts an entendue (total light throughput/ sensitivity) that is 25- to 1,000-times higher than similarly-sized commercial spectrometers. CHESS draws heritage from previous highly-sensitive fluorescence detection instruments funded by NASA. LMT has been able to leverage engineering solutions from these past projects to realize CHESS' high-sensitivity packed into a rugged and compact form factor. CHESS has many applications but is especially well-suited for integration into the HYMDOL hyperspectral microscope, developed with NASA funding, for the detection and characterization of microbial life on Ocean Worlds and rocky bodies such as Mars. In this Phase II, out primary goal is to design, build, validate (shock/vibe/thermal) and deliver CHESS to NASA.

Duration: 24

Proposal Details

Proposal Number: S13.05-1013
Subtopic Title: undefined
Proposal Title: Compact Lidar Spectrometer for Mars, Lunar Science and ISRU Prospecting

Small Business Concern

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Summary Details

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

Fibertek proposes to develop a rover-based Compact Lidar Spectrometer (CLS) to facilitate the long-range detection of water ice, other surface volatile species, and minerals within the 1.5 Âµm to 4 Âµm wavelength band. The CLS uniquely combines traditional three-dimensional (3D) lidar terrain mapping with standoff spectral mapping capabilities. The CLS

can operate with high SNR without sunlight and in Permanently shadowed Regions (PSRs) of Mars, the moon, and other planetary bodies. This system is engineered to deliver both spectral and range data from approximately 10 meters to 5,000 meters. A Mars or lunar vehicle equipped with the CLS can efficiently survey large areas and precisely locate water ice, minerals, and other volatiles of interest. This capability enables the rover to strategically navigate to high-potential areas, minimizing risk while providing lidar terrain mapping. Once an area of interest is identified, the rover can move to the location, allowing the deployment of other scientific or in situ resource utilization (ISRU) instruments.

Duration: 24

Proposal Details

Proposal Number: S13.06-1014
Subtopic Title: undefined
Proposal Title: Multi-Channel Stirling Convertor Space Controller (MC-SCSC)

Small Business Concern

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Summary Details

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

West Coast Solutions (WCS) and Sunpower, Inc. propose to build on the successful Phase I Multi-Channel Stirling Convertor Space Controller (MC-SCSC) Program and the ongoing NASA Phase II Program for a single-channel SCSC to create the next natural evolution of the technology â€“ a high fidelity, path to flight brassboard demonstration of a MC-SCSC system. The MC-SCSC is architected to support up to eight (8) Sunpower Robust Stirling Convertors (SRSCs), thus immediately paving the way for ~480 W SRSC-based systems. Perhaps more importantly for the long term, maturation of this technology begins to prove out the methods for joining Stirling convertors of any number and any scale for future higher power systems. WCS proposes to perform a preliminary flight design to ensure a â€œpath to flight,â€ and then proceed with a robust brassboard design, build, and test program. The end point of Phase II will be a TRL 5 MC-SCSC design with a low-risk path to TRL 6, and flight programs shortly thereafter. The proposed effort has been strongly informed by the topic references, related references, and consultation with Sunpower to determine a baseline architecture and preliminary requirements. The effort will be led by WCS, who is presently developing the SCSC and brings a proven track record of developing and delivering space-rated controllers for Stirling cryocoolers, as well as many other space-flight applications. WCS has again teamed with Sunpower, the industry leader in the design and build of highly efficient and reliable space-rated Stirling convertors. This well-established Team executed Phase I and is now executing the related single-channel Phase II, carrying over maximum execution efficiency to the new program.

Duration: 19

Proposal Details

Proposal Number: S14.01-1005
Subtopic Title: undefined
Proposal Title: An Advanced Surface Flux Transport Model for Space Weather

Small Business Concern

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Summary Details

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

The solar magnetic field (B) plays a key role in solar and heliospheric physics and is a crucial input for Space Weather Models. This input is in the form of full-Sun maps of B. Standard observatory maps are constructed diachronically and contain data that is as much as 27 days old. Assimilative Surface Flux transport (SFT) models can improve upon this input, by incorporating known surface flows and processes to produce a continuous approximation of the state of the photospheric magnetic field, as a sequence maps. These synchronic maps can allow space weather models to produce more accurate results. To assess uncertainty and sensitivity of solutions, SFT should produce multiple map realization sequences. Presently available SFTs are based on legacy codes that computationally can provide only a small number of realizations at low resolution in a practical amount of time. None are open source. In phase I, we developed OFTSWA (OFT for Space Weather Applications), an advanced SFT that acquires and assimilate magnetograms and produces multiple realizations at high resolution that estimate the present state of the Sun's surface magnetic field. In phase II, we will deliver an updated OFTSWA to NASA CCMC and a living database of map realizations with interfaces and tools that allow rapid assessment of the fidelity of maps for space weather models and applications. Within NASA, OFTSWA will be beneficial to the Community Coordinate Modeling Center (CCMC), especially as part of their support to the Moon to Mars Space weather Analysis Office. Outside NASA, NOAA Space Weather Prediction Center and the Air Force also require solar magnetic maps for Space Weather Models.

Duration: 24

Proposal Details

Proposal Number: S14.01-1017
Subtopic Title: undefined
Proposal Title: Commercial data assimilation tool for operational thermospheric density

Small Business Concern

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Summary Details

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

Low Earth Orbit (LEO) is becoming more congested as the number of satellites continues to grow with the rising popularity and establishment of SmallSat constellations. Accordingly, there is strong interest by U.S. agencies, companies, and international organizations to manage LEO collision hazards. Improved thermospheric density nowcasts and forecasts are a critical need identified by the Space Weather Operations, Research, and Mitigation (SWORM) Working Group, a Federal interagency coordinating body. To fill this need, the work proposed here will provide a commercial data assimilation (DA) tool that combines various data sources to provide a corrected global density state. The nowcast corrected global density state can then be combined with Space Environment Technologiesâ€™ (SET) operational forecast space weather indices to produce a forecast global density state 2- to 3-days in the future. With a team of investigators that have deep experience with the development of HASDM, this Phase II work will fully construct Solari, a commercial DA tool that assimilates radar tracking data and Space Force Energy Dissipation Rates (EDRs) of calibration satellites to correct multiple background density models simultaneously and produce a global density state. The end goal is an operational commercial density nowcast and forecast data stream, with corresponding uncertainties, that offers accuracy comparable to that of HASDM. The commercial DA tool will have a flexible architecture that allows for expansion of additional measurement data sources, such as satellite GPS data, in the future. We consider four cases of growth for our commercial data assimilation tool to improve thermosphere density forecasts: civilian agency satellites, defense applications, commercial satellites, and space traffic management.

Duration: 24

Proposal Details

Proposal Number: S14.02-1010
Subtopic Title: undefined
Proposal Title: THz Mixers, Receivers, and LO Sources for Heliophysics

Small Business Concern

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Summary Details

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

This research is responsive to SBIR Subtopic S14.02: In Situ Particles and Fields and Remote-Sensing-Enabling Technologies for Heliophysics Instruments; Scope Title: Enabling Technologies for Remote-Sensing Heliophysics Instruments; specifically, the bullet item â€œTechnologies for precise radiometry at THz bands corresponding to upper atmosphere thermal emissions in the 1-5 THz range, particularly at 4.75 THz.â€ VDIâ€™s primary goal is the development of receivers and sources that can eventually be extended throughout the 1 â€“ 5 THz range for commercial and scientific applications. This goal will be achieved by initially focusing on the most promising receiver technologies to enable NASA missions to measure the OI lines at 2.06 THz and 4.75 THz for heliophysics. The project has five objectives â€“ â€¢ Development of a fundamental mixer to be used with a QCL LO source for heliophysics at 4.75 THz. This project supports only the mixer development, not the QCL. â€¢ The development of a 4.75 THz microwatt test source for the evaluation of both the VDI mixer and NASAâ€™s receiver system (mixer and QCL LO). â€¢ Development of a 1.03 THz LO source for 2.06 THz heliophysics receivers. The goals are >2.0mW and minimal SWaP for SmallSat applications. â€¢ The development of a 2.06 THz subharmonically pumped mixer. â€¢ The integration of the LO source and mixer to realize a deliverable 2.06 receiver system meeting the core requirements for a heliophysics mission. NASA funds will be used for personnel (design, diode-IC fabrication, assembly, testing, and evaluation), power amplifier MMICs, and custom machined waveguide housings. The initial target market is atmospheric remote sensing and heliophysics research. Additional markets include plasma diagnostics for nuclear fusion experiments, QCL phase locking and testing, and general test and measurement. The components developed for the sources will also be marketed for commercial and scientific applications.

Duration: 24

Proposal Details

Proposal Number: S14.02-1013
Subtopic Title: undefined
Proposal Title: 6 Meter Antenna and Boom System for CubeSats

Small Business Concern

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Summary Details

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

Heliospace Corporation proposes accelerated development of a modular CubeSat-scale, 6.5 mm free coil (FC) diameter, 6 m length passively deployed antenna and instrument boom system. While Heliospace has produced similar antennas up to 2.7 m deployed length, demonstrating feasibility beyond 3 m requires a focused research and development effort which,

unless performed prior to and independently of mission formulation, limits the perceived suitability of the technology to scientific and other objectives. Heliospace and its partners have continued to develop a new type of BeCu helical element, whose production methods were successfully scaled down and achieved TRL 4 in Phase I. The elements are ready for application in a new CubeSat-class family of Heliospaceâ€™s SABER (Spiral Actuated Boom, Extended and Rigidized) products. Phase II intends to develop and qualify multiple configurations of this modular system for TRL 6. New and highly compact SABER root stabilizing mechanisms are the minimum required advancement for the next generation of antennas and CubeSat scale applications. New specialized tethers and payout systems including compact brakes and slip rings are required for instrumented boom applications. Proving the capability of new commercial partners to produce highly flexible tethers having embedded conductors and a means of supporting the deployment tensile loads for support of deployed sensors, is critical for instrumented booms. The technical innovations described will result in significant increase of achievable deployed length over previous CubeSat antenna and boom systems, improved accuracy, precision and repeatability of form and rigidity, and reduced disturbance of small-spacecraft dynamics during deployment. The innovations will also reduce the engineering time needed to adapt the system to specific applications and eliminate manufacturing time associated with iterative deployment testing and tuning necessary for currently bespoke solutions.

Duration: 24

Proposal Details

Proposal Number: S15.01-1014
Subtopic Title: undefined
Proposal Title: Sensors for Precision Agriculture and Crop Management Decisions

Small Business Concern

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Summary Details

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

NASA is developing spacecraft and technologies for extended duration missions. The ability to grow plants in space is beneficial for food, oxygen, and human health. New engineered plant growing systems and microgravity stressors need to be studied and understood before they can be relied on. TDAâ€™s wearable plant sensors will enable NASA researchers and astronauts to identify drought responses which could indicate potential growth hardware issues or harmful recycled water conditions, disease conditions which could spread and affect entire harvests, and nutrient deficiency identification to optimize engineered growing systems. As astronauts reach the moon or Mars and work to expand agricultural

production, sensors will be critical to ensuring soil and nutrient compatibility, identification of diseases conditions, and drought. Early identification of such issues will help prevent crop failure, which would have dire effects on the astronauts. The U.N. Food and Agriculture Organization predicts that world food production will need to increase by 70% by 2050. To make this dramatically increased production possible, technical innovations in agriculture are needed. The potential economic impact of wearable plant monitors and the subsequent analytical grower management tools is enormous. Sensors that measure useful and actionable plant health metrics will drive agricultural research to improve crop management. Researchers will be able to use these analytical tools to better understand plantsâ€™ response to stressors and enabling precision agriculture. Ultimately, our sensors will be able to assist the grower by providing fine-tuned agricultural management decisions. TDAâ€™s non-invasive sensor technology continuously tracks several physiological parameters providing crucial insights into plant health. Early detection of stress, triggered by factors like drought, nutrient deficiency, or pest infestation, would empower researchers, astronauts, and farmers to intervene.

Duration: 24

Proposal Details

Proposal Number: S15.02-1002
Subtopic Title: undefined
Proposal Title: Self-Contained Dual-Mode Sample Preparation Module Using Non-Hazardous Reagents

Small Business Concern

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Summary Details

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

Building on the successful function test demonstrated in Phase I, including a parabolic flight test, AI Biosciences proposes to further advance the capability of a microgravity-compatible, compact, dual-mode sample preparation module (DM-SPM) in Phase II. This module processes samples from various matricesâ€”such as swabs, potable water, blood, and urineâ€”to yield high-quality nucleic acids for downstream molecular detection and identification within a closed-cartridge system. Our technology can fill NASA's technology gap in sample preparation in space. Utilizing novel, non-hazardous reagents inside a dual-mode sample preparation cartridge (DM-SPC) will enhance crew safety. Its primary function will enable NASA to quickly identify microorganisms that could compromise crew safety. The system can also be extended to study the microbiomes of the space station and future space outposts, observing changes over time. This near-term deployable cartridge and platform system will additionally have the capability to perform other magnetic particle-based applications. This highly flexible system will allow previously complicated, labor-intensive, and time-consuming processes to be executed by a programmable, turn-key, closed system using pre-filled cartridges. Furthermore, the SPM can be employed to capture and purify cell and protein targets. The self-contained DM-SPC is also gravity and

reagent-agnostic when paramagnetic magnetic particle-based protocols are followed. At the end of Phase II, a fully automated platform will be tested for nucleic acid extraction during parabolic flights.

Duration: 24

Proposal Details

Proposal Number: S16.03-1003
Subtopic Title: undefined
Proposal Title: Miniature High-Performance Integrated Photonics Inertial Measurement Unit

Small Business Concern

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Summary Details

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

We propose a radical new approach for to the design and fabrication of Inertial Measurement Unit (IMU) that will meet the requirements for future NASA applications. The IMU is based on photonic Planar Light Circuit (PLC) technology and will implement a Multi-layer Integrated Silicon-photonics interferometric Optical Gyroscope (MiSOG). The MiSOG includes all the sensorâ€™s optical elements in one small optical chip and enables the development of a 5 cube inches IMU that combines high-tactical grade performance (better than 0.2 deg/hr over temperature) with higher reliability, high level of robustness and lower cost. Such an IMU will provide the best performance in a compact, ruggedized configuration suitable for the future low weight and harsh radiation environments experienced by satellite and space exploration. The MiSOG based IMU will have more than an order-of-magnitude improvement in bias stability over temperature when compared to the highest performance commercially available MEMs in the same volume and is also inherently radiation hardened, vibration and shock hardened and is best suited technology for future NASA and DoD missions

Duration: 24

Proposal Details

Proposal Number: S16.04-1003
Subtopic Title: undefined
Proposal Title: Swift Ultra Long Endurance (SULE) High-Altitude Platform Systems (HAPS) Capability Demonstration

Small Business Concern

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Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 7 - undefined
Technical Abstract (Limit 2000 characters):

The Swift Ultra Long Endurance (SULE), along with our experience in flight planning within FAA regulations, onboard computing, telemetry, payload selection/ integration, and successful SULE flight testing will be used to complete all Phase II deliverables for an effective demonstration of SULE making significant progress towards commercialization. As a HALE aircraft, the SULE allows for near continuous surveillance, communications, and sensor coverage, operating as a pseudo-satellite while staying clear of the national airspace and remaining fuel independent thanks to solar power. Swiftâ€™s previous and continued success with the SULE program has demonstrated our ability to not only plan and create detailed concepts of operations but also to execute our missions safely while cooperating with FAA regulations. The Swift SULE team is committed, experienced, and motivated for this next chapter in the program, particularly following the successful 56,000-foot, 24-hour flight in September 2024. This experience, combined with Swiftâ€™s ongoing collaboration with NASA on HAPS programs, positions us as the ideal and low-risk partner for this SBIR. The funding will be utilized for Phase II objectives, which include demonstrating a multi-day flight, and will support continued upgrades and R&D to advance towards a commercialized solution, pushing the boundaries of technology to maintain our competitive edge in the HALE industry. Target markets for this technology are commercial communication, commercial scientific, and government agencies such as NASA, DOD, USFS.

Duration: 18

Proposal Details

Proposal Number: S16.04-1005
Subtopic Title: undefined
Proposal Title: High-Altitude, Long-Endurance, Visible Through Extended SWIR Hyperspectral Imaging for Earth Sciences

Small Business Concern

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Summary Details

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

NASA has identified long-endurance, sub-orbital, stratospheric observations from High-Altitude Platform Systems (HAPS) as a key future capability for the Surface Biology and Geology (SBG) mission and supporting the needs of commercial and government organizations for ecological, climate, earth resource and emergency management information. A key source of data for SBG and other applications is hyperspectral imaging (HSI) over the Visible through Short Wave Infrared spectral region (VSWIR). VSWIR HSI systems have been flown on aircraft below 50,000 ft and recently on low-Earth orbiting satellites. However, these platforms do not meet the combined wide-area coverage, spatial

resolution, station keeping and long duration diurnal measurement requirements of SBG measurement campaigns. A HAPS VSWIR HSI solution is therefore an important science mission objective for NASA. Spectral Sciences Inc proposes an innovative combination of our rugged Terrestrial Hyperspectral Imaging Apparatus (THIA) VSWIR HSI and the Sceye Inc. Stratospheric HAPS to meet SBG sensing needs. In Phase I, SSI developed a concept for the THIA-HAPS payload and preliminary mission plan for a THIA-HAPS demonstration flight. In Phase II, our team proposes to fly the THIA-HAPS payload, in a 14-day demonstration of HAPS capability to collect VSWIR HSI imagery from 50,000 to 60,000 ft.

Duration: 24

Proposal Details

Proposal Number: S16.05-1017
Subtopic Title: undefined
Proposal Title: Flexible Variable Emission Material

Small Business Concern

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Summary Details

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

Thermal management is an enduring need for all space platforms and vehicles. Spacecraft are routinely exposed to extreme temperature fluctuations, and options for regulating temperature in the vacuum of space are limited and challenging. To address temperature fluctuations, heaters have traditionally been utilized for maintaining warmth of sensitive electronics. These battery-operated heaters significantly increase the craftâ€™s weight and power usage. Conversely, radiators and reflectors are used to dissipate waste heat and reject thermal loading, respectively, to prevent platform overheating. Depending on mission lifecycle, orbit, and whether the mission is manned or unmanned, the respective ranges of environmental conditions will vary greatly as will the crafts survivability standards. Tailorable and variable thermal management systems are therefore vital to the success of next generation space exploration. To address this issue, Plasmonics Inc. proposes to develop a new class of mission-tailorable, and autoregulating, thermal radiator coatings by leveraging its extensive experience in growing vanadium dioxide (VO2) on flexible substrates. VO2 has been investigated for use in variable emittance regulators in the past; however, in all cases the processing requirements appear to be incompatible with space craft radiator materials. Accordingly, Plasmonics Inc. proposes to design, model, fabricate, and test a range of tungsten-doped vanadium dioxide-base (WxV1-xO2)- variable emissivity materials (VEM). Various concentrations of W will be explored to evaluate its effect on transition temperature and VEM thermal emissivity. After design optimization and testing, the team will fabricate a VEM prototype on flight-certified flexible substrate such as Kapton. Demonstration of a successful flexible VEM this technology can be applied to a wide range of markets with the commercial satellite and smart glass as the most promising.

Duration: 24

Proposal Details

Proposal Number: S16.07-1006
Subtopic Title: undefined
Proposal Title: Superconducting coil operating at temperatures above 15K for ADR instruments

Small Business Concern

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Summary Details

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

The new high temperature superconducting (HTS) coil technology proposed for development in this program is vital for NASA to be able to advance the capabilities of its ADR cooling systems that maintain important space-based instruments at milli Kelvin temperatures. It will provide unmatched benefits. This program will complete development of advanced ADR magnet coils by applying our recently developed first-of-their-kind low loss HTS wires based on the â€œ2212â€ material that meets all the requirements put out by NASA in topic S16.07 of the FOA for next generation HTS-based ADR coils, including low losses in ramped field to 4T, high, > 300 A/mm2 in-coil coil operating current densities at temperatures above 15K and fields to 4T, combined with very small cross-sections that enables the specified small 6 A to 8 A operating current. It was recently established that the react-and-wind coil making approach can be applied to fabricate ADR coils with these low loss HTS-2212 wires. This program will now finish adapting long, >2.5 km length drawn low loss HTS 2212 wire with a much higher current density that is optimally suitable for a react-and wind ADR coil making approach. This wire will then be utilized to complete the development of fully functional, ADR coils that operate at temperatures above 12 K. By the end of the Phase II program a full radial build and length (60 mm) bore ADR coil will be produced and validated to meet all the requirements put forth to attain ramped fields to 4T at the required ramp rates with acceptably low losses, as well as having all of its vital auxiliary features developed, such as terminations and potting, so that no additional significant development will be required before NASA can start to qualify and incorporate this coil type into their next generation ADR systems.

Duration: 24

Proposal Details

Proposal Number: S16.08-1001
Subtopic Title: undefined
Proposal Title: Compact Optical Cavities for Quantum Photonics and Integrated Timing Solutions (COCQPITS)

Small Business Concern

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Summary Details

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

Vescent Technologies, Inc. (Vescent) proposes to develop a fully integrated compact, low-power, environmentally robust ultra-narrow linewidth (UNL) laser, based on a novel cavity architecture demonstrated by the Precision Photonic Synthesis group at NIST (NIST-PPS) and validated during the Phase I effort. Compared to incumbent UNL laser technology based on bulky reference cavities held under active high vacuum, this solution will reduce size by ~1/30, weight by ~1/6, and electrical power by ~1/10, and demonstrate a low-risk, rapid-development pathway to future space deployment. The resulting compact clock laser is a critical component in optical atomic clocks and would enable future NASA missions such as FOCOS and MAGIS, which seek to put optical lattice clocks in space for gravitational wave detection and searches for new physics. This novel UNL technology is based on a vacuum-bonded, compact optical reference cavity, which operates without the usual high vacuum enclosure of traditional ultra-low expansion cavities. This technology has been demonstrated to perform with a fractional instability of 2E-14. The Phase II effort will implement design changes made in the Phase I effort to push performance to the 6E-15 level and integrate the cavity into a rigid mount with low acceleration sensitivity. This Phase II effort will evaluate the performance of an UNL laser based on these designs. By the end of the period of performance, we will deliver a complete rugged laser system, exhibiting instability <1E-14, operating at a clock wavelength, with all components (includes laser, control electronics, opto-mechanics, and cavity) occupying 1.6 L of volume.

Duration: 24

Proposal Details

Proposal Number: S16.08-1014
Subtopic Title: undefined
Proposal Title: Space-Ready Chip-Integrated Titanium:Sapphire Lasers

Small Business Concern

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Summary Details

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

Brightlight Photonics is developing a universal nanophotonic laser, amplifier, modulator, and integrated frequency comb solution in the wavelength ranges 350 - 450 nm and 700 - 1000 nm for quantum technologies including optical atomic clocks, cold atom interferometers, and solid-state quantum sensors. The wavelength range 700 - 1000 nm is addressed by

a single, wideband Titanium:Sapphire (Ti:Sapphire) gain medium, patterned into waveguides on a nanophotonic chip to form amplifiers and lasers. We propose to extend the platformâ€™s capabilities through hybrid integration with thin-film lithium niobate for frequency-doubling to 350 - 450 nm and electro-optic modulation, as well as passive sapphire for frequency comb generation. One of the major impediments to compactifying quantum sensing and control technologies is their common reliance on bulky, expensive photonicsâ€“chip-integration of high-performance lasers below 1 micron wavelength has been an outstanding challenge. Our on-chip sources, amplifiers, and frequency combs could enable single-chip photonic generation and readout for optical atomic clocksâ€“reducing payloads for deep-space navigation, explorations of dark matter, gravitational waves, and next-generation gravimeters, as well as our target commercial market: deployable optical atomic clocks for GPS-agnostic navigation. Our on-chip lasers and modulators could create unprecedented low-SWaP-C cold atom control at a wide range of wavelengths for next generation inertial sensors and the commercial quantum processor market. In Phase I we demonstrated a widely-tunable, narrow linewidth Ti:Sapphire laser and simulated watt-level amplification. For Phase II we have assembled nanophotonic leaders at Harvard with the commercialization, ruggedization, and miniaturization expertise at Vescent to expand the addressable on-chip range to the frequency-doubled regime as well as demonstrate integrated self-injection locked lasers, amplifiers, frequency combs, and modulators.

Duration: 24

Proposal Details

Proposal Number: S16.08-1027
Subtopic Title: undefined
Proposal Title: Phosphorus doped quantum diamond for magnetometry

Small Business Concern

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Summary Details

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

Advent Diamond proposes to advance space-based magnetic field sensors by developing novel diamond nitrogen-vacancy (NV) center magnetometry components with electrical readout. This work uses recent breakthroughs in CVD-grown doped diamond and its use in all-diamond diamond components. In this project, we leverage these breakthroughs to develop NV centers embedded in diamond electronic devices for space-based magnetometry, and study two designs, one with photo-excitation and electric readout, the other for all-electric excitation and readout. In Phase II, we build upon the successful Phase I feasibility study, in which we manufactured prototype components, demonstrated growth of the material PQuantumDiamondTM, and measured the optically detected magnetic resonance (ODMR) and photo-resistance detected magnetic resonance (PDMR) signal. The PDMR results shows sharp dips, validating the use of this approach for high magnetic field sensitivity. Phase II work will raise the TRL of this material and the components, and will include

prototyping of an instrument based on the component.

Duration: 24

Proposal Details

Proposal Number: S17.01-1010
Subtopic Title: undefined
Proposal Title: Accelerating Design of ML and AI Experiments in Scientific Simulation

Small Business Concern

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Summary Details

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

Across industry and scientific fields, Artificial Intelligence (AI) and Machine Learning (ML) have ushered in a sea change in how engineers and scientists interact with their designs and tools. This is felt especially in the field of computational science, where simulations sit on the same silicon as these â€œthinkingâ€ algorithms. In the field of computational fluid dynamics, current Reynolds Averaged Navier Stokes (RANS) closure models typically cannot properly model all regimes of a given flow state. However, it has now been shown that by incorporating high fidelity simulation data into the closure model through machine learning, these closure models can be significantly improved. Furthermore, data-driven models have shown promise of some extrapolatory power, meaning that improvement can potentially be achieved even outside the narrow configuration of their training dataset. That being said, significantly more work is required to understand the interplay between the data-driven model, the simulation, and expectations of robustness and accuracy as the model's application is expanded into increasingly diverse scenarios. This problem is characteristic of many challenges faced by those looking to adopt data-driven techniques into their solvers. As such, in this Phase II effort, we are proposing to significantly advance our in situ AI toolkit demonstrated in Phase I. We plan to enable powerful new capabilities for Catalyst to serve AI and ML technologies more efficiently. Further, we will conduct exciting research into adjoint-driven model sensitivity analysis, which will provide powerful insights into how a data-driven model impacts a simulation state, and how it can be improved given quantities of interest directly relevant to the simulation.

Duration: 24

Proposal Details

Proposal Number: S17.02-1016
Subtopic Title: undefined
Proposal Title: Highly Photorealistic Programmable 3D Worlds

Small Business Concern

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Summary Details

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

Midgard AI is developing a highly photorealistic, programmable 3D lunar simulation environment to support NASAâ€™s modeling and simulation (M&S) needs. Building upon the Phase I feasibility study, Phase II will focus on refining our AI-driven terrain generation pipeline, enhancing physics-based lighting, and ensuring seamless integration with existing NASA simulation frameworks. The goal is to provide a scalable, high-fidelity tool for autonomy validation, sensor simulation, and mission planning in lunar environments. A major challenge in lunar simulation is the current lack of high-resolution, configurable digital elevation models (DEMs) that can accurately represent surface conditions for robotic and crewed exploration. Midgard AIâ€™s approach leverages AI-driven up-resolution techniques, procedural terrain generation, and real-time rendering advancements to bridge this gap. The result is a dynamic, physics-aware lunar world that can be customized based on mission needs, allowing NASA to test autonomous navigation, sensor performance, and operational scenarios with unprecedented accuracy. The platform is designed for flexibility and accessibility, integrating with industry-standard tools and NASAâ€™s proprietary simulation environments. Our focus in Phase II will be on improving terrain realism, implementing physics-based sensor data generation, and expanding the capability for real-time environmental adjustmentsâ€”essential for mission rehearsal, AI model training, and hardware-in-the-loop (HIL) testing. By the end of Phase II, we will deliver a robust prototype at TRL 6, demonstrating operational feasibility within NASAâ€™s workflows. Beyond government applications, this technology has strong commercial potential in aerospace, robotics, and geospatial intelligence, where accurate synthetic environments are critical for simulation and AI training; ensuring that NASA and its partners can simulate and validate next-generation lunar exploration technologies.

Duration: 24

Proposal Details

Proposal Number: S17.03-1001

Subtopic Title: undefined
Proposal Title: Fault Management Architecture for Distributed Systems

Small Business Concern

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Summary Details

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

Given the complex nature of current missions and spacecraft, an effective distributed onboard fault management system is pivotal to preempting failures, ensuring operational integrity, and sustaining the safety of space missions where real-time human oversight and intervention is either severely limited or not feasible. Distributed diagnosis across multiple modules that comprise the spacecraft can be achieved by designing local distributed subsystems based on global diagnosability analysis of the system, thus computing globally correct distributed diagnosis results with or without the use of a centralized coordinator. At its core, the essence of distributed onboard diagnosis lies in its ability to disseminate diagnostic capabilities across various subsystems and components within a spacecraft. This decentralization is not simply a design preference but a critical requirement, driven by the need for resiliency and redundancy in the face of component failures or external disruptions, and furthermore constrained by onboard data transmission limits and computational performance requirements. In an effort to address the aforementioned challenges, Qualtech Systems, Inc. (QSI) proposed the development of novel capabilities that work with QSIâ€™s TEAMS tool suite towards evaluation and selection of potential fault management architecture while conforming to the requirements of a distributed system architecture that is being designed for the mission. These capabilities include novel algorithms and new software tools that leverage QSIâ€™s TEAMS causal models and reasoning engines and will work effectively towards both developing the design and implementing the operations of a distributed fault management (FM) decision-making system such as for the Gateway vehicle and HelioSwarm NASA missions.

Duration: 22

Proposal Details

Proposal Number: S17.04-1008
Subtopic Title: undefined
Proposal Title: DeGaP: A Deep Gaussian Process Surrogate Model for Cleaning Data from Spatially Distributed Sensor Networks

Small Business Concern

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Summary Details

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

The DeGaP model addresses the critical challenge of cleaning, gap-filling, and quantifying uncertainty in real-time magnetic field data. Developed as a Deep Gaussian Process (GP) surrogate model, DeGaP preserves high-frequency geophysical signals while removing noise and filling data gaps In Phase I, the DeGaP model successfully filled data gaps in high-frequency magnetic field measurements from the MagStar network, preserving essential geophysical features while quantifying uncertainty in the filled-in data. The model leveraged a novel spatiotemporal GP kernel that integrated a Spectral Mixture Kernel for capturing temporal complexities and a Radial Basis Function Kernel for spatial

dependencies. Results showed that DeGap model accuracy in reconstructing high frequency components in magnetic field data under diverse geomagnetic conditions. Phase 2 will enhance and operationalize DeGaP by: 1. Advancing DeGaP by integrating it into real-time data processing workflows, delivering cleaned and gap-filled magnetic field data to NASA, NOAA, and other stakeholders. 2. Enhancements will include improved computational efficiency using GPU-accelerated techniques, expanded robustness to handle extended data gaps and noisy inputs, and an embedded anomaly detection module powered by GP uncertainty estimates. 3. The project will also develop user-friendly visualization tools for accessing cleaned data, uncertainty metrics enabling rapid decision-making for the subject matter expert in the loop to engage in ensuring data quality of the cleaned magnetic field data. The project will deliver a real-time, gap-filled magnetic field data stream with validated robustness under diverse geomagnetic conditions. DeGaP will directly support NASAâ€™s heliophysics missions, model validation efforts, and space weather monitoring programs by ensuring reliable, high-quality data for scientific analysis and operational decision-making.

Duration: 24

Proposal Details

Proposal Number: Z1.05-1018
Subtopic Title: undefined
Proposal Title: Optical Wireless Technology for Lunar to Mars

Small Business Concern

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Summary Details

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

Introduction: This SBIR supports NASA's need for Optical Wireless Power Transfer (OWPT) for the Lunar and Mars human exploration missions. Supports power distribution from solar and fission surface generators where wired cabling is costly, impractical, or unsuitable for mobility needs. The SBIR can support a space tech demo in the 2028-2031. OWPT can dynamically deliver power, provisioned within minutes, anywhere within a 20 km radius vs wired deployable tethers or RF wireless out to ~ 1 km. Limitations of Traditional Power Generation: Conventional power generation methods are limited to fixed locations with wired power distribution lines serving nearby areas around landing sites. Long-range power distribution utilizes high-voltage transmission methods for point-to-point power delivery, which is suitable for fixed locations. NASA and others are testing long wire or fiber optic deployable tethers to support mobile power up to approximately 1 km, beyond which challenges arise. On Earth, mobile power is typically provided by gasoline and batteries. Addressing NASA's Commercial Shortfall: This SBIR addresses NASA's Space Technology Mission Directorate (STMD) Commercial Shortfall List Priority #12 (1591). The benefits of OWPT include supporting longer-range deployment of mobile vehicles, Benefits of OWPT Technology: â€¢ Provides power for ISRU prospecting,

mining, and construction vehicles within PSRs. â€¢ Offers dynamic power delivery with a 20 km line of sight. â€¢ Extends the reach of solar, fission, and fuel cell generators over large area. â€¢ Supports mobile operations lasting days to weeks away from a landing site, reducing the need for direct power source connections. â€¢ Enhance mission productivity, flexibility, less wear and tear on mobile equipment traveling to wired chargers. â€¢ Nighttime Power Distribution: Distributes nighttime power for operations, ensuring survival through the night. â€¢ Provide Lifeline power to mitigate anomalies

Duration: 24

Proposal Details

Proposal Number: Z1.09-1010
Subtopic Title: undefined
Proposal Title: Lunar Surface Secondary Battery Modules for Continuous Day/Night Operation

Small Business Concern

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Summary Details

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

Future science missions to the Lunar surface will require advanced secondary battery systems that can operate from -230 ÂºC to +120 ÂºC. Advancements that address battery operation at extreme temperatures, combined with high specific energy and energy density are critically needed. Conventional rechargeable Li-ion cells operate within a narrow temperature range of -20 to 40 ÂºC, and they particularly suffer from capacity loss at lower temperatures. Improved batteries combined with light weight thermal management are critically needed for diurnal lunar survival. The solution is a new battery module using new low temperature tolerant battery cells and a novel diurnal thermal management system. It is also critical to use high voltage batteries to produce the high energy density battery modules that exceed >150 Wh/kg at the full system level including thermal management.

Duration: 24

Proposal Details

Proposal Number: Z2.01-1012
Subtopic Title: undefined
Proposal Title: Self-Healing Radiator Coolant Tubes for Spacecraft Thermal Control

Small Business Concern

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Summary Details

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

Future space exploration missions require advanced thermal control systems (TCSs) to dissipate heat from spacecraft, rovers, or habitats to external environments. The typical layout for a thermal control system includes a large surface area radiator for heat rejection, embedded with fluid-filled heat pipes or coolant tubes with actively flowing liquid. Because radiators necessarily have a large footprint with exposure to space, they are particularly susceptible to strikes by micrometeorite and orbital debris (MMOD). Tubes breached by MMOD will invariably discharge their coolant, rendering the TCS inoperable. In this context, a particular need has emerged for self-healing coolant tubes for resilience to MMOD impact, as identified by NASA in SBIR Topic Z2.01. To meet this challenge, Creare proposes a unique coolant tube containment design, for which a multi layered tube wall contains a microporous metallic internal matrix filled with a liquid reactant. In Phase I, we collaborated with self-healing materials experts to select, develop, and evaluate a test matrix of polymer systems with the potential to provide passive self-healing with exposure to two typical radiator coolants, glycol-water and HFE-7200. Our work demonstrated seals up to 100 psid in two different prospective coolants using different custom polymer-based solutions. Further, we identified that more effective seals are possible by combining mechanical sealing methods with the developed chemical curing process. These hybrid systems use mechanical methods to slow the initial leak providing additional time for a more robust, hermetic chemical seal to take hold. Finally, we developed the overall thermal, fluid, structural, and mechanical design of an integrated radiator complete with advanced features for self-healing to compare mass and layout with traditional measures of MMOD protection, including structural shielding.

Duration: 24

Proposal Details

Proposal Number: Z2.02-1003
Subtopic Title: undefined
Proposal Title: Prototyping a Resilient, Versatile, and Future-Proof Spaceflight Coprocessor Platform

Small Business Concern

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Summary Details

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

State-of-the-art NASA coprocessing for Digital Signal Processing (DSP) and Artificial Intelligence (AI) applications lacks the versatility, performance, and energy efficiency needed for future space missions which also require radiation resilience not found in commercial devices. This research and development accelerates high-bandwidth, real-time sensor

DSP and AI data processing for autonomous perception, planning, and control applications. Our proposed work integrates radiation fault tolerance, health monitoring, and power reduction techniques into open-source General Purpose GPU (GPGPU) soft cores on latest generation radiation-tolerant, reprogrammable Field Programmable Gate Array (FPGA) devices. Additionally, GPGPU software programming toolchains are leveraged to enable flexible, parallel coprocessing needed for future spaceflight missions. Initial estimations show we outperform the baseline FPGA coprocessing technology found on the Mars Perseverance Rover by 42x for similar SWaP. A low-power, radiation-tolerant Application Specific Integrated Circuit (ASIC) translation boosts this gain to over 100x while retaining the GPGPU open compute flexibility and inflight reprogrammability. Phase I funded work includes a proof-of-concept development for the FPGA-based GPGPU design. FPGA simulations validate our design choices by showing increase in versatility, performance, and energy efficiency on a radiation-tolerant, space-ready platform. NASA, DoD, and private space companies benefit from our future-proofed application coprocessing capabilities and resilience to natural and emerging, adversarial radiation space threats.

Duration: 24

Proposal Details

Proposal Number: Z2.03-1003
Subtopic Title: undefined
Proposal Title: Exploration Extravehicular Mobility Unit Spacesuit Heads-Up Display

Small Business Concern

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Summary Details

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

To address NASAâ€™s need for an augmented reality (AR) display system for extravehicular activity (EVA), Intellisense Systems, Inc. (Intellisense) in Phase II proposes to continue the development of a new Exploration Extravehicular Mobility Unit (xEMU) Spacesuit Heads-Up Display (xHUD), proven feasible in Phase I. The system is based on innovative integration of laser projectors and waveguide pupil expander combiner (WPEC) optics. This approach incorporates miniature full-color light sources and low-profile, see-through, toroid-shaped WPEC optics, which enable us to meet NASA xEMU spacesuit requirements for an AR display that is completely decoupled from the userâ€™s head and provides full sunlight readability with automated rapid brightness adaption response. The xHUD is equivalent to a display panel with a diagonal field of view of 30Â°, and it can render complex graphics, including high-definition video, at a frame rate of at least 60 fps. xHUD offers full-color, high-resolution, collimated images with a large eye box, and it is highly suited to the space and weight constraints inside an astronautâ€™s xEMU spacesuit helmet. Intellisense demonstrated the feasibility of the xHUD system by building and testing a preliminary prototype during Phase I. In Phase II, Intellisense plans to develop a fully functional prototype that mitigates thermal and radiation issues to demonstrate

sunlight readability and high-definition resolution. During Phase II, Intellisense will consider scalability and integration with other display components such as video processing electronics. The prototype will also be used to analyze ignition safety due to a 100% oxygen operating environment and vacuum and extreme temperature storage environments.

Duration: 24

Proposal Details

Proposal Number: Z4.05-1022
Subtopic Title: undefined
Proposal Title: Collaborative Robot Enabled Active Microwave Thermography Nondestructive Evaluation Prototype

Small Business Concern

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Principal Investigator

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Summary Details

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

Inspection systems are required to safely manufacture components in space, including regolith-based components. NASA is preparing for the next phase of human deep spaceflight which requires much of the materials, structures, and subsystems to be built/assembled in space. Quantitative and qualitative inspection of these components/structures is critical. Additionally, NDE sensors will be used to determine the health of structures as they age in space and for assessing structural health of lunar habitats. Multi-functional NDE tools are highly valued. The Moon-to-Mars Planetary Autonomous Construction Technology (MMPACT) project addresses the Lunar surface construction thrust area of the Lunar Surface Innovation Initiative with a goal to develop, deliver, and demonstrate on-demand capabilities to protect astronauts and create infrastructure on the Lunar surface via construction of landing pads, habitats, shelters, roadways, berms, and blast shields using Lunar regolith-based materials. MMPACT is comprised of three interrelated elements: construction hardware and process development, feedstock materials development, and structure construction capabilities. In this Phase II effort, Texas Research Institute Austin and the Missouri University of Science and Technology will build on their highly successful Phase I demonstrations to produce an active microwave thermography (AMT) system capable of inspecting regolith-based materials in space and acting as an in-space capable multi-functional NDE tool, supporting these NASA goals. The prototype system will be fabricated and delivered software set for easy operation and with a collaborative robot to enable mobile and flexible operations for this powerful inspection tool.

Duration: 24

Proposal Details

Proposal Number: Z4.07-1018
Subtopic Title: undefined
Proposal Title: Multiuse Quick Disconnect for Lunar Surface Fluid Transfer Operations

Small Business Concern

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Principal Investigator

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Summary Details

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

Creare proposes to develop critical sealing technology needed to transfer cryogenic fluids on the lunar surface. We are building on and improving Creareâ€™s existing seal technology, which has already demonstrated the ability to repeatedly produce excellent seals at cryogenic temperatures over many mate/demate cycles. This sealing technology is the key component in quick-disconnect couplings that can be handled easily by astronauts or robotic systems. In Phase I, we demonstrated by test that our seal is dust tolerant, producing leak-tight seals that exceed NASAâ€™s requirements even with prototypical levels of contamination using lunar dust simulant. In Phase II, we will build complete, engineering-model quick-disconnect couplings that incorporate our seals into cryogenic transfer hardware. We will demonstrate by test that the coupling can produce hermetic seals for cryogenic fluid transfer in the laboratory under simulated, dusty lunar surface conditions. We will demonstrate that this performance can be repeated at temperatures down to 20 K after multiple mate/demate cycles, and produce concept designs for couplings that are suitable for manipulation by robotic effectors. We will deliver a prototype coupling to NASA for testing and evaluation.

Duration: 24

Proposal Details

Proposal Number: Z4.07-1026
Subtopic Title: undefined
Proposal Title: HELCoW: High energy laser capable of welding

Small Business Concern

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Principal Investigator

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Summary Details

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

ICON Technology proposes development of a laser beam welding toolhead for use in palentary and on-orbit applications. The HELCoW laser toolhead will utilize direct diode lasers to realize a simplified optical design compared to fiber and gas lasers typically used for welding. The laser toolhead will be capable of extended operation in a microtorr vacuum environment and include instrumentation for monitoring the weld process as well as the toolhead state of health. Software will be written to enable robotic manipulation of the toolhead to produce welds on appropriate workpiece geometries and adjust processing parameters based on data from the process and instrument monitoring data.

Duration: 24

Proposal Details

Proposal Number: Z5.06-1013
Subtopic Title: undefined
Proposal Title: Acoustic Fluid Management Device

Small Business Concern

Firm: Parabilis Space Technologies, Inc.
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Principal Investigator

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Summary Details

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

Parabilis Space Technologies is proposing the further development of a novel acoustic propellant manipulation device in response to solicitation Z5.06 Servicing and Assembly Applications; Refueling and Storable Fluid Transfer. The proposed innovation leverages momentum transfer from acoustic waves to bulk fluid (e.g. as â€œEchart streamingâ€) and acoustic radiation pressure to move liquid/gas within a propellant tank. This device will be capable of liquid gas or fluid phase separation in propellant tanks, ensuring that pneumatic pressurant gas can be vented free of liquid propellant during refueling operations. During Phase I, Parabilis completed computational analysis of the concept and designed test prototypes that will be suitable for microgravity experiments in this subsequent Phase II effort. The Phase I accomplishments significantly reduced technical risk and the effort required for prototype testing. During Phase II, Parabilis will complete more detailed analysis, fabricate developmental test articles, and perform testing to validate the technology. This will position the technology for rapid adaptation into a flight system during a subsequent Phase III.

Duration: 23

Proposal Details

Proposal Number: Z5.09-1003
Subtopic Title: undefined

Proposal Title: Robotic, Efficient Arm for Cargo Handling

Small Business Concern

Firm: Apptronik, Inc.
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Summary Details

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

Robotic, Efficient Arm for Cargo Handling (REACH) explores the adaptation of Apptronikâ€™s innovative gravity-compensation robotic arm to lunar use cases. Specifically, we are pursuing integration with a commercial Lunar Terrain Vehicle (LTV) for highly capable mobile manipulation. In terrestrial markets, Apptronikâ€™s gravity-compensated robotic arms compete with the capabilities of other state-of-the-art systems far outside their weight class. A conventional robotic manipulator weights roughly 10x what it lifts, while REACH systems can lift what they weigh. This order of magnitude improvement represents significant savings in launch costs and will allow NASA to establish lunar infrastructure faster with new manipulation abilities. These advancements are possible due to seven years of design refinement at Apptronik. A spring embedded inside a parallelogram mechanism passively stores potential energy, reducing the need to scale actuators and exert power accordingly. This spring can be adjusted along a pre-determined path to dynamically compensate for additional weight, making both the robot and payload functionally weightless. These breakthroughs allow the robot to be kinematically transparent, such that astronauts can also use the system as a weight-offset device for complex manipulation of heavy payloads. REACH Phase II represents an essential step towards lunar deployment. Within the first 9 months, we propose prototyping specialized interfaces for both astronaut physical collaboration under spacesuit dexterity constraints and custom end-of-arm tooling for handling lunar cargo. These interfaces will be incorporated onto a TRL 5 Engineering Development Unit, and the robotic system will be demonstrated on a mock LTV in an uneven, rocky representative environment. At the end of this effort NASA will retain this arm for continued testing. Additionally, the novel and complex parallelogram mechanism will be re-designed with space-compatible parts for future de-risking.

Duration: 18

Proposal Details

Proposal Number: Z5.09-1017
Subtopic Title: undefined
Proposal Title: Magnetic Gear and Sensor Technology to Enable Survival and Robotic Actuator Dexterous Operation through the Lunar Night

Small Business Concern

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Principal Investigator

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Summary Details

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

This proposal addresses a critical need for space actuators in NASAâ€™s exploration missions and the commercial space sector, particularly for environments like the lunar surface. Our magnetically geared actuator is designed to meet high torque requirements while overcoming the limitations of traditional motor-gear systems, such as backlash, friction, wear, and shock vulnerability. These issues affect current robotic manipulators like SSRMS (Canadarm2) and JEM-RMS (Kibo), as well as actuators used in missions like Curiosity and Mars 2020, which are inadequate for lunar mission demands. The magnetic gear actuator offers a lightweight, low-power, and compact solution that can endure the extreme

environments of lunar missions, including surviving the lunar night. Integrated into an MIT-cheetah style dexterous end effector, it could enable fine manipulation tasks, such as mating/demating connectors and handling tools, which are essential for Artemis lunar surface operations. Phase II funding will be used to integrate the magnetic gear with impedance controller from Phase I into a robotic end-effector for a near-term Generic Robotic Torquer tool, supporting the design, testing, and TRL 5 demonstration of this actuator developed with partners Rob Ambrose & Gray Thomas at TEES, and Josh Figuered at Novium Intuitive Machines provided a Letter of Capital Commitment for our compact and heat-efficient solution which eliminates the need for traditional clutches & temperature-sensitive torque transducers. With current customer MDA Space providing a Letter of Capital Commitment, we aim to win Lunar Outpost also. capabilities for lunar missions and other space applications. The target market includes the rotary electromechanical robotic arms and manipulators in the global space sensor and actuator market, particularly for rovers and landers. Thereafter, the allied nation â€œsmart actuatorsâ€ market and dexterous end effector for intrinsically safe cobot market shall be penetrated.

Duration: 18

Proposal Details

Proposal Number: Z5.10-1003
Subtopic Title: undefined
Proposal Title: Safe Persistent Operations with Cobots in Space (SPOCS)

Small Business Concern

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Principal Investigator

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Summary Details

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

SPOCS will change the nature of robotics in space by allowing not only operating robots in the presence of humans but actually allowing robots and humans to work collaboratively in the same space. This will increase task efficiency thereby minimizing astronaut labor and improve astronaut safety by avoiding repetitive tasks, heavy lifting, and fine dexterous movements. As a comparison to the state of the art, SPOCS will allow for a dramatic increase in the speed of completion of tasks in space (compared to ISS) and a significant reduction in the amount of labor in planning, training, simulating, and observing such robotic operations involving humans. In addition to its profound potential in space applications, similar benefits can be realized in terrestrial applications where the market is significantly larger yet no technology like SPOCS currently exists. Manual logistics tasks can be physically and mentally demanding. By delegating repetitive and physically strenuous tasks to collaborative robots (cobots), astronauts can focus on more complex and critical aspects of the mission, such as scientific research and operational decision making; however, delegation of manual logistics tasks does not negate the need for safe and effective human-robot interactions. While the astronauts perform mission critical tasks, the cobot must be aware of and plan around humans and other objects within its workspace. Furthermore, many

logistics tasks, like large payload tending (e.g., fuel tanks), require human-robot collaboration to successfully complete the task. The developed technologies are enabling capabilities that support several core objectives of NASAâ€™s mission in its Moon to Mars architecture. SPOCS is a step towards closing the Tier 2 technology gap ESDMD #0806 payload offloading, handling, and manipulation for surface assets from the Moon to Mars architecture.

Duration: 24

Proposal Details

Proposal Number: Z5.10-1021
Subtopic Title: undefined
Proposal Title: Space ROS: A Modular Framework for Cost-Effective, Reusable Space Robotics Systems

Small Business Concern

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Principal Investigator

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Summary Details

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

The Space Robot Operating System (Space ROS) is a transformative software framework for accelerating the development and deployment of complex, scalable, and modular space robotics systems. It provides common software infrastructure enabling interoperability between diverse robot hardware components and software systems, from individual components to fully autonomous robots interfacing with spacecraft systems. This approach promises to significantly reduce development cycles and implementation costs, paralleling how standardized robot operating systems like ROS 2 catalyzed terrestrial robotics. In Phase I PickNik demonstrated Space ROS feasibility through migration of a complex terrestrial ROS-based system to Space ROS. The implementation successfully integrated multiple system elements, including NASA's core Flight Software (cFS) and the RACS2 (RACS2 = ROS2 and cFS System) bridge developed by JAXA. Phase I validation utilized and expanded existing automated testing protocols to establish functional equivalence between Space ROS and its terrestrial ROS counterpart. This Phase II effort will validate Space ROS through three key objectives: (1) high fidelity recreation of a previous satellite mission, (2) evaluation and documentation of this mission rebuild, and most importantly (3) a flight demonstration via a commercial payload provider. This approach addresses critical aspects of space robotics software development while establishing foundational patterns for future mission deployment. The culminating flight test will demonstrate Space ROSâ€™s capability to manage critical

spacecraft functions and provide the critical flight heritage to encourage future Space ROS adoption. Our software platform, MoveIt Pro, is the primary way to monetize our work on Space ROS, and Space ROS is key to elevating the TRL and utility of MoveIt Pro for space. MoveIt Pro serves automation and robotic needs in the emerging areas of CLD, ISAM/SAML, ADR, lunar and planetary missions.

Duration: 18

Proposal Details

Proposal Number: Z7.01-1003
Subtopic Title: undefined
Proposal Title: Wirelessly Activated Remote DAQ for Space (WARDS)

Small Business Concern

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Summary Details

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

IC2 proposes to develop a battery-operated, ultra-low power, small form factor wireless data-acquisition (DAQ) system which has been appropriately hardened for use in spacecraft and other space systems. This system will support a variety of different sensor types and include the ability to remain dormant for at least two years while also remaining capable of rapid activation on demand. Once activated, the system will continually acquire sensor data for at least 30 days. The proposed system utilizes a distributed wireless sensor network to mitigate the challenges related to sensor installation, including technological, logistical, weight, and cost barriers. Because the proposed system uses wireless communication, it provides the end-user with the ability to deploy more sensors due to a relaxation of cable routing and weight requirements. Limiting the cable routing requirements reduces installation effort over current systems and provides for substantially more flexible sensor placement options. The primary target application for the system is instrumentation for spacecraft and other space systems, while other applications requiring environmentally hardened ultra-low power wireless instrumentation could also be supported by the systemâ€™s capabilities. Funding will be used to further establish target specifications and requirements based on NASA input and design constraints, enhance and environmentally harden the Phase I prototype, characterize the results, and perform a system-level deployment at an application-specific site.

Duration: 24

Proposal Details

Proposal Number: Z7.03-1001
Subtopic Title: undefined
Proposal Title: High Temperature Inflation Hoses and Ports for Next Generation Inflatable Heat Shields

Small Business Concern

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Principal Investigator

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Summary Details

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

The SOTA HIAD inflation hoses and port components currently limit the scalability of overall HIAD design as they significantly choke the maximum allowable gas flow. The proposed innovation, increasing the scale of these components, would result in at least a 2.5x increase in the hydraulic diameter of the hoses, allowing a far greater mass flow rate. In PH I, JBE developed manufacturing methods for these components. In PH II, the constructions will be optimized, and integration methods into HIAD tori will be developed. To determine the optimal configuration of new components, they will be tested with custom equipment designed and fabricated under this contract specifically to simulate the physical and thermal stresses experienced by the inflatable structure during packing, inflation, and atmospheric re-entry.

Duration: 24

Proposal Details

Proposal Number: Z7.03-1010
Subtopic Title: undefined
Proposal Title: Solid-State Noncombustible Gas Generator

Small Business Concern

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Principal Investigator

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Summary Details

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

Deployable aerodynamic decelerators are an enabling technology for missions to planets and moons with atmospheres as well as for returning payloads to Earth. These decelerators require a gas source for inflation, and the objective is to develop a noncombustible gas generator which will enable a wider range of applications, including near-term commercial

applications, in the Earth environment. Anasphere has previously demonstrated hydrogen generators suitable for use with Hypersonic Inflatable Aerodynamic Decelerators (HIADs). In the present project, the chemistry of this baseline design was changed to produce a mixture of two gases that formed the bulk of a noncombustible gas mixture. A makeup gas component was produced by a separate element of the system, yielding a final mixture which is noncombustible under Earth atmospheric conditions. Phase I work successfully demonstrated the new chemistry in small generators. Gas yield, temperature, and composition met expectations. The results showed that generators meeting specified gas production rates and temperatures can be built. Phase II work will involve the further refinement of the chemical components of the system, development of a new cooling approach which has not been used in Anasphere gas generators before, and the construction and test of several generators. Phase II will culminate in a freefall drop test from a balloon to simulate zero-g operation of a generator of this type. Target markets include HIADs used for launch vehicle asset return and payload return from Earth orbit.

Duration: 24

Proposal Details

Proposal Number: Z7.07-1006
Subtopic Title: undefined
Proposal Title: Nonintrusive Diagnosis of Ejecta Cloud from Plume Surface Interactions using High-Speed Digital Holography

Small Business Concern

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Principal Investigator

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Summary Details

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

The main objective of the proposed Phase II effort is to build a deliverable high-speed digital holography (DH) instrument that can be adapted to a NASA ground test facility to perform diagnosis of plume-surface interaction (PSI) events of interests to NASA scientists, and further, build a PSI facility at MetroLaser that can replicate similar PSI events and can deploy MetroLaserâ€™s DH and other advanced diagnostics, such as focusing schlieren and photogrammetry, to interrogate and obtain 3D ejecta particle trajectories, velocities and size distributions and crater profiles that will help NASA scientists understand the physics of the PSI problem, and provide benchmark-worthy datasets for validation of modeling and simulation (M&S) tools. The understanding obtained from these studies will be used by MetroLaser to develop and build another prototype DH instrument that can provide preliminary information for a future onboard space lander deployment that can perform measurements on ingested ejecta particles. Further this prototype will be tested at these PSI facilities to characterize its capabilities in real-life applications scenarios as a pathway towards onboard deployment in future NASA lander missions. The Phase II funding will be used to build a state-of-the-art PSI facility at MetroLaser with custom-built optical access ports to perform large scale physics focused ground tests akin to those

performed at NASAâ€™s Marshall Space Flight Center. Further, we will deploy DH and other diagnostics in a systematic manner at different radial and longitudinal locations from the regolith bed and obtain a map of 3D particle velocities, trajectories and sizes around the jet impingement site. This parametric study will consist of different regolith simulants, jet velocities, mass flow rates, ambient pressures, and different jet heights. The findings will be used to build a deliverable DH instrument for NASAâ€™s ground test facility and another onboard DH sensor for lander deployment.

Duration: 24

Proposal Details

Proposal Number: Z8.09-1005
Subtopic Title: undefined
Proposal Title: Advanced Transfer and Relay Stage

Small Business Concern

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Summary Details

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

In response to the 2024 NASA SBIR Phase II solicitation subtopic Z8.09, â€œSmall Spacecraft Transfer Stage Development,â€ Advanced Space, LLC (Advanced Space) proposes to mature mission architectures and requirements for customizing a low-cost transfer stage that will deliver small spacecraft to nontraditional orbits and provide position, navigation, timing (PNT), and communications relay services for the deployed small spacecraft. The proposed solution defines a set of modular mission architectures and concepts of operations (ConOps) that match launch vehicle and transfer stage capabilities for deploying a primary payload in its destination orbit. In Phase I, Advanced Space conducted a series of mission design and navigation analyses to various cislunar and lunar mission destinations. We partnered with Firefly Aerospace, Inc. (Firefly) to characterize their orbital vehicle (Elytra) as a transfer stage to demonstrate the capability to reach these mission destinations and quantified the additional required capabilities to reach and navigate unique orbits at these mission destinations. The team analyzed the resulting design reference missions (DRMs) to assess the required capabilities of a communications subsystem to provide PNT and communications relay services to end-users in proximity. The Phase II project will focus on two specific DRMs: 1) a standards-based, interoperable lunar communications pathfinder, and 2) a Mars relay communications network. Mr. Michael Caudill again will be the Principal Investigator (PI) for the proposed project. Mr. Caudill is a Senior Navigation Engineer at Advanced Space and has extensive experience with spacecraft navigation and state estimation across widely ranging mission architectures and destinations, as well as mission operations management with Advanced Spaceâ€™s active CAPSTONE mission.

Duration: 24

Proposal Details

Proposal Number: Z8.09-1014
Subtopic Title: undefined
Proposal Title: Aquila - Chemical-Electric Hybrid Transfer Stage

Small Business Concern

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Summary Details

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

Benchmark Space Systems (BSS) is a leader in space mobility and logistics and has identified a low-cost, ESPA-Grande class compatible solution for delivery of payloads and spacecraft to high energy orbits. BSS proposes to develop a critical design of â€˜Aquilaâ€™, a hybrid (chemical + electric propulsion) transfer stage that can deliver >50 kg of payload to LLO starting from a 200 km x 200 km circular LEO orbit. Aquila combines BSSâ€™ flight proven high-test peroxide (HTP) bipropellant chemical propulsion system, SmartAIM GNC technology, control electronics, and a partner supplied metal-based hall effect propulsion system. This architecture is scalable to trade off chemical propellant for electric propellant potentially allowing for an increase in payload mass and volume depending on the target mission. Most Aquila subsystems are TRL 6-9 or are COTS, providing a straightforward path to the development of a critical design, system architecture, and qualification plan to support mission infusion during the 2026/2027 timeframe. The goal of this project is to create a universally compatible system for various spacecrafts and launch vehicles. Benchmarkâ€™s expertise in multi-technology propulsion solutions is crucial for efficient and effective orbit transfers. Listed below are the key subsystems contained within Aquila.

Duration: 11

Proposal Details

Proposal Number: Z8.13-1011
Subtopic Title: undefined
Proposal Title: High-Performance Deorbit Engine with Minimal Power Requirements, Phase II

Small Business Concern

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Summary Details

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

Deorbiting a satellite generally involves either applying drag or using a propulsion system. The orbit height and the satellite mass and â€œfrontal areaâ€ will determine the velocity change requirement and the time frame over which a satellite will deorbit. The minimum-mass solution for a satellite in a higher orbit will involve the use of both drag and propulsion: a propulsion system to lower the orbit and then atmospheric drag to further slow the spacecraft and complete the deorbit. In this project, Ultramet is focusing on the propulsion system. Specifically, Ultramet is leveraging its existing green propulsion technology and its high-reliability low temperature ignition system that is being developed for the Air Force, and applying them to the development of a high specific impulse (>300 sec) hybrid rocket with low size, weight, power, and cost (SWaP C) that can be used to lower the orbit of satellites to the point where atmospheric drag can complete the deorbiting process. In Phase I, numerous liquid oxidizers and hypergolic fuels were assessed, and a model was developed to calculate the propulsion system mass needed to lower the orbit of a satellite of arbitrary mass and frontal area from any orbital height so that atmospheric drag would complete the deorbit within the required five-year period. The most promising candidates were downselected, and bench-scale testing demonstrated hypergolic reactivity between the liquid oxidizer and the fuel grain where the downselected combination has a theoretical Isp of 320 sec. Hot-fire testing of a subscale engine was performed, which again demonstrated the reactivity between the liquid oxidizer and the fuel grain. In Phase II, the structure and composition of the hypergolic fuel grain will be optimized to maximize performance, and the system will be scaled up and hot-fire tested. Using data from the testing, a larger system will be designed to accommodate larger/heavier satellites and/or those in higher orbits.

Duration: 24

Proposal Details

Proposal Number: Z10.01-1003
Subtopic Title: undefined
Proposal Title: A Compact Electrically-Driven Booster Pump for Saturated LH2

Small Business Concern

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Principal Investigator

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Summary Details

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

NASA mission projections indicate a need for pumping up to 0.6 kg/s LH2 flow with 25-45 psid head rise. To meet these requirements, Creare has assessed the preliminary design of a low NPSH cryogenic LH2 pump. The pump is a single stage centrifugal pump using a shrouded impeller, and cavitation-resistant inlet inducer, nominally operating at 24,750

rpm. The rotor assembly is supported by self acting hydrodynamic liquid film bearings. Precision labyrinth clearance seals meter internal leakage providing cooling to the bearings and motor, and managing pressure within the motor cavity, preventing vapor generation in the bearings. The non contact bearings and seals ensure reliable long term operation for many thousands of hours and start stop cycles. The motor operates in cryogenic hydrogen, reducing copper losses and maximizing specific power. The impeller inlet geometry, including inducer and operating speed are optimized to minimize cavitation potential. Materials of construction have been selected to eliminate hydrogen embrittlement concerns, enabling the pump to remain fully submerged in LH2 in transit until operation is required. The resulting design achieves a net efficiency of 69% and total electrical input of 4 kW (both values include estimated motor and electronics losses). It is very compact, with a predicted size of only 10.8 in. Ã— 6.2 in. In Phase I, we proved the feasibility of the cryogenic propellant pump by developing a preliminary design, predicting its overall performance, and demonstrating its radial impeller with inlet inducer by testing in simulant cryogenic fluids. In Phase II, we will optimize the pump design, fabricate an integrated pump assembly, demonstrate its steady-state and transient performance at representative conditions in LH2, and deliver it to NASA for further performance evaluation.

Duration: 24

Proposal Details

Proposal Number: Z10.05-1007
Subtopic Title: undefined
Proposal Title: Performance of Expansion-Deflection Nozzles for Rotating Detonation Rocket Engines

Small Business Concern

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Summary Details

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

Pressure-gain in Rotating detonation combustion (RDC) engines due to the detonation mode of combustion enables greater extractable energy potential, generating thrust more efficiently than conventional combustion engines. This increased efficiency is critical for both hypersonic air-breathing applications to enable high-speed, long-range flight, and for in-space propulsion which benefits from the increased delta-v and compact geometry of rotating detonation rocket engines (RDRE). Exhaust nozzle design determines the overall performance at the design point, contributes significantly to the total engine weight, and can affect the stability of the detonation, yet it remains an under-researched aspect of RDREs. In the Phase I effort, expansion-deflection (ED) nozzles were explored as a solution to maximize the thrust potential of RDREs operating in vacuum conditions. High fidelity CFD simulations of candidate RDRE experimental configurations were conducted to identify performance trends and transient forces and thermal loads on candidate ED nozzle designs with and without a central plug and compared to a conventional bell nozzle. A reduced-order modeling (ROM) approach was adapted to provide more rapid evaluation of candidate nozzle contours, and a novel shock-tracking numerical approach was implemented to enable more efficient CFD simulations. The proposed Phase II effort builds off

of these findings by developing a framework for RDRE nozzle design, evaluation, and optimization supported by physically-accurate combustor ROMs. The ROMs will be verified against detailed CFD simulations aided by cutting-edge acceleration techniques. Performance trends and detonation stability of parametric nozzle designs will be evaluated with respect to geometric parameters and operating conditions. An experimental RDRE test campaign featuring simulated altitude conditions will be conducted at UAH to validate the performance trends for multiple candidate nozzles.

Duration: 24

Proposal Details

Proposal Number: Z10.05-1018
Subtopic Title: undefined
Proposal Title: Validating a Novel RDRE Nozzle Optimization Approach

Small Business Concern

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Summary Details

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

Quadrus is pleased to present this Phase II proposal to continue development of a computational optimization approach for improving nozzle performance in rotating detonation rocket engines (RDRE). In Phase I, we demonstrated the feasibility of an advanced nozzle design optimization approach for a RDRE we call the Next-generation Enabling eXtreme Temperature RDRE, or NEXT-RDRE. NEXT-RDRE is an additively manufactured (AM) RDRE that uses the most advanced refractory materials in an optimized, lightweight configuration designed to provide excellent Isp performance while withstanding the punishing environment of detonative combustion. This Phase I effort focused on utilizing a combination of novel computational/simulation methods allowing strategic efforts to begin to define best practice for high area ratio nozzle design and optimization. Prior to our Phase I success, RDRE nozzle design and optimization was poorly understood due to unknown impacts of rotating detonation waves to fundamental gas dynamic expansion behavior. Our approach is meant to develop a best practice process in RDRE nozzle optimization, which required deep insight into how rotating detonation flow changes supersonic expansion behavior, particularly with upper stage and in-space nozzles with area ratios greater than 100. We resolved that approach by focusing on answering on the question â€œhow much does the presence of rotating detonation waves superimposed on the primary axial flowfield affect nozzle performance?â€ Answering that question is directly relevant to the current goals of eliminating a primary technology gap toward fully exploiting the promise of enhanced RDRE performance. Our proposed effort will begin to collect hot fire testing data with a variety of low and moderate area ratio nozzle configurations and will lay the groundwork for extending the process to nozzle area ratios >100. Our intended near term application is to a GCP-funded RDRE development being led at MSFC.

Duration: 24

Proposal Details

Proposal Number: Z12.03-1021
Subtopic Title: undefined
Proposal Title: Immortal Molten Regolith Electrolysis Anode for Oxygen and Metals Extraction from Lunar Regolith (IMMORTAL)

Small Business Concern

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Summary Details

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

The Immortal Molten Regolith Electrolysis Anode for Oxygen and Metals Extraction from Lunar Regolith (IMMORTAL) project addresses the need for scalable, efficient, and sustainable in-situ resource utilization (ISRU) to support long-term lunar and Martian presence. As NASAâ€™s Artemis program and international efforts push for off-world self-sufficiency, reducing Earth dependence and cutting costs is essential. Traditional extraction methods are impractical in extraterrestrial environments due to high energy demands, environmental challenges, and limited adaptability. IMMORTALâ€™s MRE technology overcomes these barriers with a durable, economical, and process designed to withstand extreme conditions, enabling reliable oxygen, metal and metalloid production. This innovation supports NASAâ€™s STMD sustainability goals while advancing commercial and international space mining efforts.

Duration: 24

Proposal Details

Proposal Number: Z12.03-1039
Subtopic Title: undefined
Proposal Title: Vertical Lunar Regolith Conveyance for In-Situ Resource Utilization

Small Business Concern

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Summary Details

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

The purpose of the space technology is the vertical, or near-vertical, conveyance of lunar regolith for In-Situ Resource Utilization (ISRU). The preliminary design is a modular space mechanism that uses a static screw method with a rotating tube for vertical conveyance of regolith. The funding will refine and extend the existing breadboard prototype, fund

incremental demonstrations of progressive functionality, fund associated modeling and simulation validated against the advanced prototype and fund testing in realistic environments for TRL maturation. The target markets include: Government - (1) Industrialization and infrastructure efforts for the moon and (2) Industrialization and infrastructure efforts for Mars and other Small Bodies targeted for exploration in the solar system. Commercial - (1) Vertical conveyance of terrestrial materials for industrial applications, (2) Vertical conveyance of agricultural material such as grains, granular fertilizer and herbicide and (3) Vertical conveyance of granular feedstock materials used in conventional manufacturing and additive manufacturing.

Duration: 24

Proposal Details

Proposal Number: Z13.05-1008
Subtopic Title: undefined
Proposal Title: Radiation, dust and coolant freeze-out mitigation

Small Business Concern

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Summary Details

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

Spacecraft radiators safeguard the functionality of mission critical equipment by rejecting excess heat into the environment. Exposure to high energy ionizing radiation during space travel and dust during landing on planetary bodies can contaminate/degrade the radiator surface which in turn affects its ability to reject heat. When subjected to extremely cold environments like the polar regions on the moon during lunar night, the radiator may lose heat excessively that can cause the radiator fluids used currently to freeze and fail the radiator. Through this SBIR project, we propose to develop and demonstrate a lightweight, low power, and fast actuating actively controlled louver to protect the radiators against ionizing radiation, dust, and coolant freezeout. Research completed in Phase I has established the feasibility of this technology in providing radiator protection at a level comparable to or better than the state-of-the-art passive louvers while weighing less than half and needing three orders of magnitude less time for activation. In Phase II, we propose to scale up the device to 7 m2, construct the prototype device, and demonstrate its performance under simulated space and lunar surface conditions. The key deliverables of Phase II include the documentation for the prototype louver, final report, and the delivery of prototype device to NASA for additional evaluation.

Duration: 24

Proposal Details

Proposal Number: Z13.05-1030
Subtopic Title: undefined
Proposal Title: Dust-Tolerant Resonant Connectors for Extreme Environments

Small Business Concern

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Summary Details

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

There are numerous challenges developing reliable and long-lasting charging infrastructures for electronic devices on the Moon and Mars because of the extremely harsh environmental conditions. According to the 2024 NASA Phase I subtopic Z13.05 Components for Extreme Environments, there is a current need for dust-tolerant electrical connectors that can function with light dust coating on lunar and Mars surfaces. This is especially important for critical interface connections to umbilical and transmission line products to enable a continuous human presence and operations on the Moon. When lunar regolith accumulates at the conductive terminals of state-of-the-art (SOA) connectors, it is extremely difficult to reverse and can be a single point of failure for a powering system because of regolithâ€™s strong insulating properties. In the Phase I development, Yank Technologies successfully designed, fabricated, and verified a Resonant Connector system that can deliver over 500W of power even with the accumulation of lunar regolith simulants within and around the connector enclosure. The purpose of this Phase II R&D effort is to advance the Resonant Connector system to operate for extreme lunar environments. Specifically, we will further advance the Resonant Connector system to meet many TRL 6 requirements to better prepare the system for future NASA lunar missions. This includes optimizing the system for Size, Weight, and Power (SWaP), integrating safety and indication controls, incorporating space-grade components and materials, and conducting applicable reliability and environmental testing, such as thermal vacuum, vibration, and shock testing.

Duration: 24

Proposal Details

Proposal Number: Z14.01-1013
Subtopic Title: undefined
Proposal Title: Set Partitioning Framework for Identifying LRUs with Built-In Diagnostics

Small Business Concern

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Summary Details

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

ProtoInnovations, LLC proposes to continue the development and application of an analytical simulation tool for the design of line-replaceable units (LRUs), referred to as the Set Partitioning/Packing Formulation (SPF) Engine, with a specific focus on lunar robotic excavation systems. In Phase II of this project, we will enhance the SPF Engine to incorporate diagnostics and condition monitoring in the design of LRUs. We will apply the SPF in the engineering development of mobility and excavation tool LRUs, which we will validate onboard a ProtoInnovations rover in a lunar-relevant test environment. The design of the physical LRUs will be driven by considerations of reliability, versatility, and scalability.

Duration: 24

Proposal Details

Proposal Number: Z14.03-1008
Subtopic Title: undefined
Proposal Title: Freeform 3D Printing of a Tall Lunar Tower

Small Business Concern

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Summary Details

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

Branch Technology will develop technologies to one day enable the Freeform 3D Printing of a tall lunar tower (TLT) on the surface of the moon to provide solar power and communications capabilities to a permanent settlement. In Phase I, Branch conducted a design and feasibility study to generate a geometry that is structurally optimized for both lunar environmental considerations, outfitting considerations, and Cellular Fabrication (C-Fab) manufacturing considerations. C-Fab is Branch's Freeform 3D printing technique that enables printed material to solidify in free space instead of being deposited layer by layer like traditional fused deposition modeling (FDM) additive manufacturing. The resulting structures are optimized lattice structures that use 20X less material to build up a given volume than if the structure was printed solid through. This approach holds great promise for lunar construction because of its material efficiency, autonomous operation, and structural optimization, among other benefits. This approach will perform better than assembly of prefabricated metal trusses or regolith sintering because of its ability to manufacture autonomously in place with minimal amounts of material. In Phase II, Branch proposes adapting this commercially available technology, which has already been used to print some of the world's largest and most significant 3D printed structures, to NASA mission

contexts by advancing the material science, extrusion hardware, robotics, and tower structural design to relevance for lunar construction. The project will focus on converting Branch's extrusion technology to higher-temperature, engineering-grade resin printing for materials that can actually withstand lunar environments, like polyetherimide (Ultem) or polyetheretherketone (PEEK). In addition, Branch will conduct vacuum extrusion testing and will attempt to produce a 10-m tall demonstration using the relevant materials and hardware for lunar surface operations.

Duration: 24