NASA SBIR 2025-II Solicitation

Proposal Details

Proposal Number: A1.03-1010
Subtopic Title: Air Vehicle Technology
Proposal Title: Digital Twin and Thread Ecosystem for Automated ICME and Modeling Workflow Optimization

Small Business Concern

Firm: Materials Data Management, Inc.
Address: 3202 N. Meridian Street, Indianapolis, IN, 46208-4646

Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 5 - 8
Technical Abstract (Limit 2000 characters):

Implementing effective modeling practices within an organization requires coordinated technical, institutional, and compliance capabilities, as well as the ability to manage complex, interconnected data spanning modeling, testing, and pedigree datasets. While existing tools address portions of this need, they remain fragmented and lack the infrastructure to operationalize modeling at scale. MDMiâ€™s Modeling Hub (MMH) unifies the broader modeling lifecycle and the infrastructure required to support organizational modeling readiness by ensuring modeling activities are governed and traceable across teams, tools, and applications. Unlike traditional modeling software, MMH integrates information management, workflow orchestration, model interoperability, and enterprise-level traceability into a cohesive platform for physics-based and data driven modeling across scales. While most modeling software treats information management as an afterthought, MMHâ€™s unique data management-first architecture treats all elements of the modeling process (real and virtual data to models and processes themselves) as governed assets to ensure processes are repeatable and auditable, with clear data lineage and oversight. Through organizational orchestration, MMH transforms modeling from isolated activities into a shared capability that supports collaboration and cultural change by aligning teams around a common goal. Phase II will transition MMH into a production-ready platform with industry-informed functionality, validated performance in real-world environments, enhanced usability

for expert and nonexpert users, and scalable deployment pathways for commercialization. Target markets include NASA, other federal agencies, aerospace, advanced manufacturing, consumer electronics, and other materials-intensive industries that are actively investing in digital transformation, ICME, and digital twin initiatives, yet continue to face challenges in integrating models, data, and workflows.

Duration: 24

Proposal Details

Proposal Number: A1.04-1045
Subtopic Title: Air Vehicle Technology
Proposal Title: Cost-Effective Electric Cargo Aircraft

Small Business Concern

Firm: Wingborne Aeronautics Corporation
Address: 865 Saint Charles Ave NE, Atlanta, GA, 30306-4128

Summary Details

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

Wingborne Aeronautics is proposing a Phase II effort to advance a 1,500 lb gross weight, all-electric, uncrewed CTOL cargo aircraft from conceptual design to a PDR-level preliminary design ready for full-scale prototyping. The aircraft targets regional cargo missions of 50-100 nmi carrying 150-300 lb payloads â€” routes currently served by aging turboprops operating well below capacity on thin profit margins. No existing or announced platform is purpose-built for this segment, leaving latent demand on routes that no existing aircraft can serve profitably. The estimated acquisition price and per-mission operating cost are significantly below incumbent alternatives, enabled by low-cost aluminum construction rather than composite monocoque, COTS electric propulsion components, and design-for-autonomy enabling uncrewed BVLOS operations. Target markets include healthcare logistics, geographically constrained routes, urgent industrial spares, and remote resupply, with a combined U.S. serviceable addressable market estimated at $700M-

$1.8B annually. The Phase I effort established the aircraft configuration (high-wing, single-motor pusher), validated market demand through quantitative analysis of BTS, FAF, and ADS-B data, and developed acquisition and operating cost models showing significant advantages over incumbent alternatives. Phase II funding will support detailed aerodynamic, structural, and propulsion system design; fabrication of a full-scale partial airframe and cargo bay mockup to validate manufacturing processes; and a two-stage subscale flight test program leveraging the avionics planned for the full-scale aircraft.

Duration: 24

Proposal Details

Proposal Number: A1.06-1011
Subtopic Title: Air Vehicle Technology
Proposal Title: PyFoil81: Rotorcraft Design Tool Airfoil Table Generator

Small Business Concern

Firm: M4 Engineering, Inc.
Address: -

Summary Details

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

The Revolutionary Vertical Lift Technology (RVLT) Program is exploring an open design space for novel VTOL aircraft configurations. Highly efficient and lightweight electric motors paired with the increasing energy density of batteries are enabling new aircraft concepts such as Distributed Electric Propulsion and eVTOL, which exploit new technologiesâ€™ advantages to improve existing missions and enable whole new missions such as Urban Air Mobility. Flight for these novel configurations creates new analytical challenges: unusual chords/diameters and exotic airfoil design combine with wide operational RPM and advance ratio bands to generate an extended envelope of flow fields and phenomena. To meet this departure from traditional rotor aerodynamics in context of the high impact of aeropropulsive efficiency on mission capability, M4 proposes a lightweight Python

software, PyFoil81, capable of efficiently analyzing and tabulating airfoil data from a variety of flow regimes. It will efficiently handle user inputs, airfoil rediscretization and modification, API to/from multiple aero solvers, and a data blending tool to create composite C81 airfoil data tables from various data sources.

Duration: 24

Proposal Details

Proposal Number: A1.08-1014
Subtopic Title: Air Vehicle Technology
Proposal Title: A Long-wavelength IR Sensor for Water Drop Temperature Measurement

Small Business Concern

Firm: Spectral Energies, LLC
Address: 4065 Executive Dr, Beavercreek, OH, 45430-1062

Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 5 - 8
Technical Abstract (Limit 2000 characters):

This proposed research aims to develop a long-wave infrared (LWIR) imaging sensor system for real-time, in-situ measurement of temperature and size distributions of airborne supercooled water droplets. The sensor concept, demonstrated in Phase I, utilizes an LWIR camera to perform two-dimensional imaging of water droplets in an icing environment. Through controlled calibration of LWIR intensity with known droplet temperatures in a laboratory icing tunnel, droplet temperature fields were derived from measured infrared emission intensity. In parallel, droplet streak features captured in LWIR images were used to infer droplet size distributions under flowing conditions. Phase I focused on the design, fabrication, and initial validation of the integrated LWIR sensing approach in a research-scale icing tunnel, demonstrating feasibility for simultaneous droplet thermal and morphological characterization. The system established a foundation for non-intrusive measurement of supercooled liquid water content relevant to atmospheric icing environments. Phase II will advance this technology through

deployment and testing in NASAâ€™s icing wind tunnel facilities. The effort will emphasize system integration, robustness, and operational performance under realistic aerodynamic and thermodynamic conditions. Key objectives include improving measurement accuracy, enhancing signal-to-noise performance, and validating droplet temperature and size retrieval algorithms against independent reference measurements. The Phase II effort will ultimately deliver a compact, field-deployable LWIR imaging system capable of supporting NASAâ€™s icing research and advancing predictive capabilities for aviation icing hazards.

Duration: 24

Proposal Details

Proposal Number: A1.11-1011
Subtopic Title: Air Vehicle Technology
Proposal Title: Electric Aircraft Health Management Algorithms and Infrastructure

Small Business Concern

Firm: PC Krause and Associates, Inc.
Address: -

Summary Details

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

Advanced Electrical Power Systems (EPS) are being investigated for a variety of platforms, including aircraft, spacecraft, ground vehicles, and tactical microgrids. Health evaluation and efficient maintenance of electrical systems are necessary to maintain reliability, robustness, and the performance benefits of these systems. In the Phase I effort, algorithms for converter fault type identification and permanent magnet machine winding fault detection were were successfully implemented and demonstrated on PCKAâ€™s Intelligent, expandable Point-of-Load Electrical System (IPoLES) enabled hardware featuring fast sensing, solid-state switching devices, data processing, and high-speed fiber communication. The Phase II effort will focus on 1) building a fully IPoLES-enabled inverter with integrated health management algorithms, 2) implementing system-level health management

algorithms in the IPoLES regional controller, and 3) demonstrating these capabilities in hardware tests. The outcome of this development effort is an architecture that can be used by NASA and other Government organizations to build health management capabilities into advanced electrical power systems for improved resilience, reliability, and intelligent control.

Duration: 24

Proposal Details

Proposal Number: A1.11-1015
Subtopic Title: Air Vehicle Technology
Proposal Title: AstraSense: AI-Driven Health Predictions for Sustainable Aviation

Small Business Concern

Firm: AstraQua Inc
Address: 1920 sixth st, Santa Monica, CA, 90405-1261

Summary Details

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

AstraSense is an AI-driven predictive health management system for safe, reliable electrified aircraft propulsion (EAP). EAP operates in high-voltage, high-current, electromagnetically noisy environments and often lacks graceful degradation, so early fault detection and accurate remaining-capability estimates are critical. Todayâ€™s EV-derived, threshold diagnostics are largely reactive and provide limited prognostics. Building on Phase I results, Phase II will deliver an integrated TRL-6 prototype demonstrated in a relevant environment. AstraSense uses non-intrusive multimodal sensing (electrical, vibration, acoustic, thermal), signal processing, and a modular AI model suite to detect early degradation, diagnose faults, predict remaining useful life, and estimate real-time system capability. A system-level reasoning engine fuses indicators across coupled subsystemsâ€”machines, power electronics, HV wiring, power quality, and thermal managementâ€”to produce maintenance actions and operational decision support. Phase II work includes edge-embedded implementation, integration/validation of

subsystem models, reasoning-engine development, and demonstration via hardware-in-the-loop and representative propulsion testing. AstraSense aligns with NASA ARMD electrified propulsion priorities (EPFD, AAM) and targets eVTOL OEMs, propulsion suppliers, and fleet operators seeking higher safety margins, lower maintenance cost, and faster certification.

Duration: 18

Proposal Details

Proposal Number: A2.01-1005
Subtopic Title: Integrated Flight Systems
Proposal Title: Compact UAS Sensor for Distributed Mapping of Wildfire Plumes

Small Business Concern

Firm: Trident Sensing Inc
Address: 635 S State St, Salt Lake CIty, UT, 84111-3819

Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 3 - 7
Technical Abstract (Limit 2000 characters):

Wildfire frequency and severity is increasing across the US. Simply throwing more resources at the problem while doing things the same way is not a cost-effective solution to the wildfire crisis. Uncrewed Air Systems (UAS) provide the opportunity to conduct operations at night and in degraded visual conditions when firefighting conditions are more favorable but crewed assets are grounded. However, there are many hazards associated with operating UAS around wildfires at night including dangerous wildfire plumes. This research focuses on tackling the problem of detecting, mapping, and avoiding the high energy wildfire plume. Plumes contain extreme temperatures, severe updrafts and windshear to include firenadoes and areas of zero visibility. Following a successful Phase I airborne concept demonstration, Phase II will develop a full prototype UAS sensor for real time distributed mapping of plumes using Long Wave Infrared (LWIR) sensing technology. A 3D plume model will be assembled from multiple viewpoints similar to a 3D Radon transform. Onboard â€œedgeâ€ processing will allow for local sense

and avoid capability to support UAS autonomy. The 3D plume data will support digital twin Common Operating Pictures and facilitate second shift operations. By shrinking the sensor to small UAS size and leveraging low-cost Commercial Off the Shelf (COTS) components, the payload will be able to be placed on every crewed and uncrewed asset participating in the aerial firefighting. The research also applies to other emergency airspace operations where use of UAS for response to chemical spills, tornadoes, radiological events and volcanic activity will benefit from the capability to sense and avoid plumes. The proposed research can directly support the NASA FireSense and ACERO wildfire projects. In addition, commercial UAS operators are rapidly expanding wildfire services. The proposed plume mapping sensor will enhance revenue streams for these commercial operators.

Duration: 24

Proposal Details

Proposal Number: A2.02-1002
Subtopic Title: Integrated Flight Systems
Proposal Title: Flight Computer for Artificial Intelligence and Autonomy

Small Business Concern

Firm: Hover, Inc
Address: 909 5th Ave, Seattle, WA, 98164-2007

Summary Details

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

Hover, Inc. has developed a family of ultra-low Size, Weight, and Power (SWaP) single and dual channel flight computers with a custom ARINC 653 Real Time Operating System (RTOS). A modular design is utilized where Single Board Computers (SBCs) are electrically and mechanically compatible across the family of computers. This enables the interchangeability of a safety critical SBC and an Artificial Intelligence (AI) SBC capable of edge inference. Furthermore, a hybrid approach is supported where both SBCs are used together. They are the only known computers that will support a certifiable Run Time Assurance (RTA) architecture

such as NASAâ€™s Expandable Variable Autonomy Architecture (EVAA). The proposed Phase II effort focuses on adapting the computers for NASAâ€™s National Defense Authorization Act (NDAA) compliant flight computer requirement as follows: -Integrate NASA's Matlab/ Simulink auto-code generation and FPGA block pipelines. -Offloading of computationally intensive tasks such as Machine Learning (ML) and autonomy algorithms and technologies through deep hardware and software integration. -Alignment with NASA's requirements for computers that adhere to aerospace hardware/ software design assurance requirements and that are ruggedized for a flight environment.

Duration: 24

Proposal Details

Proposal Number: A2.04-1010
Subtopic Title: Integrated Flight Systems
Proposal Title: Cyber-agents for Live Onboard Aviation Network Security (CLOANS)

Small Business Concern

Firm: ATC-NY, Inc
Address: 1610 Trumansburg Road, Ithaca, NY, 14850-9213

Summary Details

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

ATC-NY will continue developing the Cyber-agents for Live, Onboard Aviation Network Security (CLOANS) software, a distributed cybersecurity monitoring, reporting, and response system. CLOANS employs portable agents that collect and analyze network activities onboard flight systems in near-real-time, reporting Cyber Threat Intelligence to system operators as well as to the centralized CLOANS Service. The CLOANS Service can be deployed on cloud or on-premises computing infrastructure, where it automatically discovers, manages, and processes reports from CLOANS cyber-agents. The CLOANS Service maintains a Common Operating Picture of aviation networksâ€™ cybersecurity posture and enables

personnel at Cyber Security Operations Centers and flight data centers to coordinate threat mitigation strategies and respond in time to thwart attacks. Using CLOANS, aviation staff, security engineers, and operators can improve safety and security through heightened situational awareness. Early alerts and detailed reports enable interrupting cyberattacks, particularly manipulation and abuse of multicast protocols.

Duration: 24

Proposal Details

Proposal Number: A3.02-1038
Subtopic Title: Airspace Operations and Safety
Proposal Title: On-demand Regional Intelligent Operations Network (ORION)

Small Business Concern

Firm: ResilienX, Inc.
Address: 100 Madison Street, Syracuse, NY, 13202-2701

Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 4 - 7
Technical Abstract (Limit 2000 characters):

The On-Demand Regional Intelligent Operations Network (ORION) is a scalable, hardware-agnostic system-of-systems architecture that coordinates autonomous and semi-autonomous UAS for wildfire response, disaster management, and emergency operations. ORION provides an orchestration and data integration layer connecting drones, sensing systems, communications, command-and-control, and mission intelligence services into a unified operational system, delivering real-time situational awareness through a shared Common Operational Picture and resilient operations in communications-degraded environments. Current wildfire operations rely on fragmented single-platform UAS deployments and manual coordination across agencies, limiting situational awareness during time-critical incidents. ORION addresses these gaps through four innovation areas: hardware-agnostic mission orchestration, unified operational data integration via a Secure Data Exchange, AI-enabled mission intelligence, and human-centered autonomy under a

human-on-the-loop model. Phase I established the ORION subsystem architecture using MBSE methodologies, validated hardware-agnostic operations across heterogeneous UAS, and demonstrated a U-Net wildfire perimeter segmentation prototype on edge hardware, achieving TRL 4. The 18-month Phase II effort matures ORION to TRL 7 through subsystem development, integration with Vigilare AI's TitanOps platform, Hoplynk's resilient edge networking, and cooperative airspace sensing. Two operational demonstrations in the Adirondack Mountains region of New York will validate baseline functionality at Month 9 and full operational capability at Month 17. ORION directly supports NASA priorities under ACERO, AOSP, the AAM National Campaign, and System-Wide Safety research, building on ResilienX's FRAIHMWORK IASMS platform. Phase III opportunities include NASA Langley, Project ULTRA, FEMA engagement, and a $3.8B serviceable obtainable market across 300 U.S. metropolitan areas.

Duration: 18

Proposal Details

Proposal Number: A3.02-1042
Subtopic Title: Airspace Operations and Safety
Proposal Title: A software-based positioning, navigation, and timing solution for reliable operation in GPS-degraded environments

Small Business Concern

Firm: PrecisionTerra, Inc.
Address: 1842 Mallard Dr, Superior, CO, 80027-4434

Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 4 - 7
Technical Abstract (Limit 2000 characters):

PrecisionTerra proposes a software-defined GPS receiver (SDR) that can reliably and accurately acquire, track, and process GPS signals in real-time in GPS-degraded environments. The technologyâ€™s foundational IP is a patented signal tracking algorithm developed at the University of Colorado-Boulder, licensed for commercial use by PrecisionTerra, and designed to effectively track navigation

signals in signal-degraded conditions. This proposal will explore the use of this SDR for NASA ARMDâ€™s autonomous aerial wildfire mitigation efforts, as wildland firefighting operations often take place in GPS-degraded locations like mountains, canyons, and forests. The project will entail (1) Improving upon PrecisionTerraâ€™s current software signal processor, (2) Developing the RF and FPGA hardware needed to run PrecisionTerraâ€™s signal processor in real time on-board a small unmanned aerial system (sUAS), and (3) Testing the reliability and positioning accuracy of PrecisionTerraâ€™s SDR on-board sUASs in environments prone to both wildfires and GPS signal degradation. Funding will be used to hire one signal processing research scientist to improve upon the current signal processor and navigation solution, one software and data analytics engineer to support software development efforts and conduct statistical analysis of data collected, and an RF engineer to create an RF front end board for signal acquisition. Additionally, funds will be used to partner with both an engineering firm for the FPGA implementation of PrecisionTerraâ€™s software and a UAS company for testing the full SDR on-board UASs in flight. Finally, funds will be allocated for office space and equipment purchases and for Technical and Business Assistance (TABA). The target markets for PrecisionTerraâ€™s technology include farming and agriculture (autonomous equipment for row crop farms), mining and construction, emergency management (both ground-based and aerial), and assured positioning and navigation for the military.

Duration: 24

Proposal Details

Proposal Number: A3.03-1014
Subtopic Title: Airspace Operations and Safety
Proposal Title: AI-Enhanced Digital Twin Framework for UAS Component Reliability in Support of In-Time Aviation Safety Management Systems (IASMS)

Small Business Concern

Firm: AlarisPro, Inc.
Address: 2840 Prism Court, Lusby, MD, 20657-2422

Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 4 - 7
Technical Abstract (Limit 2000 characters):

AlarisPro proposes a 24-month Phase II R&D program to advance our AI-enhanced Safety and Reliability (AISR) Digital Twin framework from validated Phase I feasibility prototypes to a three-tier operational demonstrator: an onboard real-time PHM execution segment, an operator fleet intelligence segment, and a ground-based global AI/ML intelligence engine continuously mining AlarisPro's decade-built proprietary aircraft component data lake. The AISR Digital Twin combines EKF-based stochastic state estimation, grey-box physics-informed subsystem modeling, and a three-lane PHM architecture (threshold logic, EWMA/CUSUM degradation trending, Isolation Forest novelty detection) to generate real-time, severity-ranked health outputs across heterogeneous UAS platforms. Phase I validated this architecture on two distinct platforms and subsystems, achieving ~2Â°C RMSE CHT thermal state estimation and <2% false-positive rates on real operational telemetry. Phase II funding will be used to expand onboard coverage to â‰¥3 subsystems, develop hybrid AI/ML digital twin models with quantified uncertainty, integrate operator-facing SMS/FRAT-aligned decision-support workflows, operationalize cross-fleet pattern intelligence, and execute an end-to-end validation campaign culminating in an IASMS-aligned operational demonstration and NASA transition package. The AISR Digital Twin's EKF residual architecture is directly compatible with NASA's Generic UAM (GUAM) simulation framework. Phase II will leverage GUAM challenge-problem effector failure datasets, encompassing stuck effectors, scaled outputs, and control reversals across aerodynamic and propulsive channels, as a high-fidelity, NASA-sanctioned synthetic validation source for PHM detection sensitivity and fault-localization benchmarking, complementing sparse real-fault cases in the Phase D validation campaign. Target markets include NASA and federal agencies, commercial BVLOS operators, UAS/AAM OEMs, aviation insurers, and MRO providers.

Duration: 24

Proposal Details

Proposal Number: A3.03-1028
Subtopic Title: Airspace Operations and Safety
Proposal Title: Integrated Surface and Approach Risk Monitor

Small Business Concern

Firm: Robust Analytics
Address: 2053 Liza Way, Gambrills, MD, 21054-2007

Summary Details

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

The rise in runway incursions and surface incidents over the past few years, including three recent crashes at LGA since October 2025, underscores the need for in-time, reliable monitoring and alerting technologies that fill the gaps left by todayâ€™s reactive systems. During take-off and landing interactions among arriving, departing, and taxiing aircraft can rapidly escalate into catastrophic consequences. In busy airports the operational margins are tight, errors propagate, and pilots and controllers have very little time to respond. During Phase I, Robust Analytics demonstrated an end-to-end real-time prototype of the Integrated Surface and Approach Risk Monitor (ISARM) at ATL and JFK that synthesizes SWIM track data, operational context, and interpreted ATCâ€“Pilot communications to identify reduced safety margins and unsafe interactions. Phase II will mature the ISARM prototype. We will refine the Aircraft Movement Event model with confidence-quantified probabilistic states extended through final approach and initial climb, retrain the context-aware speech-to-logic model with end-to-end context injection, and integrate weather, NOTAM, ATIS, and demand data into a unified digital airport status object that conditions every risk computation. ISARM will be extended to five additional Class B airports (EWR, LGA, SFO, ORD, CVG) and a concept developed for data-poor Class D/E fields. We will quantify performance through a tiered accuracy model and demonstrate safety impact by replaying historical near-miss and surface-incident recordings, including 150 hours of audio and track data from NASA, through the integrated alerting logic. Phase II will also deliver an FAA AC 120-76Eâ€“aligned Type B EFB application concept, a controller-facing tower alerting view, and a transferable NASA-usable scenario playback and authoring environment. An expert panel of controllers, pilots, and airport stakeholders will guide development and validate the design every quarter.

Duration: 24

Proposal Details

Proposal Number: A3.05-1006
Subtopic Title: Airspace Operations and Safety

Proposal Title: Weather Information Systems at Heliports and Vertiports for Advanced Air Mobility (AAM)

Small Business Concern

Firm: TruWeather Solutions, Inc.
Address: 2 Tower Place, Albany, NY, 12203-3735

Summary Details

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

TruWeather Solutions proposes to advance a scalable Weather Information System (WIS) capability for heliports, vertiports, and other Advanced Air Mobility (AAM) landing environments. Phase I produced a requirements-driven WIS architecture process that maps site climate, operational domain, terrain and built-environment influences, mission type, operational frequency, and existing weather infrastructure to the weather parameters and sensing needs most relevant to a specific location. Phase II funding will be used to transform that architecture into a software-enabled tool, validate it at a minimum of three representative sites, integrate deployed and partner-provided sensor data into TruWeatherâ€™s data warehouse, and evaluate high-resolution microscale wind characterization using TruWeatherâ€™s Street-scale Wind Analysis and Prediction System (SWAPS). The Phase II effort will include partner identification, site selection, operational use case development, site climatology and gap analysis, sensor deployment or integration, data ingestion, WIS software development, multi-site demonstration, performance comparison against baseline sources such as HRRR and ASOS/AWOS, and enterprise-level commercialization planning. The resulting capability will help determine what weather data is needed at a specific vertiport, how it should be collected, how sensor placement can be optimized, and how WIS data should be structured for future Automated Data Service Provider (ADSP) integration. Target markets include AAM vertiport developers and operators, airport and heliport operators, state and regional transportation agencies, aircraft operators, OEMs, ADSPs, and weather-sensitive low-altitude aviation and UAS operations.

Duration: 24

Proposal Details

Proposal Number: A3.05-1007
Subtopic Title: Airspace Operations and Safety
Proposal Title: Rain Rate Quantification Dissemination and Determination

Small Business Concern

Firm: Intellisense Systems, Inc.
Address: 21041 S. Western Ave., Torrance, CA, 90501-1727

Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 6 - 8
Technical Abstract (Limit 2000 characters):

In support of the Advanced Air Mobility (AAM) concept for safe, sustainable, affordable aviation, ASTM International (formerly known as the American Society for Testing and Materials) has formed a Subcommittee F38.02 (part of Committee F38 on Unmanned Aircraft Systems) to establish the ASTM F3673 Weather Information Provider standard to address the performance and interoperability requirements for weather data reports, analysis, and services for operations including uncrewed aircraft systems and AAM end users. While the current standard covers most required weather parameters relevant to AAM, the National Aeronautics and Space Administration (NASA) has identified shortcomings in the measurement of rainfall rate that must be addressed. To fill these NASA-identified gaps, Intellisense Systems Inc. (Intellisense) has developed the Rain Rate Quantification Dissemination and Determination (RAINMINDER) system in a Phase I effort to address all four stated NASA goals. Specifically, in Phase II, Intellisense will advance its patented microvolumetric rain rate measurement technology, calibrating it for the full range of weather conditions, and will compare its performance to rain rate estimates produced by nonvolumetric systems. It will also make rain rate data available to AAM operators using either public dissemination through the National Weather Service or through a private data network depending on the preference of each AAM operator. As a current member of the F3673 development committee, Intellisense will lobby to include new rain rate thresholds in the F3673 Tier 2 performance standard to align with Federal Meteorological Handbook No. 1 standards, thereby increasing the usefulness of the standard. This, in turn, will promote wider adoption and deployment and enhance safe and effective operational decision-making, thus broadening the weather data available to nonaviation customers and increasing the market for hyperlocal and microweather data.

Duration: 24

Proposal Details

Proposal Number: A3.05-1008
Subtopic Title: Airspace Operations and Safety
Proposal Title: Next-Gen Precipitation Intensity System for Advanced Air Mobility (AAM)

Small Business Concern

Firm: TruWeather Solutions, Inc.
Address: 2 Tower Place, Albany, NY, 12203-3735

Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 2 - 6
Technical Abstract (Limit 2000 characters):

Advanced Air Mobility (AAM) aircraft will operate in the atmospheric boundary layer where precipitation can change rapidly across distance, altitude, and time. Current surface-focused precipitation observation networks and products do not adequately characterize the rainfall environment encountered across low-altitude AAM corridors, particularly instantaneous rain rate, vertical variability, and drop size distribution (DSD) proxies that influence aircraft performance, energy use, sensor contamination, and operational safety. Phase I established the technical feasibility for a layered precipitation observing architecture combining radar, surface sensors, high-fidelity anchor measurements, and data-fusion workflows to enable a 3D precipitation intensity product. Phase II will develop and demonstrate a prototype time-evolving, corridor-scale 3D precipitation intensity capability for AAM decision support. The effort will be focused within a notional Florida AAM corridor and will define product requirements, deploy and integrate surface and radar observations, implement data ingest and quality control functions, and develop an AI multimodal precipitation intensity model analysis field. The resulting prototype will produce a best-estimate precipitation state from the surface through 5,000 ft AGL, including rain-rate depiction, quality-control indicators, and provenance and metadata.

Duration: 24

Proposal Details

Proposal Number: H3.13-1004
Subtopic Title: Habitation Systems
Proposal Title: Polybenzoxazine Aerogels for Insulation in 38% Oxygen Environments

Small Business Concern

Firm: Material Answers, LLC
Address: 66 Buckskin Dr, Weston, MA, 02493-1130

Summary Details

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

The proposed work will expand upon the achievements of Phase I through the continued development of ultra-low flammability polybenzoxazine aerogels for insulation in 38% oxygen environments. The proposed work will develop aerogels for insulation based on a novel polybenzoxazine resin that exhibits ultra-low flammability in high oxygen concentration environments. The aerogel is designed to provide thermal insulation in high oxygen concentration environments up to 38% vol oxygen. The molecular structure of the polymer and the microstructure of the material are both specifically designed to achieve three critical performance characteristics: ultra-low flammability, excellent, thermal insulation, and very low density. This directly targets the need for materials suitable for service in exploration environments where the oxygen concentration may be as high as 38% vol due to habitat, cabin, and vehicle environment optimization. This proposal highlights an aerogel microstructure structure most suitable for thermal insulation applications. However, the ultra-low flammability polybenzoxazine is anticipated to have additional applications such as acoustic barriers, packaging, panels, coatings, and other slab, sheet, film, and molded applications. This approach provides a path towards addressing the needs for materials that can perform in high oxygen environments in a variety of applications. Performance will be evaluated using NASA-STD-6001B Test 1 Upward Flame Propagation at 38% vol oxygen.

Duration: 24

Proposal Details

Proposal Number: H3.13-1006
Subtopic Title: Habitation Systems
Proposal Title: Insulative Acoustic Composite Materials for Oxygen-Rich Environments

Small Business Concern

Firm: NanoSonic, Inc.
Address: 158 Wheatland Drive, Pembroke, VA, 24136-3645

Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 4 - 7
Technical Abstract (Limit 2000 characters):

NASA seeks new materials that are not flammable in 38% oxygen to reduce safety risk to the crew. New flame-resistant materials that pass NASA-STD-6001B Test 1 Upward Flame Propagation at 38 vol% oxygen and reduced (8.2 psia) pressure environments are needed for surface habitation applications and insulation and acoustic barriers for life support systems. New flexible composites will be engineered through multilayer construction to obtain tailored flame resistance, acoustic and insulative properties for space habitats. Flame-resistant foams will also be produced using siloxane copolymers containing custom formulated additives and fillers. During Phase I, fabricated composites and foams demonstrated flame retardancy in upward flame propagation test at 38% oxygen at 1 atm. Optimized composites and foams shall be developed and characterized per NASA specifications for flame resistance.

Duration: 24

Proposal Details

Proposal Number: H3.14-1000
Subtopic Title: Habitation Systems
Proposal Title: High-efficiency Photocatalytic Hydrogen Peroxide Production Using Polymeric Optical Fibers and Visible Light

Small Business Concern

Firm: H2O Insights, LLC
Address: 12794 E Sahuaro Dr, Scottsdale, AZ, 85259-4331

Summary Details

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

NASA seeks compact, reliable systems capable of producing hydrogen peroxide (Hâ,,Oâ,,) in spacecraft environments for disinfection, cleaning, wastewater stabilization, and planetary protection. Hâ,,Optic Insights, in collaboration with Arizona State University, AquiSense Technologies, and Surface Sciences, is developing a low-power photocatalytic (PC) hydrogen peroxide production unit (PcHPU) that uses visible light, oxygen, and water to generate Hâ,,Oâ,, under autonomous operation. Unlike conventional chemical or electrochemical systems, the PcHPU eliminates catalyst slurries, electrochemical membranes, and complexity of electrode assemblies. The system uses low-cost polymer optical fibers (POFs) coated with porous bismuth vanadium oxide (BVO) photocatalysts. Visible blue light (400â€“440 nm) from low-power LEDs is launched into the fibers, which side-emit light along their length to continuously activate the surface-bound catalyst. This architecture enables highly efficient photon utilization, stable catalyst activation, and scalable reactor geometries while minimizing size, weight, and power (SWaP). Phase I demonstrated >1000 mg/L Hâ,,Oâ,, production with <2 kWh/day energy consumption and stable operation beyond 500 hours with low power consumption (<2 kWh/day). The PcHPU architecture also incorporates gravity-independent oxygen delivery using hollow-fiber membranes or oxygen nanobubbles, supporting operation in microgravity environments. The modular PcHPU architecture is designed for autonomous, low-maintenance operation compatible with NASA Environmental Control and Life Support Systems (ECLSS) and future lunar and Mars missions. The proposed Phase II effort will advance the technology from TRL 4 to TRL 6+ through development of a flight-relevant engineering prototype capable of producing >10 L/day of Hâ,,Oâ,, at >100 mg/L with energy consumption <4 kWh/day and operational stability exceeding 2,500 hours.

Duration: 24

Proposal Details

Proposal Number: H4.09-1009
Subtopic Title: Extra-Vehicular Activity (EVA)
Proposal Title: Regenerable, Integrated Rapid Cycle Amine and Trace Contaminant Control System for Sustainable Lunar and Mars EVAs

Small Business Concern

Firm: XploSafe
Address: 712 Eastgate St, Stillwater, OK, 74074-6409

Summary Details

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

In this Phase II SBIR proposal, XploSafe will build on the successful results of the Phase I work to deliver a vacuum-regenerable dual-sorbent bed for an integrated RCA/TCC system with high trace contaminant and CO2 removal capabilities for sustainable Lunar and Mars Extravehicular Activity (EVA). A sweep gas-based regeneration capability will also be evaluated to quantify the amount of additional gas/ullage that will be required for regeneration for Mars EVA. Current suit architecture treats CO2/humidity control and TCC as separate functions, increasing system mass, volume, and logistical burden. The primary goal of the Phase II project will be to deliver a 3D-printed bench testable prototype of the integrated RCA/TCC sorbent beds that can be integrated into the Exploration Extravehicular Mobility Unit (xEMU) test system for validation testing. This Design, Verification, and Test (DVT) unit will enable both component and integrated system testing. This will be accomplished by the successful execution of four objectives comprising of 11 total tasks and 16 deliverables. Several innovations are targeted including the development of advanced dosing, EVA exposure simulation, and software controlled dynamic pressure regulation to facilitate continuous and consistent pressure within the xEMU test rigs for simulating sub-atmospheric pressure (Lunar, Martian and other pressure ranges as needed). The execution of the proposed tasks will also generate sorbent storage stability data including potential off-gassing and performance evaluations over a long-time interval (up to 72 weeks). Finally, evaluation of the operational efficiency of the integrated RCA/TCC system for existing Lunar-spacesuit configurations and the future Mars-spacesuit will provide at least two regenerability options for the proposed integrated RCA/TCC sorbent

module.

Duration: 24

Proposal Details

Proposal Number: H4.11-1001
Subtopic Title: Extra-Vehicular Activity (EVA)
Proposal Title: Impact-resistant Composite Structures for Spacesuits

Small Business Concern

Firm: Composites Automation LLC
Address: 9 Adelaide Court, Newark, DE, 19702-2068

Summary Details

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

Composites Automation (CA) is partnering with the University of Delaware Center for Composite Materials (UD-CCM) to investigate innovative composite material and structure concepts that meet projected Mars impact energy goals of >600J with leak rates < 0.5LPM. The proposed effort focuses on hard structural components in the spacesuit pressure garment subsystem. Phase I demonstrated material concepts at the coupon scale for impact energies exceeding 600J while meeting leak rate requirements. Phase II will extend the coupon scale solutions to the Hard Upper Torso (HUT), with laminate optimization, manufacturability assessment and the fabrication of a full-scale HUT assembly to be delivered to NASA. In parallel, a concept study will evaluate new joint/interface strategies for the HUT with coupon and sub-component demonstrations.

Duration: 24

Proposal Details

Proposal Number: H4.11-1016
Subtopic Title: Extra-Vehicular Activity (EVA)
Proposal Title: Additively Manufactured ScalmalloyÂ® EMU Spacesuit Bearings

Small Business Concern

Firm: Quadrus Corporation
Address: -

Summary Details

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

Quadrus Corporation is pleased to present this proposal focused on advancing next generation lightweight bearing technologies for future NASA exploration systems. Our Phase I effort was focused on establishing viable material and process pathways for next generation eXploration Extravehicular Mobility Unit (xEMU) bearing systems that simultaneously reduce mass and improve service life relative to the current Ti-6Al-4V (Ti64) based solution. Our Phase I effort focused on determining whether additively manufactured Scalmalloy could be transformed into a bearing-grade material system without sacrificing its inherent mass advantage. The most impactful technical accomplishment of this work was demonstrating that additively manufactured Scalmalloy can be successfully plasma nitrided using a specialized ion assisted process designed to overcome the native oxide layer that has traditionally restricted aluminum alloy surface hardening. Phase I conclusively demonstrated that nitrided Scalmalloy is a promising pathway toward lightweight, high-performance bearing systems for future planetary EVA applications. Accordingly, Phase II will focus on advancing this demonstrated material capability into a fully validated bearing system through process optimization, lightweight structural design, and comprehensive wear and life-cycle testing in collaboration with the bearing integration partner. At the conclusion of Phase II, QAM will have demonstrated an end-to-end additive manufacturing and surface engineering process for fabrication of nitrided Scalmalloy bearing systems validated through wear, torque, and life-cycle testing under representative operational conditions.

Duration: 22

Proposal Details

Proposal Number: H5.01-1012
Subtopic Title: Lightweight Structures and Materials
Proposal Title: Modular Operations, Resource, & Power Hub (MORPH)

Small Business Concern

Firm: Opterus Research and Development, Inc.
Address: 5645 Kitty Hawk Dr, Loveland, CO, 80538-7298

Summary Details

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

Opterus proposes to develop and demonstrate a 6 kW â€œtowerâ€‘agnosticâ€ Modular Power & Payload Truss (MPPT) and Selfâ€‘Stiffening Rollable Array Module (SSRAM) suitable for nearâ€‘term CLPS missions and scalable to 20â€“50 kW VSAT systems envisioned in NASAâ€™s Project Ignition. Phase II will mature a modular, deployable surface power architecture integrating highâ€‘strainâ€‘composite structures, dustâ€‘tolerant electromechanical interfaces, and roboticâ€‘compatible payload attachment points. The MPPT will support solar power generation, communications, and situationalâ€‘awareness payloads while providing azimuth tracking via an integrated SADA and embedded harnessing for power and data routing. Its â€œtowerâ€‘agnosticâ€ design enables straightforward integration with masts from multiple providers, including NASAâ€™s Tall Lunar Tower. Each 1.5 kW SSRAM incorporates a rollable silicon photovoltaic blanket with a selfâ€‘stiffening composite backing, housed within a protective canister and equipped with robotic grapple features, dustâ€‘tolerant wireless connectors, and integrated thermal radiators. The modules stow compactly for lander integration and autonomously deploy after landing, with the option to demonstrate robotic removal and reinstallation for modular assembly validation. Phase II activities will mature the 6 kW MPPT/SSRAM system into a scalable, Artemisâ€‘aligned architecture; develop standardized mechanical, electrical, and data interfaces; evaluate structural and operational scaling to 50 kWâ€‘class networks; and demonstrate deployment, retraction, and robotic assembly through prototype testing. The system directly addresses multiple Moonâ€‘toâ€‘Mars architecture technology gaps and provides a practical pathway from early CLPS demonstrations to persistent lunar and Martian surface power infrastructure.

Duration: 24

Proposal Details

Proposal Number: H5.01-1013
Subtopic Title: Lightweight Structures and Materials
Proposal Title: 50kW Pneumatic Modular Solar Array STAC Mast

Small Business Concern

Firm: Moonprint Solutions
Address: 1287 McD Drive, Dover, DE, 19901-4639

Summary Details

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

Ensuring constant and reliable electrical power generation on the lunar surface is a critical part of NASAâ€™s Artemis missionâ€™s infrastructure goals. NASA is pursuing scalable and reconfigurable modular power generation technologies to optimize the value of mass delivered to the lunar surface, facilitate architecture expansion, and reduce mission cost. Artemis missions target the lunar south pole, which have nearly constant sunlight at elevated terrain features across the lunar seasons, making them ideal for continuous capture of solar power. The low incidence angle of the sun at this latitude requires solar panels to be elevated 10m or more from the lunar surface to avoid shading from nearby terrain. Moonprint will advance the development of the modular, vertically deployable 50kW class solar array pneumatic mast system is capable of being quickly reconfigured, expanded or relocated to adapt to changing lunar surface infrastructure needs. The technology being developed on this program enables solar array modules to be combined (ganged) through connectable nodes capable of multiple configurations using vertical extensions and horizontal keel beams to expand power collection capability in needed areas. This approach maximizes operability by leveraging adaptable 10kW modules into larger arrays or using the smaller arrays on habitats, rovers, or other installations. The pneumatically telescoping masts and modular components are capable of multiple deploy/retract cycles with very little power and have excellent operational reliability in the extreme cold of permanently shaded regions (PSRs) and in the presence of highly abrasive lunar dust. The high modulus composite tubes can be made to any structural requirement and are highly structurally scalable. Moonprint will also perform work to demonstrate the structural scaling capability of the technology to meet future needs for larger or elevated deployed solar arrays and tall towers for communications or navigation.

Duration: 24

Proposal Details

Proposal Number: H6.25-1032
Subtopic Title: Autonomous Systems

Proposal Title: Model Validation via Precomputed Transformations (MVPT)

Small Business Concern

Firm: VISIMO LLC
Address: 1501 Reedsdale Street, Pittsburgh, PA, 15233-2345

Summary Details

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

VISIMO proposes Model Validation via Precomputed Transformations (MVPT), a software approach for validating AI and machine learning models used by autonomous systems when they encounter novel operational data. MVPT precomputes how model-validation results change across transformations of representative data before deployment, then uses a lightweight mission-side lookup to estimate whether a model remains validated when new data are observed. This approach is intended to support autonomous systems that must continue operating under delayed or unavailable human supervision and constrained onboard computing resources. Phase II funding will be used to mature MVPT from a validated proof of concept into a mission-ready software prototype. The effort will simulate a NASA-relevant extraterrestrial rotorcraft mission using navigation-camera data, physically informed surface simulations, and ground-truth labels for height variance estimation, hazard detection, and feature tracking. VISIMO will implement and evaluate the ground-side and mission-side MVPT software, validate accuracy and reliability against simulated novel data, test computational performance in spacecraft-like environments, and package the software with documentation and APIs for mission and engineering workflows. The expected outcome is a reusable AI/ML validation software package that supports pre-mission validation-table generation, low-overhead mission-side validity estimation, and integration with mission-specific models, data, validation methods, and transformations. Target markets include NASA deep-space and planetary autonomy missions, near-Earth autonomous space operations, Earth-observation systems, commercial space operators, autonomous aerospace platforms, UAS developers, and other organizations deploying AI/ML models in mission- or safety-critical environments.

Duration: 24

Proposal Details

Proposal Number: H8.01-1006
Subtopic Title: ISS Utilization and Microgravity Research
Proposal Title: Thin-Film Lithium Niobate Single-Crystal Growth via Liquid Phase Epitaxy for ISS-Based Manufacturing

Small Business Concern

Firm: Goeppert LLC
Address: 3401 Grays Ferry Avenue, Philadelphia, PA, 19146-2700

Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 3 - 7
Technical Abstract (Limit 2000 characters):

This project develops a scalable method for producing high-quality thin-film lithium niobate (TFLN) using liquid phase epitaxy (LPE), with a pathway toward microgravity-enabled manufacturing on ISS. Lithium niobate is a critical material for next-generation photonics, enabling high-speed, low-power optical modulation, nonlinear optics, and quantum photonic systems. However, current thin-film fabrication approaches, primarily â€œSmart-Cutâ€ dominated by overseas suppliers, face limitations in cost, defect density, and supply chain reliability, creating barriers to U.S. competitiveness in advanced communications, AI infrastructure, and quantum technologies. Building on Phase I results demonstrating the feasibility of LPE-grown TFLN and successful furnace development, Phase II will advance material quality and scalability while designing a compact, ISS-compatible furnace system in collaboration with Leidos. The project will optimize growth parameters to achieve controlled thickness, crystallographic orientation, and low-defect films against application-driven requirements. Parallel engineering efforts will mature the system toward microgravity operation, where suppression of convection and sedimentation is expected to improve crystal quality beyond terrestrial limits. Funding will support process optimization, furnace system upgrades, device fabrication, and ISS flight design activities. The resulting technology establishes a domestic, cost-effective manufacturing pathway for high-performance TFLN and enables future in-space production for premium materials. Target markets include photonic integrated circuits, optical communications (including space-based systems), AI data center interconnects, quantum information technologies, and defense applications. By addressing both performance and supply chain limitations, this work supports U.S. leadership in advanced materials, microelectronics, and space-based manufacturing.

Duration: 14

Proposal Details

Proposal Number: H9.03-1003
Subtopic Title: Space Communications and Navigation
Proposal Title: Plume Impingement Module for Autonomous Proximity Operations

Small Business Concern

Firm: Rarefied Studios, LLC
Address: 1817 Crockett St, Houston, TX, 77007-4090

Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 4 - 7
Technical Abstract (Limit 2000 characters):

Successfully executing proximity operations in space, including docking, in-orbit servicing, and orbital debris mitigation, requires autonomous systems that can safely react to dynamic environments in real time. One of the most critical risks during proximity operations is plume impingement between nearby vehicles. High-speed plumes can damage components, destabilize the spacecraft, and potentially result in mission failure or loss of crew. Current plume impingement analysis methods rely on time-consuming and computationally expensive iterative pre-flight analyses. This often leads to schedule delays, risk acceptance, and costly late-stage redesigns. In this Phase II effort, Rarefied Studios will develop and validate a real-time plume impingement module integrated with spacecraft flight software and evaluated within a representative flight environment. The culmination of this effort will deliver prototype flight software suitable for integration with flight controller development and onboard mission applications. The resulting software has broad NASA and commercial applications, including pre-flight controller development, real-time monitoring, and onboard autonomous mission operations. In particular, the module is immediately useful for space station proximity operations, orbital debris mitigation, and in-space servicing missions. By enabling real-time plume impingement analysis capabilities, this technology reduces operational risk and costs while supporting autonomous and complex missions.

Duration: 24

Proposal Details

Proposal Number: H9.08-1012
Subtopic Title: Space Communications and Navigation
Proposal Title: Wireless Channel Simulation for Antennas Mounted on Spacesuits and Lunar Vehicles

Small Business Concern

Firm: Remcom, Inc.
Address: 315 S. Allen Street, State College, PA, 16801-4852

Summary Details

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

In this SBIR Phase II, Remcom proposes an extension to channel modeling and coverage analysis capabilities for lunar environments in its Wireless InSite prediction software, addressing shortfalls associated with near-field effects around antennas mounted on spacesuits, lunar vehicles, or other structures. One area that poses challenges to simulation lies in the modeling of the complex, layered materials used in spacesuits and their impact on antenna radiation and ultimately on communication links. Several anticipated applications for wireless communications during the Artemis missions involve links between astronauts and 3GPP networks, or use of 3GPP sidelink or alternative protocols to allow device-to-device (D2D) communication between astronauts or network relay when one astronaut is out of network range. A robust simulation capability is needed to evaluate how the positions of single or multi-antenna configurations may impact communication performance in realistic lunar scenarios for these cases. Remcom proposes innovative approaches using Huygens surfaces to merge near-field and far-field domains, while also capturing effects of creeping waves and incorporating accelerations to reduce computation times by multiple orders of magnitude. The final result will be an end-to-end channel simulation capability for lunar scenarios that incorporates these new features, augmented with link-level analysis to predict overall effects on communications.

Duration: 24

Proposal Details

Proposal Number: H10.04-1003
Subtopic Title: Ground and Launch Processing
Proposal Title: Autonomous Real Time, Multi Species Monitoring System for In-line Commodity Purity Analysis

Small Business Concern

Firm: Sporian Microsystems, Inc.
Address: 515 Courtney Way, Lafayette, CO, 80026-8821

Summary Details

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

In NASA and commercial aerospace processes involving hydrogen, oxygen, methane, air, nitrogen, and helium, real-time in-line analysis of gas purity is critical for ensuring product quality, process efficiency, and compliance with stringent standards for mission success. Current standard methods, such as GC/MS, require significant downtime, labor, and sample transport for analysis, struggle with real-time monitoring, and do not support in-line sampling within the process stream. There is a need for innovative gas/fluid composition monitoring technologies capable of achieving real-time in-line analysis of hydrogen, oxygen, methane, air, nitrogen, and helium process streams, with a focus on detecting and quantifying impurities such as hydrocarbons, moisture, and total impurities per NASA purity standards. The long-term objective of the proposed effort is to leverage Sporianâ€™s prior work on machine learning-enabled, spectroscopy-based sensing systems to realize an intelligent, real-time, cost-effective process gas stream composition monitoring system focused on detecting and quantifying both composition and impurities per NASA purity standards. This initial effort will focus on methane process streams and their specific needs and technical requirements that traditionally present significant challenges for conventional in-line sensor technologies. Phase I focused working with stakeholders to define requirements; evaluating revised hardware designs; and experimental demonstration of technology

feasibility. The Phase II effort will include: (1) working with NASA and industry stakeholders to support transition; (2) evaluating revised hardware and electronics architectures and designs; and (3) conducting multiple rounds of full system prototyping, testing, and demonstration to meet NASAâ€™s technical readiness expectations. If successful, Sporian will be well positioned for the post-Phase II transition efforts with NASA and industry stakeholders.

Duration: 24

Proposal Details

Proposal Number: H12.09-1006
Subtopic Title: Human Research and Health Maintenance
Proposal Title: In-Suit Detection of Venous Gas Emboli

Small Business Concern

Firm: Creare LLC
Address: 16 Great Hollow Road, Hanover, NH, 03755-3116

Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 5 - 6
Technical Abstract (Limit 2000 characters):

Future manned missions to the moon and Mars will be resource constrained. Crew time and oxygen are among the most important resources for any manned mission. Unfortunately, current strategiesâ€”de nitrogenation by long duration oxygen pre-breathe protocolsâ€”for mitigating the risk of decompression sickness (DCS) during extravehicular activities (EVA) consume significant time and oxygen. NASA needs new and better strategies for monitoring, mitigating, and managing DCS risk. On this SBIR program, Creare, working with our longstanding collaborators at the University at Buffalo (UB) and Dartmouth College, are adapting our diver-worn DCS risk assessment tool (the Wireless Diver Physiology Monitor, WDPM) for the NASA mission. Our Body-worn Emboli Notification Device (BEND) non-invasively monitors an astronautâ€™s blood for venous gaseous emboli (VGE) via two different ultrasound techniques: Doppler and dual-frequency ultrasound (DFU). It has long been established that there is a very strong correlation between VGE and

DCS and that monitoring VGE is a promising avenue for assessing DCS risk in real-time. In addition to monitoring for VGE, BEND will use DFU to monitor microbubbles in the tissue and in the blood. We have shown that microbubbles in the blood and in the tissue often precede the formation of VGE. As a leading indicator, microbubbles may be more useful than VGE for managing DCS risk. While Doppler is the â€œgold standardâ€ for evaluating bubble loading (and therefore warrants inclusion in BEND), DFU offers two important benefits over Doppler: DFU does not require precise alignment with the heart or veins to function (reducing the amount of crew time needed to properly don the device) and DFU requires minimal embedded signal processing (reducing the necessary processing power, which reduces the device size while increasing battery life). BEND will meet the NASA need to monitor, mitigate, and manage DCS risk.

Duration: 24

Proposal Details

Proposal Number: H15.01-1001
Subtopic Title: Human Surface Mobility
Proposal Title: Robust LiDAR-Stereo Fusion for Lunar Autonomy

Small Business Concern

Firm: Quartus Engineering Inc.
Address: 9689 Towne Centre Dr, San Diego, CA, 92121-1964

Summary Details

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

Autonomous lunar surface operations under the Artemis program require reliable, long-range, and high-fidelity perception despite extreme lighting variability, low-texture terrain, and strict computing and power constraints. Traditional stereo vision degrades severely in shadowed or low-contrast regions, while LiDAR alone provides sparse depth insufficient for dense mapping and high-rate hazard detection. To address this gap, Quartus has developed a LiDAR-Stereo Fusion approach that combines the complementary strengths of both modalities to produce dense,

accurate, and computationally efficient RGB-D data suitable for embedded lunar mobility systems. During Phase I, Quartus demonstrated the feasibility of a fusion architecture that injects sparse LiDAR measurements directly into a custom SGM-based stereo pipeline using a diffusion prior and cost-volume conditioning optimized for space-relevant hardware. Implemented on an AMD Versal platform, the fused system achieved real-time performance with substantial accuracy gains in low-illumination and low-texture environments, validating both algorithmic design and embedded deployability. Phase II will mature this capability into a field-tested, flight-representative perception system. Efforts include improving simulation fidelity for diverse lunar conditions; advancing fusion algorithms; developing a robust API and SLAM integration framework; building an integrated stereo + LiDAR hardware demonstration unit; and performing terrestrial field tests at desert analog sites and a NASA lunar simulation site. The resulting system will deliver dense, reliable depth at high rates with minimal compute overhead, supporting high-mobility navigation, hazard avoidance, and mapping for crewed and uncrewed lunar vehicles. This technology offers immediate applicability to lunar missions and broader relevance to terrestrial robotics operating in degraded visual environments.

Duration: 24

Proposal Details

Proposal Number: H15.01-1005
Subtopic Title: Human Surface Mobility
Proposal Title: Visual Intelligence for Situation Awareness

Small Business Concern

Firm: TRACLabs
Address: -

Summary Details

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

Visual Intelligence for Situation Awareness (VISTA) aims to address the significant situational awareness challenges inherent in remote space robotics operations.

Currently, operators on platforms like the Mobile Servicing System (MSS) on the International Space Station (ISS) must manually manage camera configurations and downlinks before mentally fusing multiple 2D camera views to understand the 3D operating environment. With upcoming Artemis lunar surface missions anticipating stricter bandwidth and downlink constraints, VISTA's purpose is to intelligently select task-relevant RGB camera feeds subject to downlink constraints and automatically generate interactive 3D reconstructions to reduce operator cognitive load and improve task execution. The Phase II effort builds upon our successful Phase I effort that resulted in a proof-of-concept system demonstration and will focus on validating and implementing the remaining key system components, with the ultimate goal of transitioning the proof-of-concept system demonstrated in Phase I to a functional prototype system and demonstrating it in NASA mission contexts. The target market for VISTA is commercial space, particularly LTV, CLPS and CLPS 2.0 providers, supporting their remote robot operations on the Lunar surface. With the planned uptick in planned robotic missions to the lunar surface the technologies developed in VISTA to increase remote operator situation awareness while respecting downlink constraints will directly help address challenges facing remote robot operations.

Duration: 24

Proposal Details

Proposal Number: H15.02-1012
Subtopic Title: Human Surface Mobility
Proposal Title: Physics-Based Numerical Framework for Large-Scale Lunar Terramechanics Applications

Small Business Concern

Firm: Blueshift, LLC
Address: 155 Commerce St, Broomfield, CO, 80020-2243

Summary Details

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

Outward Technologies proposes to continue development of a physics-based, multi-scale computational framework to predictively simulate large-scale soil-wheel interaction (SWI) and planetary mobility under extreme granular deformation. Current terramechanics methods fail to balance particle-scale physical fidelity with system-level computational efficiency. This framework solves this trade-off via a novel physics-driven adaptive Reduced-Order Modeling (ROM) approach within the Discrete Element Method (DEM), where the active computational domain evolves dynamically according to granular force transmission and stress propagation rather than arbitrary geometric boundaries. Phase II funding will be used to transition Phase I proof-of-concept models into a fully validated, highly scalable simulation environment. Key objectives include: 1) developing the physics-driven adaptive ROM DEM framework; 2) establishing exploratory DEM-FEM multiscale coupling to enable seamless transitions between particle and continuum representations; 3) employing the Unified Automated Calibration Tool (UACT) to fit simulated macroscale responses to experimental SWI datasets; and 4) performing full vehicle-scale mobility evaluations to predict rover traction, sinkage, and slip limits under Artemis-relevant conditions. The primary target market includes NASA and commercial space entities developing lunar and planetary surface systems, such as the Lunar Terrain Vehicle (LTV), Pressurized Rover, and In-Situ Resource Utilization (ISRU) excavators. Additionally, terrestrial target markets encompass off-road vehicle engineering, defense (impact/blast modeling), civil engineering, and agricultural/mining equipment manufacturing, where explicitly resolving large-deformation granular mechanics is critical for accelerating design cycles, reducing physical prototyping costs, and mitigating operational risks.

Duration: 24

Proposal Details

Proposal Number: S11.01-1001
Subtopic Title: Earth Science
Proposal Title: Scalable Metasurface ARray Telescope, SMART

Small Business Concern

Firm: Exciting Technology LLC
Address: 1529 Brown Street, Dayton, OH, 45409-3401

Summary Details

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

Exciting Technology (ET) is proposing a beam steering solution that will allow a single telescope to point in two directions for a future wind lidar in Low Earth orbit, LEO. The proposed approach has no moving parts, is completely passive, and will be easy to space qualify. We will be able to scale this passive pointing solution to the required 50- 60 cm aperture diameter, and we plan to provide > ï¬/20 optical quality, allowing high mixing efficiency for a coherent lidar. The two pointing locations are chosen based on the laser polarization. This metasurface beam steering approach will also enhance future optical phased array development for NASA, because it can provide easy step steering, essentially doubling the steering angle of an OPA that uses a certain level of lithographic precision. The LEO wind lidar application only requires two steering angles, which we can provide with the passive, non mechanical, metasurface steering approach. When we combine metasurface steering with OPAs we will be able to point to any angle within a certain limit that is twice as large as the OPA by itself. This combined OPA and metasurface approach will be applicable to many NASA and non-NASA application. Fast, non-mechanical steering will revolutionize any lidar NASA, or NASA contractors, build, or any free space optical communication system. Todayâ€™s optical beam steering technology for large apertures and wide angles is restricted to classic gimbals, which are expensive and bulky, or possibly Risley prisms, which can also be heavy with low optical quality near the steering field of view (FOV) boundary. Risley-based beam scanners are considered an improvement on traditional gimbals and galvanometers because they have lower C-SWaP and are vibration-insensitive. Our proposed non-mechanical design, which we call a metasurface point steering, results in further improvement, significantly reducing the size and weight, while dramatically increasing reliability.

Duration: 24

Proposal Details

Proposal Number: S11.02-1029
Subtopic Title: Earth Science
Proposal Title: Atomically-Referenced Optical Wavelength Standard

Small Business Concern

Firm: Opto-Atomics Corp.

Address: 1891 N Gaffey St, San Pedro, CA, 90731-1270

Summary Details

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

Rydberg atom-based RF sensors provide broadband, SI-traceable electric-field measurements, but practical deployment is limited by the coupling laser subsystem. Cesium Rydberg sensors require a frequency-stabilized coupling laser around 510 nm; however, existing solutions for coupling laser stabilization involve high-finesse cavities, which are bulky and environmentally sensitive, or power-intensive EIT-based locks, which require excess optical power. Opto-Atomics proposes to continue development of the Atomically Referenced Optical Wavelength Standard (AROWS), a compact, ruggedized optical frequency reference that provides atomically referenced frequency markers for direct stabilization of Rydberg coupling lasers. Phase I demonstrated green frequency-marker generation across the target spectral range, external laser stabilization below 100 kHz, and vibration testing of key components under airborne-relevant conditions. In Phase II, Opto-Atomics will integrate, package, and validate an AROWS prototype that provides simultaneous spectral coverage over a 5 nm wavelength range, sub-100 kHz long-term frequency stability (goal: 10 kHz), and stable operation under representative environmental perturbations. The Phase II prototype will advance AROWS toward TRL-5 and provide a deployable enabling subsystem for NASA quantum RF sensing missions.

Duration: 24

Proposal Details

Proposal Number: S11.03-1014
Subtopic Title: Earth Science
Proposal Title: Multi-Beam Passive Microwave Radiometer Design using Multi-Path Cross Correlation Radiometry

Small Business Concern

Firm: Orbital Micro Systems, Inc. DBA Weather Stream

Address: 6350 Nautilus Drive, Boulder, CO, 80301-5389

Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 4 - 5
Technical Abstract (Limit 2000 characters):

The Multi-beam Multipath Cross Correlation Radiometer (MMXCR) is an extension of the existing Multipath Cross Correlation Radiometer (MXCR) technique to a system with multiple input antennas. MXCR is a new means of continuous multi-beam radiometer â€œself-calibrationâ€ that obviates the need for conventional switched calibration looks, whether from internal noise sources or external blackbody targets. It provides this capability by splitting the input RF signal into multiple receiver paths, the gain and offset responses of which are cancelled out through processing of cross-correlated sampled signals and taking key ratios of off-diagonal coherency terms, each of which introduce uncorrelated (and therefore non-detectable) receiver noise. The unique gain cancellation algorithm allows for continuous calibration that is immune to gain fluctuations and 1/f noise. It is specifically resilient to out-of-band gain compression caused by radio frequency interference that affects all other filter bank and hyperspectral radiometers. â€œMulti-beam MXCRâ€ (MMXCR) simultaneously implement multiple independent radiometric antenna beams that provide a simultaneously sampled push broom imaging capability, thus reducing or eliminating mechanical scan requirements. In this Phase 2 effort, we propose development of multi-beam hardware prototypes and characterization of their precision, noise standard deviation (NEdT), and stability. This involves development of fundamental theory and algorithms necessary to invert off-diagonal coherency matrix measurements in addition to hardware design and build. The theory supports the implementation of demonstration systems providing simultaneous and independent radiometer antenna beams using an appropriate transmission network for signal splitting along with FPGA-based channelization and coherency accumulation firmware. The proposed 2- and 4-beam prototypes will provide continuous measurement of the antenna temperatures of multiple inputs simultaneously.

Duration: 24

Proposal Details

Proposal Number: S11.04-1019
Subtopic Title: Earth Science
Proposal Title: INFRARED SLS FPAS ON DIGITAL-PIXEL ROICS FOR

GREATLY IMPROVED SIGNAL-TO-NOISE PERFORMANCE

Small Business Concern

Firm: QMAGIQ, LLC
Address: 22 Cotton Road, Unit H, Nashua, NH, 03063-4219

Summary Details

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

How to better find trace minerals and water on the lunar surface? How to detect and track dangerous invisible asteroids? How to better analyze the atmospheres of exoplanets to find the potentially habitable ones? A key method is by drastically improving the signal-to-noise ratio (SNR) of the infrared sensor used for these applications. The measure of the SNR of an infrared focal plane array (FPA) is the temporal noise equivalent difference in temperature (NEDT) which is a function of FPA operating temperature, spectral band, photon flux, pixel size, and the charge-well-depth of the readout integrated circuit (ROIC). For ANALOG ROICs with typical 10-20 million electron (me-) well-depths, NEDT values of 20-30 mK are observed. A recent development is the commercial availability of the DIGITAL-PIXEL ROIC (DROIC) which uses a digital counter in each unit cell to greatly increase well-depth to 100 me- and higher. Since background-limited NEDT varies inversely as the square root of the well-depth, DROICs promise much lower NEDT of ~ 3 mK, which immediately translates to the detection of fainter objects or a longer detection range by a factor of at least 2.5x. In Phase I, we fabricated and tested both analog and digital FPAs (on analog and digital ROICs, respectively) from the same detector lot and compared performance. We demonstrated a stunning low NEDT of ~ 5 mK in the digital FPA. In Phase II, we will develop and deliver a camera using the new DFPA. At a minimum, these new digital FPAs will allow NASA to detect dimmer infrared targets at longer ranges, and fainter chemical traces in the atmosphere and on the surface of the Moon and Mars.

Duration: 24

Proposal Details

Proposal Number: S11.04-1021
Subtopic Title: Earth Science
Proposal Title: Quantum Waveguide Infrared Photodetector for Heterodyne Spectroscopy

Small Business Concern

Firm: EMode Photonix LLC
Address: 315 S 38th St, Boulder, CO, 80305-5469

Summary Details

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

The Quantum Waveguide Infrared Photodetector (waveguide-QWIP) is a patented, room-temperature detector for mid-infrared heterodyne spectroscopy (NIST Patent US 11,271,023). The device couples light through the facet of a GaAs/AlGaAs ridge waveguide into the TM-polarized guided mode, propagating it along a single embedded quantum well. This decouples optical interaction length from active device volume, enabling high responsivity, low noise, and high bandwidth simultaneously at room temperature. No existing commercial detector achieves this combination in the 3-5 Âμm band. NASA SBIR Phase I (Contract 80NSSC25C0197) advanced the technology from TRL 2 to TRL 3. Responsivity that increases systematically across 100-750 Âμm devices directly confirmed guided-mode intersubband absorption. Phase I also measured 75 fF capacitance corresponding to 42 GHz bandwidth, with intrinsic device noise below the measurement floor at room temperature. Phase II funding advances the waveguide-QWIP from TRL 3 to TRL 5 through six quarterly fabrication runs, continuous characterization at the 3.3 Âμm design wavelength, new tapered waveguide and linear array geometries, anti-reflective facet coatings, and TO can prototype packaging. Phase II targets responsivity above 100 mA/W, NEP below 10 pW/Hz^0.5, and bandwidth above 40 GHz, surpassing the only commercial room-temperature high-speed MWIR detector (Hamamatsu P16309-01: 1 mA/W, 20 GHz) by over 100 times in responsivity and more than double in bandwidth. Target markets are NASA planetary science instruments for heterodyne spectroscopy of Titan, Io, and Enceladus; DoD programs in coherent MWIR free-space communications and chemical sensing; and commercial photonics instrumentation through active licensing discussions.

Duration: 24

Proposal Details

Proposal Number: S11.05-1010
Subtopic Title: Earth Science
Proposal Title: The Pandora-Inspired Advanced Hyperspectral Camera for Atmospheric Monitoring (PANCAM)

Small Business Concern

Firm: Sciglob Instruments & services LLC
Address: 9881 Broken Land PKWY, Columbia, MD, 21046-3011

Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 4 - 7
Technical Abstract (Limit 2000 characters):

Spatially resolved, continuous measurements of atmospheric trace gases are critical for validating NASA's Earth-observing satellites and supporting field campaigns. While satellites such as TEMPO, TROPOMI, GEMS offer broad regional coverage, they have limited ability to resolve urban pollution gradients. Conventional ground-based instruments operate sequentially, are restricted to a single azimuth, and require 10 to 15 minutes per scan, making continuous spatial mapping impractical. The Pandora-Inspired Advanced Hyperspectral Camera for Atmospheric Monitoring (PANCAM) addresses this measurement gap. Using Imaging Differential Optical Absorption Spectroscopy, PANCAM captures the sky as a hyperspectral image cube in the UV-Visible range, with spectral resolution finer than 0.6 nm. Under clear conditions, it completes a 90Â° panorama at 0.1Â° angular resolution in less than seven minutes, generating over 9,000 images for real-time atmospheric assessment. The opto-electrical bench weighs under 10 kg and consumes less than 100 W, consistent with NASA's requirements for compact, field-deployable instruments. PANCAM operates autonomously and is remotely monitored, eliminating the need for on-site personnel. PANCAM's modular design enables future versions with diverse spectral ranges and resolutions, establishing it as a platform for calibrating and validating TEMPO, TROPOMI, GEMS, PACE, and MAIA. The system also supports air quality agencies and urban monitoring networks and serves as a ground-based testbed for atmospheric retrieval algorithms. Phase I validated the concept using cost-effective imaging optics, a scientific-grade detector, and an NVIDIA Jetson embedded GPU for real-time image acquisition. Phase II will advance PANCAM from TRL 4 to TRL 6â€“7, delivering a robust optical bench, a validated instrument system, and standards-compliant data products for integration into NASA data base.

Duration: 24

Proposal Details

Proposal Number: S12.02-1000
Subtopic Title: Astrophysics
Proposal Title: Micrometeorite Shield with Tailorable, High-Performance, Thermal/Optical Properties for Spacecraft Telescope Baffle

Small Business Concern

Firm: ZeCoat Corporation
Address: 1506 West 3rd Street, Granite City, IL, 62040-1883

Summary Details

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

ZeCoat Corporation is developing advanced thermal, optical, and micrometeoroid-shielding materials for space-based optical systems for the Habitable Worlds Observatory (HWO). Using ZeCoatâ€™s roll-to-roll vacuum coating system, we will manufacture multilayer coatings on ballistic-reinforced polymer membranes up to 30 meters long. These membranes incorporate high-strength fibers, fillers with high heats of vaporization, and/or dense metal foils to protect observatories from damaging micrometeoroid impacts. Combined with advanced coatings, the membranes provide thermal control, straylight suppression, and micrometeoroid protection to extend mission life and improve imaging performance. In Phase I, we manufactured and demonstrated seven thermal/optical coating designs on 3-meter custom polyimide membrane substrates supplied by NeXolve Inc. (CP1). The designs optimized two primary objectives: (1) low emissivity (Îµ) for thermal insulation as multi-layer insulation (MLI), and (2) low absorptivity/high emissivity (low Î±, high Îµ) for optical solar reflector (OSR) performance, maintaining near-room-temperature surfaces in sunlight. This technology is currently at TRL-3. Phase II will produce full-scale coated membrane materials and validate them under simulated space and ground-storage environments. We will also develop high-Î±, low-Îµ â€œblack coatingsâ€ for straylight absorption and thermal insulation. By the end of Phase II, our goal is to offer commercial-off-the-shelf (COTS) roll-to-roll

coated membranes with a range of thermal, optical, and ballistic properties for near-term large baffle and sunshield designs deployable in space. Our materials exceed current state-of-the-art performance: the MLI material has 1.6Ã— lower emissivity than the SOW baseline, the OSR coating has 2Ã— lower Î±/Îµ, and the black coating demonstrates 6Ã— lower visible-near-IR reflectivity than the SOA. Environmental testing will be completed by the end of Phase II, advancing the technology to TRL-5.

Duration: 24

Proposal Details

Proposal Number: S12.03-1014
Subtopic Title: Astrophysics
Proposal Title: Advanced Ultra-Stable Affordable Mirrors (AUSAM)

Small Business Concern

Firm: Advanced Glass Industries, Inc. d/b/a EvolvOptic
Address: 1390 Mt Read Blvd, Rochester, NY, 14606-3006

Summary Details

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

Affordable, large aperture optical components are essential for successful NASA space-based imaging system missions. Leveraging the promising results achieved in the Phase I study, EvolvOptic proposes to develop and implement manufacturing technologies and production approaches to enable the rapid production of affordable, lightweight, thermally stable large-aperture mirrors for near-term and long-term NASA missions. There are potential applications for other ground- and space-based missions as well. This effort incorporates three key initiatives: 1) Implementation of a scaled-up high-stability mirror assembly and bonding approach to enable efficient, cost-effective fabrication of low mass, closed-back mirror designs; 2) leveraging affordable low CTE mirror materials such as CLEARCERAMÂ®-Z along with stable inorganic bonding materials; and 3) optimization of the mirror production supply chain, including materials, assembly,

and manufacturing processes, leading to lower costs and reduced delivery schedules when compared to the current state of the art for lightweight mirror production. The combination of these initiatives will enable design trades, analyses, assembly and production processes for two (2) unique-design 760 mm diameter mirrors. Each design will deliver low mass, ultra-stable, rapid, affordable mirrors for consideration of potential thermal stability testing and evaluation by NASA.

Duration: 24

Proposal Details

Proposal Number: S12.04-1008
Subtopic Title: Astrophysics
Proposal Title: Polishing Iridium Coatings for Zero-Net-Stress

Small Business Concern

Firm: OptiPro Systems, LLC
Address: 6368 Dean Parkway, Ontario, NY, 14519-8970

Summary Details

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

The next generation of space-based X-ray observatory missions require low-cost, low-weight, high-precision grazing-incidence mirrors with high reflectivity in the < 10 keV X-ray band. The two primary approaches to meeting this engineering challenge are full shell mirrors and segmented mirror arrays. In the proposed Phase II project, OptiProâ€™s primary focus will be on further reducing the cost and cycle time for the segmented mirror array approach. While much of the fabrication process for silicon mirror segments has been reduced to practice, distortion due to iridium coating stress remains a significant source of mission cost and risk. Currently, the issue of segment distortion due to coating stress is resolved with an eight-step process. These steps are silicon oxide layer deposition, initial acid-etching, magnetron-sputtered iridium coating, thermal annealing, surface metrology, calculation of stress compensating silicon oxide layer, fabrication and application of acid-etching mask, and final acid-etching on back side. In this Phase II project,

OptiPro will investigate a much simpler two-step process to significantly reduce mission cost and risk. In the proposed process, a uniform iridium coating is deposited on all sides of the segment using Atomic Layer Deposition (ALD), which is a commercially available process. This uniform distribution of iridium results in a zero-net-stress segment free of distortion. However, the surface roughness left behind by the ALD process is out of specification by several angstroms. Using a novel polishing technique closely related to Elastic Emission Machining (EEM), OptiPro has demonstrated the ability to improve the surface roughness of ALD iridium coated mirror segments. The Phase II funding will be used to fully develop this promising polishing process. The outcome of this project will help inform and possibly enable future X-ray missions, building on an otherwise low-cost, low-risk approach to building X-ray observatories.

Duration: 24

Proposal Details

Proposal Number: S12.06-1010
Subtopic Title: Astrophysics
Proposal Title: Vertically Integrated Silicon Carbide/Silicon Detectors and Detector Arrays for UV/Vis Multicolor Sensing

Small Business Concern

Firm: CoolCAD Electronics, Inc.
Address: 7850 Walker Dr., Greenbelt, MD, 20770-3234

Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 4 - 5
Technical Abstract (Limit 2000 characters):

We propose to build vertically-integrated Silicon Carbide/Silicon (SiC/Si) spectrometry arrays for high-responsivity and performance Ultraviolet/Visible (UV/Vis) sensing in the ~200-1100 nm range. The effort includes identifying the requirements for individual sensors, fabricating custom SiC photodiode arrays for the purpose, developing the integration scheme (including stack assembly techniques), and readout circuit development and integration. The effort also

includes roadmap creation to scale this approach to higher resolution and 2-D arrays, and developing spectroscopic/imaging applications, with significant enhancements to NASAâ€™s capabilities in Planetary & Earth science, astrophysics, and heliophysics. For applications requiring increased spectral range, multi-spectral detectors with one sensor array (for shorter-wavelength light, SiC in our case) mounted over a second sensor array (for longer wavelengths, Si in our case) allow measurement and detection with a more compact device. The proposed technology, a multispectral spectrometry sensor array with enhanced capabilities, addresses the need in the 2026 Civil Space Shortfall List for â€œadvanced remote sensing and science measurements with improved sensing capabilities and autonomy.â€ With its fully vertically-aligned sensors helping avoid problems such as image shifting and signal attenuation, while providing a wider spectral range with better sensitivity optimization and opportunities for verification, this is an enabling technology for e.g. compact handheld instrumentation for Lunar/Martian exploration, more accurate surface and atmospheric analysis, and remote monitoring. Target commercial markets include defense applications (such as rocket plume detection), biological and health applications (such as sterilization, water purification, laser surgery monitoring and feedback), industrial applications (flame detection, combustion control), semiconductor fabrication equipment applications, and metrology.

Duration: 24

Proposal Details

Proposal Number: S13.01-1001
Subtopic Title: Planetary Science
Proposal Title: HERA: A Cost-Effective and High-Performance Robotic Arm Architecture for Versatile Space Applications

Small Business Concern

Firm: Sol Robotics, Inc.
Address: -

Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 3 - 4

Technical Abstract (Limit 2000 characters):

Sol Robotics is developing HERA, a cost-effective robotic arm architecture for non-terrestrial mobility, manipulation, and sampling under NASA SBIR subtopic S13.01. HERA uses a Hyper Extension-Retraction Actuator: a compact, all-electric linear actuator that deploys a coiled structural member into a rigid extended beam. Two HERA actuators arranged in a pin-jointed truss carry load primarily in tension and compression rather than bending, which significantly improves load-carrying capability over conventional serial-chain manipulators at long reach. With a turret and wrist, this architecture forms a long-reach 6-DoF robotic arm that stows compactly, reaches large workspaces, and carries useful payloads while reducing backlash sensitivity and cost. The purpose of HERA is to provide a lower-cost, multi-mission manipulation platform for surface robotics where reach, compact stowage, payload capacity, and precision are all constrained. Phase I established analytical feasibility against key space-environment risks, including buckling, thermal-vacuum exposure, regolith ingress, and radiation. Phase II funding will be used to design, fabricate, and environmentally verify a TRL-4 capability unit through truss-level structural validation, deployment testing, thermal-vacuum cycling, dust-chamber endurance testing with lunar simulant, controls and hardware-in-the-loop testing, and radiation modeling to support a Phase III beam-screening and flight-forward qualification plan. HERA directly addresses S13.01â€™s focus on robotic mobility, manipulation, and sampling, including novel robot arm designs that enable cost-effective multi-mission versatility. The Phase II effort will mature the core arm architecture and environmental-risk mitigations needed for future NASA infusion while preserving a shared component base with terrestrial systems, reducing cost and improving supply-chain maturity for future space-qualified versions.

Duration: 24

Proposal Details

Proposal Number: S13.01-1009
Subtopic Title: Planetary Science
Proposal Title: Photonically Sensorized Robotic Subsurface Sampling System

Small Business Concern

Firm: Intelligent Fiber Optic Systems Corporation
Address: 46608 Landing Pkwy, Fremont, CA, 94538-6420

Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 5 - 6
Technical Abstract (Limit 2000 characters):

IFOS will work with Stanford Universityâ€™s Center for Design Research (CDR) and Honeybee Robotics (HBR) to advance a robotic system with optical fiber-based physical sensing capabilities (particularly force, vibration, texture and temperature) for rover rotating components. The robotic system RoverSenseï*f*" will be designed for facilitating determination of surface and subsurface properties first on the Moon â€" particularly near the South Pole (e.g., Shakleton and surrounding craters), followed by Mars, and eventually Enceladus, Europa, Titan and Triton. In Phase I, a feasibility prototype including sensorized rotary components (rover wheels and drills) with the capability to operate on laboratory samples was demonstrated. In Phase II, two engineering prototype systems will be developed including fiber optically sensorized lunar compatible wheels and drills.

Duration: 24

Proposal Details

Proposal Number: S13.03-1014
Subtopic Title: Planetary Science
Proposal Title: -200Â°C Rad hard Cold Capable Thermally multiplexed controller

Small Business Concern

Firm: Kouros Sariri
Address: 15302 Bolsa Chica St., Huntington Beach, Ca 92649, Huntington Beach, CA, 92649-1245

Summary Details

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

The proposed novel effort aims at design and fabrication of unique microcircuit

blocks that enable radiation hardened and cold capable performance (-200C to +125C). While adhering to the conceptual model of Proportional Integral Controller, our 180nm CMOS RHBD circuit design intends to be implemented based on the successful studies performed in Phase I. The circuit design includes an adaptive feedback loop which drives to thermally stabilize an electronic component or sensor via a sub-miniature micro-heater. The target temperature is set based on the requirement of the subjected component while the response of a miniature RTD temperature sensor element is monitored in the thermal convergence process until the target temperature is achieved. The ASIC design utilizes radiation by design and SEL mitigation design methods. The ASIC design will yield standalone linear low-dropout voltage regulator (LDO), which is continuously monitors for anomalous increases in supply current, and any rapid changes in supply current as a result of a single event latch-up. The third circuit block is a trans-impedance resonator driver and buffer. In phase I we produced real working model of the same control loop functional blocks by using commercially available components to thermally stabilize a miniature crystal oscillator and demonstrated a frequency stability in parts per billion range. For Phase II, the proposed effort intends to fabricate the described ASICs to be used in the thermally monitored closed loop. The advantage of this design approach will be two dimensional. while we will apply the yielded devices to fabricate miniature precision clock with 1cc volume, there will be standalone cold capable and rad hard ASICs like PWM, and LDO which includes single event mitigation feature. Precision clock will be adaptable to wide range of operating frequencies while retaining cold capable performance. The additional standalone ASIC will perform single event latch-up mitigation (SELM).

Duration: 24

Proposal Details

Proposal Number: S13.04-1013
Subtopic Title: Planetary Science
Proposal Title: In-Situ Radioisotope Sterilization for Backward and Forward Contamination - Enabling low-mass, Low-Complexity Solutions for Planetary Protection

Small Business Concern

Firm: G21 Nucleonics Inc.
Address: 12757 12th Ave NE, Seattle, WA, 98125-4012

Summary Details

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

G21 Nucleonics proposes Phase II development of in-situ radioisotope sterilization for Mars Sample Return (MSR) planetary protection. The technology places a low activity radiation source inside the Orbiting Sample container before launch. The source passively accumulates 100-200 kGy over the 22-month Earth return transit at 2-6 mGy/s. Samples arrive sterilized; containment failure is no longer a planetary protection failure which enables novel mission architectures that greatly reduce cost. The Phase I (Contract 80NSSC25C0208) demonstrated feasibility: MCNP dose modeling confirmed sterilization at sub-A2 activity levels (which means it is realitively easy to license), a 286-intersection science impact matrix showed 93% of sample science preserved at 100 kGy, and a regulatory roadmap established the non-SNS licensing path. TRL advanced from 2 to 3. Phase II conducts a 60-week irradiation experiment at JPL's Low Dose Rate Facility at three Co-60 positions (5.5, 2.8, and 1.4 mGy/s). The experiment produces the first validated D10 values in this regime for B. pumilus, B. atrophaeus, and D. radiodurans at the low dose rate and provides strong experimental validation data for meeting planetary protection, raising the TRL of the fundamental technology. In addition Three Mars-analog geological samples are co-irradiated to ~200 kGy for pre/post analysis to assess gamma radiation effect on Mars analog samples of interest compare to samples currently in the cache on Mars. A design maturation study works toward TRL5 for a deign by having a SRR, notional design trade study down select on the design, hardware coating development, and a Conceptual Design Review. Commercialization tasks perform a market study, meeting with partners and customers, and issuing a final business plan with a roadmap for commercialization.

Duration: 24

Proposal Details

Proposal Number: S13.05-1011
Subtopic Title: Planetary Science
Proposal Title: Lunar Materials Analyzer (LuMA)

Small Business Concern

Firm: eXaminArt LLC
Address: 17 E Toole Ave, TUCSON, AZ, 85701-1209

Summary Details

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

Optimizing lunar regolith ISRU and construction processes requires the knowledge of the raw materials composition. We propose to develop a Lunar Materials Analyzer (LuMA) which primary functions are to monitor the mineral phase composition and the elemental composition of a lunar regolith feedstock of ISRU or construction processes. LuMA uses X-ray diffraction (XRD) and X-ray fluorescence (XRF), two analytical techniques that are well proven and have already been developed for in-situ planetary science. This SBIR will 1) adapt proven planetary science instrument technologies to the constraints and requirements of in-line analysis, 2) develop a robust robotic sample handling system for maintenance-free operation on the surface of the moon over periods exceeding one year, 3) automate XRD and XRF data interpretation, 4) evaluate the potential of XRD/XRF analyses to predict regolith softening and melting points. The Phase II research will focus on the design of sampling stages for transmission XRD and XRF, the construction and test of robotic XRD and XRF modules, and the development of XRD and XRF data analysis pipelines for automated analysis. Foreseen NASA markets are future ISRU applications, missions intended to identify/quantify resources, and robotic or astronaut-operated instruments for in-situ science. Commercial markets are automated applications of XRD and/or XRF for in-line monitoring of raw materials or products, in industries such as cement, mining, petroleum, pharma, food, etc.

Duration: 24

Proposal Details

Proposal Number: S13.06-1002
Subtopic Title: Planetary Science
Proposal Title: Rad-hard Electronic Control and Power Integrated Circuit for Stirling-based Radioisotope Power System

Small Business Concern

Firm: Alphacore, Inc.
Address: 304 S. Rockford Drive, Tempe, AZ, 85288-3052

Summary Details

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

In response to the NASA SBIR topic S13.06 â€œDynamic Power Conversionâ€, subtopic â€œRadiation-hardened electronic controllers and power processingâ€ from 1 to 100 watts, Alphacore Inc. is developing a full Radiation-Hardened (Rad Hard) Controller and Power Management Integrated Circuit (PMIC) chipset for Radioisotope Power System (RPS) free-piston Stirling cycle converter inclusive of Stirling engine, engine controller, and DC/DC converter, yielding a 28V regulated output with total high system efficiency (>30%). This proposal collaborator (subcontractor) Sunpower, Inc. has a long track record in Stirling converters including a 65W converter at TRL6 and a 35W at TRL 4. Alphacore will develop a companion rad-hard PMIC chipset capable to work with Sunpower hardware, both the 65W Sunpower Robust Stirling Convertor (SRSC) and the 35W EE-35. University of California at Berkeley (UCB) Professor Seth Sanders is consulting with Alphacore on the controller design. Our chipset was simulated in Phase I and a complete RPS prototype will be demonstrated in Phase II. The chipset will drive discrete enhancement-mode GaN (eGaN) FETs for the power stage. Alphacore has licensed the NASA C-NAC technology and will utilize it to implement a rad-hard fully analog Stirling converter controller driver PMIC solution. In parallel with the chipsâ€™ fabrication, dedicated plans for characterization and printed-circuit boards (PCBs) are prepared. The test plan and PCBs will allow the two individually packaged chips to be submitted to: 1) overall functionality evaluations, 2) tests to measure and assess performance benchmarks, 3) TID radiation effect evaluations, and 4) single event effect evaluations with heavy ions. The two chips will be tested individually for electrical and rad hard performance. Subsequently, the chips and associated FETs and passives will be mounted on a system PCB and tested with a Stirling engine or Stirling engine emulator.

Duration: 24

Proposal Details

Proposal Number: S14.01-1001
Subtopic Title: Heliophysics
Proposal Title: Improved Probabilistic Forecasts of Solar Energetic Particles with MagPy

Small Business Concern

Firm: Predictive Science Incorporated
Address: 9990 Mesa Rim Road, San Diego, CA, 92121-3933

Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 4 - 7
Technical Abstract (Limit 2000 characters):

Solar energetic particles are a major operational hazard for Artemis, lunar surface operations, Mars mission planning, and robotic spacecraft. Existing SEP forecasting tools provide useful probabilistic guidance but remain limited by incomplete magnetic context, Earth-centric inputs, weak connectivity treatment, and insufficient uncertainty quantification. FOCUS-MagPy addresses these limitations by maturing MagPy, NASA/SRAGâ€™s Python-based evolution of MAG4, into a connectivity-aware, multi-vantage SEP forecasting framework. Phase I demonstrated feasibility by reproducing baseline MagPy behavior, adding MHD field-line tracing to connect active regions with observers at Earth and Mars, introducing field-line bundle uncertainty estimates, incorporating HipFT and Carrington-map magnetic representations, and developing retrospective validation workflows. Phase II will refine these capabilities into an operational prototype. The work will extend MAS connectivity solutions beyond 1 AU, develop MHD ensemble connectivity estimates, propagate connectivity uncertainty into SEP forecast probabilities, and test whether connectivity-aware forecasts improve skill relative to connectivity-blind baselines. It will also incorporate global magnetic maps from HipFT, selected Solar Orbiter/PHI data, active-region characterization, >100 MeV forecast extensions, statistical and machine-learning predictors, and tailored validation metrics. Retrospective and quasi-near-real-time testing will quantify forecast accuracy, reliability, Brier skill, contingency-table performance, all-clear skill, and uncertainty calibration. The Phase II deliverable will be a documented, robust framework with improved probability estimates, multi-point forecast products, all-clear and threat-gauge outputs, uncertainty estimates, validation reports, and visualization tools. The expected maturity advance is from TRL 4 at Phase II start to TRL 7 at completion.

Duration: 24

Proposal Details

Proposal Number: S14.01-1022
Subtopic Title: Heliophysics
Proposal Title: Producing a Benchmark HASDM Forecast Density Database

Small Business Concern

Firm: Space Environment Technologies
Address: 528 Palisades Dr., Pacific Palisades, CA, 90272-2844

Summary Details

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

Low Earth Orbit (LEO) is becoming increasingly congested raising the risk of unintentional collisions and the potential for cascading events such as the Kessler syndrome. Despite these challenges, there is no consensus among agencies or industry on how best to quantify and predict thermospheric density changes that drive satellite drag. This proposal addresses the need for accurate, validated, and agreed-upon thermospheric density models to improve current and predicted drag estimates. To support forecasting improvements, this Phase II will create and publicly release two first-ever HASDM forecast density databases: a) a 15-year legacy database, and b) an 11.5-year next-generation database. These will provide a baseline of legacy and current U.S. operational capabilities and, building on the success of the existing nowcast database, can enable community-wide density forecasting research and development. In Phase I the 2000-2019 SET HASDM nowcast density database was extended through 2025 and will be further extended to 2028 in Phase II. This database (https://spacewx.com/hasdm/) is widely used in the international density modeling community as the de facto global density baseline. Additionally, a Machine-Learned (ML) surrogate model of HASDM, called HASDM-Sol(+), will be fully developed, validated, and launched commercially to provide the community and satellite operators with near real-time density nowcasts and forecasts. In addition to providing free public access to the HASDM nowcast and forecast databases on SETâ€™s website, a commercial platform will be developed to host value-added services. The goal is a commercial SET website that maintains free access to the HASDM databases while offering paid access to advanced products, including near real-time HASDM-Sol densities and interpolated HASDM densities along user-defined satellite orbits. This platform represents the primary commercialization pathway for the proposed SBIR work.

Duration: 24

Proposal Details

Proposal Number: S14.02-1009
Subtopic Title: Heliophysics
Proposal Title: Meta-optic Spectropolarimeter For Heliophysics Imaging

Small Business Concern

Firm: Nanohmics, Inc.
Address: 6201 E. Oltorf St., Ste.400, Austin, TX, 78741-0000

Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 4 - 5
Technical Abstract (Limit 2000 characters):

Spectropolarimetric measurements show great promise for heliophysics in many wavelength regimes, including for observing hydrogen-alpha (H-alpha) emissions in solar flares, or UV features of the K-corona. Nanohmics is developing a high-performance imaging spectropolarimeter with low size, weight, and power (SWaP), based on a light-weight, microfabricated multifunction meta-optic. Nanohmicsâ€™ spectropolarimeter combines a commercial off-the-shelf (COTS) focal plane array (FPA) with a single meta-optic that collects polarization, spectral, and one-dimensional (1D) imaging data simultaneously at a high frame rate with hyperspectral resolution, but with a mass and volume approximately 1/10 of that of existing spectropolarimeters. The successful SBIR Phase I brassboard spectropolarimeter (contract 80NSSC25C0268) was the first step toward adapting this meta-optic technology to H-alpha and other visible (VIS) spectral bands for heliophysics missions. In Phase II, Nanohmics proposes to advance the brassboard to the prototype stage through ruggedization, laboratory testing, and field testing, advancing it to TRL 5 and delivering it to NASA. Meta-optic microfabrication will shift from Si to titania (TiO2), which is compatible with the full VIS band and into the UV. A scaled-up meta-optic will increase measurement precision and light collection. The low SWaP of the spectropolarimetric imaging meta-optic camera â€“ SPIM-Cam â€“ will make it valuable for CubeSats and other SWaP-constrained vehicles. It can be integrated into NASA heliophysics missions, such as monitoring

coronal magnetic field strength via the polarized Zeeman effect, for accurate space weather forecasting. For NASA transition, Nanohmics will find partners including large integrators for longer-term commercialization of sensors based on multifunction meta-optics. Meta-optic fabrication using standard CMOS microfabrication techniques will reduce costs and provide a rapid route to commercialization.

Duration: 24

Proposal Details

Proposal Number: S15.02-1000
Subtopic Title: Biological & Physical Sciences
Proposal Title: Automated Nucleic Acid Extraction in Space

Small Business Concern

Firm: ANTA Biotechnologies Corporation
Address: 9276 Scranton Road, San Diego, CA, 92121-1723

Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 5 - 6
Technical Abstract (Limit 2000 characters):

ANTA Biotech will develop a spaceflight-ready automated, gravity-agnostic platform for DNA and RNA extraction and library preparation that closes the critical sampleâ€‘prep gap blocking routine in situ sequencing in space. The proposed Phase II effort will use NASA funding to advance proprietary biochemistry from reducedâ€‘gravity feasibility into mission-ready protocols and hardware prototype supporting mammalian-cell RNA workflows and environmental monitoring for crew and crop health on the International Space Station (ISS), future commercial space stations, and Artemis lunar surface missions. WRKR-B replaces crewâ€‘intensive, gravityâ€‘dependent lab techniques with a closed system that integrates multiple variables to execute endâ€‘toâ€‘end nucleic acid extraction and longâ€‘read library preparation in any gravity regime using nonâ€‘toxic, nonâ€‘flammable chemistries compatible with crewed spacecraft. Phase II will: (1) engineer and validate automated mammalian-cell RNA extraction; (2) engineer and

validate automated mammalian-cell sequencingâ€‘ready RNA library-prep workflows; (3) demonstrate spaceflight-relevant multi-omics sequencing workflow for spacecraft environmental monitoring using representative samples; (4) validate room-temperature stable nucleic acid preservation system; and (5) deliver a reducedâ€‘gravityâ€‘optimized WRKR-B hardware prototype for NASA partner alpha testing. Target markets include space biotechnology, in situ research, biomanufacturing in low Earth orbit and lunar environments, as well as terrestrial â€œground controlâ€ labs, austere settings, and decentralized genomics applications that require safe, automated sample prep without large liquid handlers or hazardous reagents. This dualâ€‘use architecture leverages NASA investment to unlock a scalable commercial platform that advances omics autonomy in space while addressing a broad Earth market for robust, automated nucleic acid preparation.

Duration: 24

Proposal Details

Proposal Number: S15.02-1013
Subtopic Title: Biological & Physical Sciences
Proposal Title: High-sensitivity Quantum Spectrometer for Autonomous Biological Analysis

Small Business Concern

Firm: QuSpectra Inc
Address: 1941 Columbia St, San Diego, CA, 92101-2272

Summary Details

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

QuSpectra is developing a chip-scale quantum NMR spectrometer that performs molecular analysis of picoliter liquid samples without cryogens, hyperpolarization, or shielded rooms. The instrument uses nitrogen-vacancy (NV) centers in diamond to detect oscillating magnetic fields from nearby nuclear spins, and runs two complementary modes on shared hardware: spin-noise spectroscopy for quantitation, and J-coupling spectroscopy for chemical identification at fields below

100 mT. A monolithic diamond microfluidic chip places the analyte directly on the NV sensing layer, eliminating the standoff and contamination pathways of prior NV-NMR demonstrations. Phase I delivered a 46 g integrated controller and validated ODMR, Tâ, relaxometry, and vector field sensing on the quantum prototype. Phase II funding will (i) upgrade the FPGA firmware and add the audio-band RF-NMR drive chain for both detection modes, (ii) fabricate the three-piece diamond/fused-silica microfluidic assembly at UCSD Nano3, (iii) integrate the controller, carrier, and Halbach pre-polarization stage into a â‰¤200 g engineering unit, and (iv) demonstrate dual-modality detection on NASA-relevant analytes cross-validated at NASA JPL and the USC Clay Wang Lab under signed LOIs. The target NASA applications are crew health and metabolite monitoring on ISS, Gateway, and exploration vehicles; biosignature and organic-molecule detection on Ocean Worlds, Mars, and small-body missions; and planetary protection assays for spacecraft assembly and sample-return curation. Commercial target markets are staged: California olive oil and wine authenticity testing as the beachhead (Years 1â€“3); pharma R&D and natural-products discovery (Years 3â€“4); and clinical diagnostics via the RUO and CLIA-LDT pathway (Years 4â€–5), addressing a combined SAM of ~$2.7B across food authenticity, NMR instrumentation, and adjacent verticals.

Duration: 24

Proposal Details

Proposal Number: S15.03-1007
Subtopic Title: Biological & Physical Sciences
Proposal Title: Autonomous Platform for Phyllosphere Monitoring in Space Habitats

Small Business Concern

Firm: Advanced Growing Resources
Address: 447 Vosburg Road, Webster, NY, 14580-1040

Summary Details

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

Advanced Growing Resources, Inc. (AGR) proposes a zero-consumables autonomous platform enabling long-duration space crews to grow, protect, diagnose, treat, and harvest fresh food without chemical inputs, consumables, or ground support. The platform integrates three technologies: Heliosâ„¢, a 17-channel biofeedback-controlled LED luminaire adapting its spectral recipe to crop response in real time; CropSightâ„¢, an AI diagnostic pipeline detecting disease presymptomatically at 99% confidence-routed accuracy with 8-day pre-symptom lead time; and a 222 nm far-UVC germicidal system eliminating surface pathogens without chemicals, dark periods, or crew evacuation. The platform addresses three documented gaps in NASA's crop production capability: chemical pesticides are incompatible with closed-loop life support systems; current fixed-channel LED arrays cannot serve multi-crop production; and batch-harvest scheduling creates labor spikes that space habitat crews cannot absorb. Phase II funding supports live grow experiments on NASA-priority crops to validate biofeedback spectral control and derive Helios II from experimental results; dose-response validation of 222 nm far-UVC treatment on lettuce and tomato; expansion of CropSightâ„¢ to 18 crop species and an end-to-end astronaut workflow demonstration with serialized harvests and zero cold storage. Deliverables include five Helios II prototype units, validated biological datasets, an 18-crop diagnostic knowledge base, pre-compliance EMC and radiation characterization, and a Phase III certification pathway. Primary NASA target: bioregenerative life support for ISS, Gateway, and Mars transit. Commercial targets include controlled environment agriculture and open-field precision agriculture diagnostics at $2 per acre per season.

Duration: 24

Proposal Details

Proposal Number: S15.03-1010
Subtopic Title: Biological & Physical Sciences
Proposal Title: Portable Major and Trace Constituent Gas Analyzer for Habitable Environments

Small Business Concern

Firm: Guardion, Inc.
Address: 151 South Bedford Street, BURLINGTON, MA, 01803-5295

Summary Details

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

This project will design and build a prototype mass-spec instrument with a single pump suitable for future miniaturization to handheld size. This will be used to monitor major gas constituents (Oxygen, CO2, etc.) and also trace contaminants that are difficult to detect. It will also be useful for monitoring biological experiments through volatile organic compound identification, and water-systems health by monitoring contaminants there. The instrument leverages Guardionâ€™s ultrasensitive 2D material charge detector, developed in a prior NASA SBIR project, with sensitivity rivaling electron multipliers, which operates at the higher pressures achievable by single pump solutions. The detector sensitivity at high pressure is what unlocks the ability to construct the instrument, as Faraday cup/ transimpedance amplifiers simply are not sensitive enough at pressures >10 mTorr and electron multipliers can not be used >1E-4 Torr. This allows sensitivity to lower ion currents, making high pressure mass-spec at normal mass-spec sensitivity and resolution (<1 Dalton). A short, high frequency quadrupole mass filter will be integrated with custom ionization and backend detection using the Guardion charge detector to develop a standalone instrument. Multiple ionization methods will be tested along with multiple vacuum pump options and filter drive schemes to arrive at an instrument with detection levels less than 100 ppb for trace gas identification, as required by Spacecraft Maximum Allowable Concentrations (SMAC) of certain dangerous compounds. Components will be used with SWaP values suitable for a miniature instrument when optimized (<5 kgs, battery operated, handheld).

Duration: 24

Proposal Details

Proposal Number: S16.03-1004
Subtopic Title: Crosscutting Hardware
Proposal Title: Active Spacecraft Jitter Cancellation Using Deployable Panels

Small Business Concern

Firm: Samara Aerospace
Address: 901 Minnesota St., San Francisco, CA, 94107-3011

Summary Details

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

Samara Aerospace proposes to advance its Multifunctional Structures for Attitude Control (MSAC) technology by integrating, validating, and environmentally qualifying an active noise cancellation (ANC) system for spacecraft jitter suppression using deployable panels. MSAC embeds piezoelectric actuators into deployable solar panel hinges, enabling the panels themselves to serve as both attitude control actuators and active vibration cancellation devices, eliminating the need for dedicated reaction wheels or passive isolation hardware. This Phase II will advance the specific multi-axis active noise cancellation MSAC capability from TRL 3 to TRL 6. Phase I demonstrated the feasibility of MSAC ANC using a two-panel Hummingbird Engineering Model testbed, achieving substantial jitter cancellation in simulation and RMS jitter reduction in open-loop hardware testing, exceeding the Phase I target with two validated controller candidates. Phase II funding will be used to integrate the Phase I ANC software onto flight-validated MSAC hardware; validate multi-axis closed-loop ANC performance under realistic observer noise, controller latency, and ADC quantization; qualify the ANC chain through vibration and radiation testing; and derive empirical scaling laws across panel counts producing a mission-sizing design space map. A precision inter-panel timing synchronization subsystem, the key new technical element enabling coherent multi-panel ANC, will be developed and characterized as part of Phase II. Target markets include NASA science observatories, optical communications relay platforms, and commercial and defense SmallSat operators requiring ultra-stable pointing.

Duration: 24

Proposal Details

Proposal Number: S16.03-1008
Subtopic Title: Crosscutting Hardware
Proposal Title: KEYAN: an Event-Driven High Angular Rate Star Tracker

Small Business Concern

Firm: Lynntech, Inc.

Address: 2501 Earl Rudder Freeway S, College Station, TX, 77845-7384

Summary Details

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

CubeSats have emerged as vital tools for remote sensing, particularly for Earth's atmosphere and surface, yet their compact size poses a challenge for sensors which incorporate rapidly spinning antennas. We propose the development of a CubeSat-ready star tracker capable of providing accurate attitude information to rapidly spinning CubeSats hosting Earth-observing instruments. Current star trackers offer high pointing accuracy under stable conditions but struggle with rapidly spinning platforms. Our solution addresses this critical gap by developing a compact, low-power star tracker that maintains precision even at high spin rates, enabling CubeSats to acquire accurate Earth observation data. The proposed star tracker aims to achieve a pointing accuracy of 0.05Â° or better across roll, pitch, and yaw axes while the CubeSat spins at up to 20 revolutions per minute (rpm) in low Earth orbit. This capability is essential for off-nadir observations necessary for retrieving ocean surface winds and other atmospheric parameters. We will ensure the SmallSat readiness of the tracker, targeting SWaP (Size, Weight, and Power) characteristics comparable to existing CubeSat payloads. Phase I focuses on demonstrating technical feasibility, outlining a clear path for Phase II integration and testing. Phase II will involve developing a laboratory-tested to space-qualified hardware prototype of the star tracker, reaching TRL 5 to 6. This project aligns with NASA's goals of advancing CubeSat technology for Earth observation, with potential applications in oceanography, meteorology, and environmental monitoring. By enhancing CubeSat attitude control capabilities, this project contributes to the broader objective of improving space-based remote sensing and scientific research.

Duration: 23

Proposal Details

Proposal Number: S16.04-1007
Subtopic Title: Crosscutting Hardware
Proposal Title: Stratospheric Balloon Free-Space-Optical Communication (SB-FSO)

Small Business Concern

Firm: Torrey Pines Logic
Address: 10505 Roselle St. , San Diego, CA, 92121-1553

Summary Details

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

Stratospheric Balloons or stratostats are a dynamic low-cost platform that carry a wide variety of payloads and instrumentation to altitudes between 27 km and 46 km (90000 ft and 150,000 ft) above sea level. These platforms are primarily used for data collection missions such as space research (ASTHROS and GUSTO) (NASA, 2022), (NASA, 2023), weather research, geological survey, investigation of high-altitude atmospheric phenomenology (BARREL) (NASA, 2017), and defense applications. As payload instrumentation and sophistication evolve, the amount of data collected rapidly increases. Offloading large amounts of data, while in flight, has become critical for many missions. A gap exists in reliable high-data-rate, low power, and low-cost orbit / sub-orbital craft to ground communication links. While relatively low-cost, RF X and Ka band communications have low data rates and scale poorly. High data rate RF solutions are especially power hungry. Free space optical communication (FSO) solutions solve the data rate-power efficiency problem but are usually either low reliability or exceedingly expensive. There are several players in the LEO (low earth orbit) satellite space, and notable among them is Kepler Communications (Kepler Communications, n.d.) in Ontario, Canada. But the cost model is a prohibitive long-term mass market that recoups COTS and launch costs through subscriptions. To fill the gap, TPL proposes developing a long-distance FSO communications payload and ground-station system that can offload significant amounts of data from operational stratospheric balloons. TPL has completed a Phase I feasibility study and created a blueprint for a low power, reasonably priced optical wireless communication payload that can offload sensor data to truck-portable ground stations; while the stratospheric balloon passes overhead. We researched two technological paths forward for high-speed development and generated a suggested roadmap.

Duration: 24

Proposal Details

Proposal Number: S16.05-1003
Subtopic Title: Crosscutting Hardware
Proposal Title: Innovative Advances in Coatings for Extreme Environmental Thermal Radiators and Complex Surfaces

Small Business Concern

Firm: Applied Material Systems Engineering Inc. (AMSENG)
Address: -

Summary Details

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

This Phase II proposal fulfills the technology validation needs and provides the reliability data for the durable, stable thermal control material systems (TCMS) coatings that are Operator-sprayed with needed structural/adhesive tolerance to coating thickness variation and is dust shedding in charging environments and can furthermore survive and operate in the extreme environments. The recent efforts at AMSENG for the Lunar Applications indicated that the Charge Dissipating TCMS based on the secondary emission engineering are the promising and have very low dust sticking ability to the lunar simulant dust. This proposal extends this work towards required reliability in the developed coatings for the extreme environments with the requirements of the Operator-sprayed coatings with needed tolerance to coating thickness variation while meeting the thermal cycling vacuum environments and have the space stable optical, dissipative performance. The innovative Coatings are: Cementacious Binders with the Pigments: PZTâ„¢, Y2O3 and BNNMâ„¢ filled cured above RT at â‰¤ 150Â°C. Thus, the proposed efforts can address the Qualification and Validation studies for the advanced dust shedding TCMS coatings for the Lunar and Mars Extreme Environments through: â€¢ Process Newly Designed Cementacious Sols for the Shelf life with PZTâ„¢, Doped Zn/ Mg:Î²AGOâ„¢ and Synthetic Low EOL Pigment Concepts for the passivated Y2O3, PS-M6, and Y2Ga5O12 â€¢ Process Selected Pigments with New Rad Hard Cementacious Sol concepts with Elevated Temperature Cure iterations. â€¢ Provide the Dust Shedding TCMS coatings concepts for Thermal Control for durable long life and harsh extreme environments â€¢ Evaluation and selection of low cost coating processing options, with validation proof through GEO simulation, and Dust Simulation â€¢ Qualify and recommend through Validation efforts for the Reliable Material Systems and the processing options (SOPs & Protocols) for Lunar / Mars Mission hardware

Duration: 24

Proposal Details

Proposal Number: S16.07-1012
Subtopic Title: Crosscutting Hardware
Proposal Title: Low Vibration Cooling Technology for IR Detectors

Small Business Concern

Firm: Creare LLC
Address: 16 Great Hollow Road, Hanover, NH, 03755-3116

Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 4 - 5
Technical Abstract (Limit 2000 characters):

Cutting edge space detector technologies rely on low noise sensors that require operation at extremely low temperatures and with virtually no vibration. Examples of these technologies include infrared detectors and low noise amplifiers. Future deep space missions, including the Habitable Worlds Observatory, will benefit from enhanced cryocooler technology that delivers efficient low temperature cooling with virtually no vibration. On this program, we will develop an ultra low vibration cryocooler configured for the thermal and jitter requirements needed for deep space telescopes similar to the Habitable Worlds Observatory. Our cryocooler is a hybrid cryocooler that simultaneously delivers 100 mW at 4.5 K for cooling a lower temperature cryocooler and several watts of cooling at higher temperatures for intercepting heat. The focus of this effort will include demonstrations for low exported vibrations of a prototypical cryocooler, as well as cryocooler design and optimization. Successful completion of the effort will allow advanced detector technologies to be utilized on future space science missions.

Duration: 24

Proposal Details

Proposal Number: S16.08-1005
Subtopic Title: Crosscutting Hardware
Proposal Title: Atomic beam quantum sensor on a chip

Small Business Concern

Firm: 8Seven8, Inc.
Address: 316 E Pharr Rd, Decatur, GA, 30030-4404

Summary Details

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

8Seven8 is developing a new class of low size, weight, and power (SWaP) quantum sensors for future NASA missions and commercial precision sensing applications. The proposed technology, SA-BISCUIT (Slow Atom Beam Inertial Sensing Chip Using Interferometer Technology), replaces bulky cold-atom systems with lithographically fabricated MEMS atomic-beam devices integrated with photonic integrated circuits (PICs). The architecture enables compact atom interferometers and quantum sensing systems suitable for spacecraft, planetary missions, and autonomous platforms. Current state-of-the-art cold-atom systems require centimeter-scale 2D MOT architectures, high electrical power, and large vacuum packages, limiting deployment on smaller spacecraft. 8Seven8â€™s chip-scale directed atomic-beam approach uses stimulated bichromatic-force slowing and integrated photonics to dramatically reduce SWaP while maintaining science-grade atom flux and interferometric performance. Funding will support fabrication and laboratory validation of two modular hardware deliverables: (1) a compact cooling package capable of generating and slowing high-flux rubidium atomic beams, and (2) a chip-scale atom interferometer package for inertial sensing demonstrations. The Phase II effort will mature the technology from TRL 3 to TRL 4 through wafer-scale packaging development, optical integration, vacuum validation, and atom interferometry testing. Target markets include NASA and other government agencies pursuing quantum-enabled sensing, navigation, Earth observation, and planetary exploration systems, as well as commercial markets for GPS-denied navigation, portable atomic clocks, autonomous systems, precision inertial sensing, and high-precision quantum sensors.

Duration: 24

Proposal Details

Proposal Number: S16.08-1008
Subtopic Title: Crosscutting Hardware
Proposal Title: Cooling Lasers for Optical Clocks in Space (CLOCS)

Small Business Concern

Firm: Vescent Technologies Inc.
Address: 14998 W 6th Ave, Golden, CO, 80401-5025

Summary Details

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

A major hurdle to the realization of space-deployed cold-atom optical clocks is the present lack of ruggedized, compact laser sources at clock-relevant wavelengths, particularly (1) high-power lasers for cooling/trapping and (2) low-phase-noise clock lasers to probe ultranarrow clock transitions. In Phase I, this SBIR program has addressed the initial characterization of a MEmbrane eXternal cavity Laser (MEXL) technology that is capable of outputting >500 mW (at 556 nm) of cooling/trapping light, which is essential to the operation of spaceborne optical clocks. Phase II will design, build, and test integrated MEXL systems with fast cavity length transducers, allowing for frequency stabilization of these modules to quantum relevant wavelengths of optical atomic clocks. This particular effort will focus on laser generation at 556 nm which corresponds to Ybâ€™s second stage cooling transition for optical lattice clocks and will leverage NIST-Boulderâ€™s testing infrastructure to validate these laser systems. Improved environmental ruggedization will also be focused on to ensure these units can support optical output powers >500 mW. Vescent will deliver a 556 nm laser system to NASA with documentation and user-training as part of the final deliverable. The proposed solution not only addresses the specific needs for Yb optical lattice clock, but also paves the way for the development of robust lasers sources from the ultraviolet through the near-infrared for atomic species of clocks including Yb+, Sr, Sr+, all of which will be of interest for NASA, government, and commercial quantum applications.

Duration: 24

Proposal Details

Proposal Number: S16.08-1020
Subtopic Title: Crosscutting Hardware
Proposal Title: Nonlinear Optical Converters for Next-Generation Optical Clocks (NOCNOC)

Small Business Concern

Firm: Octave Photonics
Address: 325 W South Boulder Rd, Louisville, CO, 80027-1130

Summary Details

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

We propose to develop Nonlinear Optical Converters for Next-Generation Optical Clocks (NOCNOC). The NOCNOC project will address a critical NASA need for ultra-stable timekeeping in space-based environments by significantly reducing the size, weight, power-consumption, and cost (SWaP-C) of the laser subsystems that currently restrict optical-based clock technologies to the laboratory environment. Our key innovation is the development of a photonic-integrated circuit platform for harmonic frequency conversion to visible and near-ultraviolet wavelengths with record efficiency. While a major strength of the proposed platform is its general applicability to many key quantum systems, NOCNOC will specifically target integration with a Sr+ ion clock targeted for spacecraft use. Phase 2 funding will support the development of ruggedized prototype modules as well as environmental qualification compatible with future spaceflight integration. Beyond NASA, commercial markets for this technology include quantum information processing, secure communications, remote sensing, and spectroscopy.

Duration: 24

Proposal Details

Proposal Number: S16.08-1029
Subtopic Title: Crosscutting Hardware
Proposal Title: A Space-Qualified Optical Frequency Comb with Integrated Nanophotonic Heterodyne Module

Small Business Concern

Firm: Chi3 Optics LLC
Address: 1880 S Flatiron Ct, Boulder, CO, 80301-2873

Summary Details

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

Chi3 Optics is developing a low-SWaP optical frequency comb with wavelength support across the visible, and near-UV. Combining a radiation-hardened modelocked fiber laser and nonlinear nanophotonics based on thin-film lithium niobate (TFLN), our design dramatically reduces the power consumption and footprint necessary for a broadband frequency comb, enabling space-deployed next-generation optical clocks based on Sr and Yb. In Phase I we built a frequency comb based on a nonlinear amplifying loop mirror constructed with radiation-hardened gain fiber, with efficient self-referencing and supercontinuum generation out to <400 nm on TFLN nanophotonics. We demonstrated low phase noise offset-frequency locking (<200 mrad 100-1MHz), sustained even as the laser was subjected to a vibration test with >4g acceleration. In Phase II, we will demonstrate full comb stabilization with optical locking at the Yb+ ion clock wavelength through targeted spectral broadening on a TFLN chip, and deliver a fully packaged prototype designed for direct integration into a Yb+ ion clock. The modular design enables further extensions to stabilize cooling, repump, and lattice lasers, as well as adaptation to other architectures such as Sr+, Sr, and Yb. We will carry out thermal, mechanical, and radiation testing to advance our comb towards space qualification. The product developed in this Phase II will support NASA JPLâ€™s Yb+ miniature space optical clock (mSOC) program, NASA GSFCâ€™s spaceflight compatible optical atomic Sr+ ion clock (OASIC), and development of low SWaP optical lattice clocks with precision of 1E-18, enabling long-term deep-space navigation and future missions (e.g. FOCOS) for clock-based tests of general relativity. It will also benefit quantum industry players interested in the space development of optical clocks, as well as the secondary market of trapped ion/neutral atom quantum computing, which shares core technology and laser stabilization needs with optical clocks.

Duration: 24

Proposal Details

Proposal Number: S17.01-1002
Subtopic Title: Crosscutting Information Systems
Proposal Title: TAU Performance Engineering of HPC and AI Applications Programmed in Julia

Small Business Concern

Firm: ParaTools, Inc.
Address: 135 E 39th Ave., Eugene, OR, 97405-4717

Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 6 - 7
Technical Abstract (Limit 2000 characters):

The increased complexity of exascale high-performance computing systems compared to previous generations creates difficulties in productively creating performant and portable scientific codes. At the same time, there is growing demand for techniques for memory-safe programming to increase confidence in correctness. One approach to solving these problems is the use of high-level programming languages designed specifically to target scientific computing. One such language is Julia, which has recently been gaining popularity in high-performance computing for government, academic and industrial uses. High-level Julia code is lowered to an LLVM intermediate language and then to native code, and may also incorporate native library code and be part of multi-language workflows. To get the best performance from Julia code requires performance tools capable of spanning these levels of abstraction. In Phase I, the TAU Performance System was extended with proof-of-concept Julia profiling for CPU code, NVIDIA CUDA GPUs, and MPI-based distributed applications. Phase II will harden this prototype into a production-quality system: resolving the host/device code cache limitation preventing simultaneous host and GPU instrumentation; reducing instrumentation overhead through LLVM-level optimization passes; extending GPU profiling to AMD ROCm and Intel oneAPI to cover all three exascale GPU vendors; and adding support for Julia's native distributed-computing mechanisms. The APEX performance tool will be extended to profile Julia's task-based concurrency and to enable empirical autotuning of JIT-compiled function variants. The Phase II software will be commercialized as turnkey cloud images via ParaTools Pro for E4S, available across AWS, Azure, OCI, IBM Cloud, and Google Cloud marketplaces. The target

market is all organizations developing scientific codes in Julia.

Duration: 24

Proposal Details

Proposal Number: S17.02-1020
Subtopic Title: Crosscutting Information Systems
Proposal Title: Set-Based Modeling, Visualization, & Trade-Space Exploration for Superior Conceptual System Design Phase II

Small Business Concern

Firm: Targeted Convergence Corporation
Address: 320 Decker Dr #254-03, Irving, TX, 75062-3999

Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 5 - 6
Technical Abstract (Limit 2000 characters):

The proof-of-concept prototype developed in Phase I of this project demonstrated how the â€œcross-cutting challengesâ€ identified by Topic S17.02 Integrated Campaign and System Modeling can be effectively addressed by utilizing TCCâ€™s set-based innovations and software, thereby enabling NASA to more successfully perform conceptual design of the complex system & mission design projects that NASA faces. Further, the prototype demonstrated how TCCâ€™s trade-off solver technology can be used as an active specification of the conceptual design that will effectively bridge the â€œphase transition boundariesâ€ identified by Topic 17.02 as the key â€œgeneric interoperability problemâ€ faced by NASA teams as they get into the later phases of development. The Phase II Proposal then explains how that proof-of-concept can be further developed out in order to become the â€œWorking prototype suitable for demonstrations with compelling case for NASA.â€ that is required as the Phase II deliverable by Topic 17.02. A â€œcompelling caseâ€ of how the â€œphase transition boundariesâ€ are bridged must necessarily include some sort of back-end team using back-end tools to emulate those boundaries such that they can be overcome. Researching how best to do that and then actually implementing that into the new working prototype will be

a key part of the Phase II effort. To not only make that case more compelling to NASA engineers, but also to enable NASA teams to more quickly and effectively adopt that approach they find so compelling, the Phase II effort will develop training-quality documentation of that working prototype. Not only will that benefit NASA, that will also benefit TCCâ€™s commercialization efforts, as a lack of real-world examples that can be publicly released is one of TCCâ€™s key hurdles to wider adoption. Beyond NASA, the size of the potential market (all engineering organizations developing physical products with complex trade-offs) is in the billions of dollars.

Duration: 24

Proposal Details

Proposal Number: S17.03-1001
Subtopic Title: Crosscutting Information Systems
Proposal Title: Mission Assurance and Risk Mitigation in the Design of Autonomous Systems using Fault Management

Small Business Concern

Firm: Qualtech Systems, Inc.
Address: 100 Corporate Place, Rocky Hill, CT, 06067-1803

Summary Details

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

QSI is developing techniques to â€œintegrate disjoint FM dataâ€, provide â€œcapabilities for risk engineeringâ€, and â€œperform Mission Assurance tradesâ€ focused on â€œSystem Autonomyâ€. The main focus of this effort is to (1) capture diverse and disjoint data products and multi-source Failure Mode And Effects Analysis (FMEA) information into TEAMSÂ® for standardizing FM techniques and processes, (2) develop an FMEA exchange tool that can interchange information in various source formats, and import into TEAMSÂ®, (3) output the TEAMSÂ® FMEA reports and Fault Tree Analysis (FTA) reports in industry standards-compliant MBSE format, and (4) support risk engineering studies, link

design trade metrics to overall system autonomy, targeting SMD science missions and their unique goals. Integrating FM early in the design process ensures: adequate detection and diagnosis built into the system; enhanced communication and coordination among stakeholders; reduced development risks through improved quality, traceability; and model reusability. QSI will apply model-based systems engineering (MBSE) framework to facilitate the creation, evaluation and integration of FM concepts early in the design process so that adequate detection and diagnosis is built into the system design, thereby lowering the total cost of development; enhanced communication and coordination among stakeholders; reduced development risks (cost and schedule) through improved quality and traceability; and model reusability to reduce operational costs. Such a solution can (1) Integrate data from multi-domain tools, (2) Perform risk engineering studies of FM design architectures and operations, (3) Output FM analyses reports for verification and validation (V&V), and (4) Provide visualization of FM design across the entire system life cycle.

Duration: 24

Proposal Details

Proposal Number: Z-ENABLE.01-1002
Subtopic Title: Power Distribution, Generation, and Energy Storage
Proposal Title: Innovative 20-kW Delta Stirling Generator for Fission Surface Power

Small Business Concern

Firm: Stirling Innovations LLC
Address: 8509 Clara Dr., Pasco, WA, 99301-1715

Summary Details

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

Stirling Innovations, LLC (SI) has introduced innovative delta Stirling machines. Delta engines and coolers are a subset of double-acting alpha free-piston Stirling machines. They are characterized by having a piston on each end of a linear

alternator/motor and by optimal heat exchanger interfaces and manifolds. This leads to the potential for the highest efficiency, lightest weight and lowest cost possible for Stirling machines. Development of a 25-kW delta Stirling engine prototype is proposed to directly address NASA needs for high efficiency and high reliability fission surface power convertors. SI uses the flexure bearings with clearance seals technology developed by Infinia and Qnergy to enable unparalleled life and reliability for Stirling machines. These are exemplified by three Infinia engines that have operated at NASA GRC for over 17 years with no maintenance or degradation and thousands of Qnergy remote power generators in the field with no issues for up to 60,000 hours. The Phase I project developed a fully resolved preliminary design that met or exceeded aggressive expectations. The proposed Phase II laboratory prototype will be much closer to a pre-production engine than a typical lab prototype because it uses critical components and technology that are commercially proven by Qnergy, but rearranges them in a simplified and optimal configuration. The proposed Phase II project will complete final design, fabrication, assembly and testing of an advanced fully balanced delta Stirling engine designed for NASA fission surface power conversion but readily adaptable to several critical commercial applications.

Duration: 24

Proposal Details

Proposal Number: Z-ENABLE.01-1012
Subtopic Title: Power Distribution, Generation, and Energy Storage
Proposal Title: Large Format Ceramic Oscillating Heat Pipes

Small Business Concern

Firm: ThermAvant Technologies
Address: 2508 Paris Road, Columbia, MO, 65202-2514

Summary Details

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

In response to NASA FY 2025 SBIR solicitation topic Z-ENABLE.01 â€œEnabling

Power and Thermal Technologiesâ€, scope â€œAdvance Thermal Transport Technologies for Space Missionsâ€, sub-system â€œPower Conversion System (PCS) Heat Transportâ€ -- ThermAvant Technologies (TAT) proposes a ceramic oscillating heat pipe (OHP) solution to address two subcomponents: â€œReactor to the power conversion systemâ€ and â€œAdvanced Heat Exchangers at power conversion system interfaceâ€. High temperature heat acquisition and transport is a critical technology gap inhibiting implementation of nuclear energy propulsion (NEP) for Mars transit vehicles, deep space habitats and crewed vehicles, i.e. Orion, Gateway, and HLS. The development priority is reflected in the STMD 2024 Civil Space Shortfall report, with ID 709: Nuclear Electric Propulsion for Human Exploration at rank 8 of 187 technology areas. NEP requires the acquisition of MW-levels of heat at 1000-1400K from the reactor core, and transport to the power conversion system with temperature drop <150K. Alkali metal heat pipes 3-5 meters long are required. TAT has active NASA funding for development of metallic OHPs for this application and recently demonstrated the first known 3-meter heat pipe operating > 1000K (with SS316 envelope). There is potential to significantly improve reactor designs if large format neutron transparent envelopes (e.g. alumina) are manufacturable and reliable: â€¢ Of key importance for an affordable, fuel-efficient system is to operate in a thermal neutron spectrum. This is problematic considering the refractory metals and high nickel content alloys that have been studied to date as heat pipe container materials. Enabling a commercially viable heat pipe reactor concept that uses LEU requires the use of low neutron absorption cross section materials â€¢ By replacing metallic heat pipes with ceramic, the reduced parasitic neutron absorption leads to about 5500kg mass savings in the reactor

Duration: 24

Proposal Details

Proposal Number: Z-ENABLE.02-1007
Subtopic Title: Spacecraft and Platform Subsystems
Proposal Title: Assured Isolation of AI (AI^2) for HPSC Platforms

Small Business Concern

Firm: DornerWorks LLC
Address: 3445 Lake Eastbrook Blvd SE, Grand Rapids, MI, 49546-5935

Summary Details

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

Our reliance on space systems continues to increase yet there has been little focus on securing these systems. The same cybersecurity methods that have been adopted on Earth based systems have not yet made their way into space. This is in part due to the lack of performance and capabilities of Space hardware. To address this need, Microchip developed a new High-Performance Spaceflight Computing (HPSC) series of processors that are designed to significantly improve computational capacity for future space missions. With this increased capability, space systems can take advantage of more modern and emerging technologies such as AI. Despite this increase in capability, adoption of emerging technologies within space systems can still be impeded by the high safety requirements. While many systems would like to leverage AI as a part of their solution it can be difficult because of the unpredictable effects on the safety of the system due to AIâ€™s non-deterministic nature. Also, introducing these emerging technologies in space systems not only makes them more capable but also more complex creating larger and more impactful targets for malicious actors. An infiltrated or infected space system would not only compromise the mission but be extremely costly. Therefore, as emerging technologies are used to push the boundaries of space discovery and exploration it becomes imperative to protect these systems from cyber-attack. Phase I laid the groundwork for and showed the feasibility of the high assurance base platform leveraging the seL4 Hypervisor on the Microchip HPSC. The identified novel AI based space algorithms and gaps in support have informed the phase II design to continue development toward creating a solution that will provide space system developers with a method to isolate non-deterministic, untrusted applications, and AI workloads from the safety-critical subsystems while providing safety, security, and cyber resilience in their next generation space systems.

Duration: 24

Proposal Details

Proposal Number: Z-ENABLE.02-1017
Subtopic Title: Power Distribution, Generation, and Energy Storage
Proposal Title: Multi-Spacecraft On-orbit Space Computing Testbed

Small Business Concern

Firm: EarthTraq Corporation
Address: 936 Cherry St, San Carlos, CA, 94070-3205

Summary Details

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

This Phase II advances EarthTraqâ€™s multi-spacecraft High-Performance Space Computing (HPSC) testbed from a ground-validated prototype to an operational, on-orbit computing platform. The system consists of a four-spacecraft small satellite cluster, each hosting a modular, sandboxed computing payload capable of hosting commercial processors and AI/DSP coprocessors in the space environment. The architecture enables over-the-air (OTA) reprogramming, electrical and functional isolation from spacecraft avionics, and coordinated multi-node execution across the cluster. Building on Phase I validation of hardware integration, avionics isolation, and OTA workflows, Phase II focuses on on-orbit activation, performance characterization, and sustained experimental use. The testbed supports both single-node and distributed computing experiments for the evaluation of advanced onboard processing, cooperative autonomy, and cluster-level tasking under real orbital conditions. Key technical capabilities include heterogeneous processor hosting, inter-spacecraft communication for distributed workloads, and fault-tolerant operation through sandboxing and isolation strategies. The proposed work addresses a critical gap in current HPSC systems: the lack of a persistent, low-cost platform for iterative evaluation of emerging computing technologies in orbit. Traditional HPSC demonstration missions are single-use and tightly coupled to mission avionics, limiting flexibility and increasing risk. In contrast, EarthTraqâ€™s testbed introduces a reusable infrastructure model that decouples experimentation from mission-critical systems.

Duration: 24

Proposal Details

Proposal Number: Z-ENABLE.03-1018-80NSSC26C0022
Subtopic Title: -
Proposal Title: Lightweight High-Energy X-ray Source for In-Space Nondestructive Evaluation

Small Business Concern

Firm: RadiaBeam Technologies LLC
Address: 1717 stewart street, SANTA MONICA, CA, 90404-4021

Summary Details

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

This proposal describes the development of a lightweight, hand-portable 2 MeV Ku-band electron linear accelerator for in-space nondestructive evaluation (NDE) applications. The system is intended to provide electronically controlled, high-energy X-ray generation for inspection of additively manufactured and fracture-critical aerospace components aboard future space stations, lunar infrastructure, and long-duration exploration missions. The proposed technology combines several innovations, including a high-frequency Ku-band accelerating structure, split-structure accelerator fabrication technique, compact vacuum-compatible RF architecture, and an ultralight solid-state Marx modulator capable of battery-powered operation. During Phase I, RadiaBeam demonstrated the feasibility of adapting its compact portable accelerator technology for NASA environments through redesigning the pulsed power system, optimization of the X-ray converter, development of thermal management strategies, and creation of modular system architecture suitable for ruggedized space-compatible operation. In Phase II, the project will focus on developing, building and testing a table-top prototype of 2 MeV X-ray generator, based on the findings made in Phase I, and making it available for further evaluation to NDE specialists.

Duration: 24

Proposal Details

Proposal Number: Z-ENABLE.04-1002
Subtopic Title: Robotic, Autonomy, and Servicing and Assembly Systems
Proposal Title: Multi-modal Tactile Sensor for Extreme Environments

Small Business Concern

Firm: Sensate Robotics
Address: 329 North Van Ness Avenue, Los Angeles, CA, 90004-1523

Summary Details

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

Sensate Robotics will advance its multimodal tactile sensor from laboratory prototype (TRL 4) to flight-qualifiable hardware (TRL 6) for robotic manipulation in extreme space environments. The sensor integrates four sensing modalities in a single rugged fingertip: optical force sensing via LED-phototransistor arrays with Diffuse Optical Tomography (DOT) for sub-millimeter spatial resolution, thermal effusivity sensing for material discrimination, electrical conductivity sensing for material classification, and accelerometer-based texture characterization. Phase I demonstrated 0.1â€“50N dynamic range, 96.3% repeatability, 4.2% hysteresis, and statistically significant thermal discrimination across multiple material classes. Phase II funding will deliver: (1) a fully integrated electronics PCB with onboard impedance measurement; (2) optimized elastomer formulations qualified to ASTM E595 outgassing standards; (3) a Peltier thermal management subsystem validated in vacuum; (4) calibrated real-time DOT, thermal, and conductivity algorithms; (5) two application demonstrations exercising the complete system; and (6) environmental qualification (vibration, thermal-vacuum, EMC, IP67, wear) that produces the data package required for Phase III flight insertion. The technology directly addresses subtopic Z-ENABLE.04 and supports NASA Moon-to-Mars objectives by enabling autonomous robotic manipulation for in-space servicing, planetary surface assembly, science sample collection, and habitat operations where vision alone is insufficient. Commercial target markets include precision manufacturing quality inspection and agricultural postharvest sorting, where multimodal tactile feedback addresses persistent automation gaps in produce grading, end-of-line packing, and dimensional verification.

Duration: 24

Proposal Details

Proposal Number: Z-ENABLE.05-1024
Subtopic Title: Robotic, Autonomy, and Servicing and Assembly Systems
Proposal Title: Space ROS Improvements for Space Flight

Small Business Concern

Firm: PickNik Inc.
Address: 4730 Walnut St., Boulder, CO, 80301-2558

Summary Details

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

This Phase II effort establishes a permanent, automated quality-assurance and certification-evidence infrastructure for Space ROS, transforming the one-time tooling and optimization improvements achieved in Phase I into a sustainable software-quality ecosystem for safety-critical space robotics. The work advances Space ROS from TRL 4 laboratory validation to TRL 6 prototype demonstration in a relevant operational environment through continuous integration/continuous deployment (CI/CD), static analysis, hardware-in-the-loop validation, and automated compliance-evidence generation. The project delivers six core technical objectives: (1) automated binary-size analysis and regression enforcement with merge-blocking CI quality gates; (2) automated Cobra static-analysis issue generation and triage integrated with Space ROS GitHub workflows; (3) modernization of the process_sarif infrastructure for centralized SARIF processing, visualization, and defect tracking; (4) remediation of high-severity code-quality defects identified through the JPL ruleset; (5) automated release generation and validation on flight-representative hardware platforms, including the SolidRun Honeycomb LX2 (NXP LX2160A) and a RISC-V target; and (6) automated generation of NPR 7150.2-aligned compliance artifacts, including traceability matrices, defect-resolution records, and release-validation evidence. All infrastructure and tooling developed under the effort will be released as open source under the BSD-3 license, enabling adoption by NASA missions and the broader robotics community while establishing reusable quality-assurance patterns for other safety-critical robotics domains.

Duration: 18

Proposal Details

Proposal Number: Z-EXPAND.01-1002
Subtopic Title: Robotic, Autonomy, and Servicing and Assembly Systems

Proposal Title: Compressor for In-Space Gas Transfer and Pressurization

Small Business Concern

Firm: Creare LLC
Address: 16 Great Hollow Road, Hanover, NH, 03755-3116

Summary Details

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

Future space exploration missions will entail extended, complex operations in space or on lunar and planetary surfaces, including many that require the efficient transfer and compression of gaseous propellant, pressurant, expendables, or products. Storage pressures may be extremely high, and gases of interest range from helium to xenon. Creare proposes to develop an innovative, compact compressor that will enable collection of nearly all gas from a supply vessel while pressurizing to extremely high pressures (up to 6,000 psia) in the receiver. Our innovative compression and drive technology enables isothermal compression of any gas using high-reliability components that maintain ultrahigh gas purity, provide accurate measurement of the transfer rate, and simplify integration with spacecraft systems. In Phase I, we proved the feasibility of our compressor through (1) performance analysis, (2) demonstration of fabrication methods for pressure and sealing structures that enable maximum operating pressures of 6,000 psia and burst pressures greater than 15,000 psia, (3) mechanical design, and (4) proof-of-concept testing demonstrating compression using prototypical components to pressures of 5,750 psia. In Phase II, we will design and build a flight-like engineering model compressor, demonstrate and measure gas transfer and compression performance, and demonstrate durability through random vibration and thermal vacuum environmental testing according to GEVS.

Duration: 24

Proposal Details

Proposal Number: Z-EXPAND.01-1007
Subtopic Title: Robotic, Autonomy, and Servicing and Assembly Systems

Proposal Title: Clean Robotics Containment Covers

Small Business Concern

Firm: Moonprint Solutions
Address: 1287 McD Drive, Dover, DE, 19901-4639

Summary Details

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

In-space servicing, assembly, and manufacturing (ISAM) is an emerging national initiative to transform the way spacecraft are designed, built, and operated in space. The goal of the initiative is to develop a strategic framework to enable robotic servicing, repair, assembly, manufacturing, and inspection of space assets. Significant improvements in cleanliness of robotic systems that will enable in-space servicing and assembly of highly sensitive spacecraft and platforms, such as the Habitable Worlds Observatory. With increasing inclusion of in-space servicing, assembly, and manufacturing in future architectures, there is a need to reduce contamination for operations around highly sensitive platforms. The current state of the art for robot systems poses risks for servicing of platforms with ultraviolet systems that may be susceptible to contamination which could dramatically reduce instrument performance. Moving parts, lubrication, thermal management systems, harnesses, and sensors are likely to result in outgassing, particulate ejection, and other forms of contamination. Moonprint will develop containment solutions that can be applied to a range of robotic systems to capture and sequester any contaminants (outgassing or particulate) from robotic systems. Containment solutions offer a predictable accounting of contamination sources that can be factored into future standards for quantifying contamination ranges to be expected. This will aid with verification and validation approaches for mission assurance and account for changes in ISAM robotic equipment over time such as component wear or unpredictable circumstances. Containment solutions will support a layered strategy of contamination mitigation to meet mission specific contamination budgets, including ISAM robotic systems and terrestrial cleanroom equipment such as lifts during manufacture. ISAM cover solutions provide design freedom for robotic system developers and reduce mission costs.

Duration: 24

Proposal Details

Proposal Number: Z-EXPAND.02-1007
Subtopic Title: Robotic, Autonomy, and Servicing and Assembly Systems
Proposal Title: Axolotl: Autonomous Robotics to Enable Cost-Effective In-Space Assembly and Outfitting of Orbital Infrastructure

Small Business Concern

Firm: Starfish Space
Address: 665 Andover Park W, Tukwila, WA, 98188-3319

Summary Details

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

Starfish Space is designing a next-generation servicer called Axolotl that will refuel and attach ORUs through the interface that Starfish developed in its Phase I. For this Phase II, Starfish proposes an effort focused on the robotic servicing payload carried by Axolotl to effect these on-orbit operations. In this Phase II study, Starfish will define a concept of operations for a robotic servicing payload and develop its full design concepts. Starfish will build and iteratively test an initial prototype of on-orbit upgrading hardware and its associated software, fabricate a more robust and durable prototype, and build an on-orbit replacement article for use in functional testing. Starfish will execute demonstration testing of robotic installation of an upgradeable on-orbit replacement unit onto a Starfish interface. Starfish will document all activities and lessons learned from this effort and present them in an actionable final report that defines a path forward to commercialization and flight mission(s) with the technology. Through the Phase I study and ongoing customer engagement now, Starfish has identified satellite upgrading and refueling needs that Axolotl can effectively serve across all market segments. Commercial and National Security operators alike face operational bottlenecks in onboard compute capabilities, power availability and reliability through mission lifecycle, and on-orbit mobility tradeoffs. Beyond the commercial market needs that Starfish identified in Phase I, the US Space Force has sent strong demand signals to the commercial market about its existential need for additional âˆ†V, communicating that in-space refueling is a critical technology on their roadmap . Therefore, Axolotlâ€™s target market also spans commercial and government operators, especially those who value efficiency and long-term high return monetization/value enhancement of their platforms.

Duration: 15

Proposal Details

Proposal Number: Z-EXPAND.03-1032
Subtopic Title: Small Spacecraft Technologies and Responsive Space Access
Proposal Title: Deorbit Object with Navigation (DOWN)

Small Business Concern

Firm: Benchmark Space Systems
Address: 128 LAKESIDE AVE, Burlington, VT, 05401-4939

Summary Details

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

BSS proposes the continued development of DOWN by building ICEMAN, a software suite combined with a propulsion controller to enable smart, autonomous mobility on-orbit of any spacecraft supported by BSS named ICEMAN. Through the successful Phase I campaign, BSS identified that the next step in the DOWN capability would be building in autonomy, increased processing, and decision making authority. ICEMAN builds upon MAAVRIC which is the standard propulsion controller that BSS has developed which serves as a low-cost, modular subsystem able to be configured for any number of inputs and outputs across any propulsion system. The next generation version of MAAVRIC will be ICEMAN, capable of supporting the CONOPS and mission sets that DOWN is targeted for such as RPOD, collision avoidance maneuvers, and autonomous deorbiting. An increase in processing capability, fault tolerance, and software decision making allowing for enhanced maneuvering capable of collision avoidance, spacecraft repositioning, and controlled re-entry.

Duration: 18

Proposal Details

Proposal Number: Z-EXPAND.04-1007
Subtopic Title: Other
Proposal Title: LEO Debris Tracking and Remediation Using Advanced Beam Control

Small Business Concern

Firm: MZA Associates Corporation
Address: 4900 Lang Ave NE , ALBUQUERQUE , NM, 87109-9708

Summary Details

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

Innovative approaches for detection, tracking, and laser mitigation of LEO small debris identified under Phase II will be studied using simulation and analysis to determine efficacy and practicality when implemented on a large scale as a network of detection and tracking stations. Integration with suitable HEL sources and beam directors will be investigated. Best practices and experience gained by NASA and external space operations experts will be applied to inform our approach. Target markets include government and non-government operators of LEO orbital assets of all types including telecommunications constellations, Earth-observing platforms, and remote s4ensing networks. Any operators involved in manned LEO missions would be interested in personnel safety aspects.

Duration: 24

Proposal Details

Proposal Number: Z-EXPAND.04-1017
Subtopic Title: Robotic, Autonomy, and Servicing and Assembly Systems

Proposal Title: Adaptive 4D Radar for Debris Tracking

Small Business Concern

Firm: MobLobSpace LLC
Address: 48 Hildreth R, Harpswell, ME, 04079-2824

Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 2 - 6
Technical Abstract (Limit 2000 characters):

Orbital debris in low Earth orbit in the 1â€“10cm size regime is the most dangerous uncatalogued population in near-Earth space â€” large enough to destroy an operational spacecraft on impact, numerous enough to pose statistically significant threat (estimated 500,000 objects per NASA Orbital Debris Program Office models), and small enough to escape routine cataloging by the USSF Space Fence, commercial ground radar networks, or optical telescopes. MobLobSpace LLC proposes the 4D Adaptable Radar (4DAR â€“ â€œAtheneâ€): a space-based 40 GHz Ka/Q-band active phased-array radar that detects, tracks, and maintains custody of orbital debris in the 1â€“10cm regime from a LEO platform. Four simultaneous measurement dimensions â€” range, Doppler, azimuth angle-of-arrival, and elevation angle-of-arrival â€” are recovered from each coherent processing interval. The Phase II effort advances 4DAR from concept (Phase I TRL 2â€“3) to highest technical risk subsystem component validation in a laboratory environment (TRL 6). The Phase II test article consists of three integrated elements: one 50cm Ã— 25cm Q-band slotted-waveguide antenna panel from Optisys (one tile of the planned 50cm Ã— 50cm phase center aperture); one prototype 64-element RF front-end phase center subsystem designed and packaged by KRF Technologies; and a dual-role DSP and phase center control firmware platform on the AMD VCK190 Versal evaluation board. These test articles, characterized independently and in an end-to-end integrated test campaign, validate the first-principles link budget parameters from Phase I and retire the highest hardware risks before Phase III full-payload integration. The test article represents the first of eight identical tiles making up the full 1m Ã— 1m TX center panel of the BOM 1 baseline spacecraft. Demonstrating aperture and phase center performance at this tile level validates the design by geometric symmetry â€” the full TX panel is eight of these tiles combined coherently.

Duration: 24

Proposal Details

Proposal Number: Z-EXPAND.05-1007
Subtopic Title: Other
Proposal Title: Lunar Sentinel

Small Business Concern

Firm: Advanced Space LLC
Address: 1400 W 122nd Ave, Westminster, CO, 80234-3440

Summary Details

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

Advanced Space envisions a future constellation of spacecraft at the Moon in low lunar orbits (LLO) and an array of telescopes at Commercial Lunar Payload Services (CLPS) landing sites that provide close-approach risk assessment of spacecraft at the Moon. This vision is called Lunar Sentinel. In our strategic mission concept, our company aims to optimize the architecture and use of commercial-off-the-shelf (COTS) space-based sensors to provide metric observations of non-transmitting spacecraft and cooperative assets orbiting the Moon. The primary goal of this proposed effort is to provide space situational awareness (SSA) for the growing cislunar market and to prevent collision events at the Moon, especially in the increasingly congested LLO domain. The project proposed here is our plan to mature critical technical elements of the Lunar Sentinel mission concept. Advanced Space is the prime contractor for the Oracle-P mission for AFRL/RV, which is the first step toward SSA stationed at the Earth-Moon Lagrange Point 1 (EML1). Additionally, Advanced Space owns and operates the Cislunar Autonomous Positioning System Technology Operations and Navigation Experiment (CAPSTONEâ„¢) mission in partnership with NASA STMD, which has provided strategic lessons learned in cislunar operations, navigation, and communications. This vision for the proposed effort is designed to prove out key capabilities necessary to make the Lunar Sentinel mission architecture a flight mission reality: specifically, the framework for an accurate SSA system capable of detecting, tracking, and maintaining custody of multiple non-transmitting objects through high-resolution, rapid imagery enabled by precision position, navigation, and timing (PNT) capabilities.

Duration: 24

Proposal Details

Proposal Number: Z-GO.01-1003
Subtopic Title: In-Space Propulsion Technologies
Proposal Title: Magnetic Bearings for Cryogenic Fluid Management

Small Business Concern

Firm: Mainstream Engineering Corporation
Address: 200 Yellow Place, Rockledge, FL, 32955-5327

Summary Details

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

Cryogenic Fluid Management (CFM) systems aboard spacecraft employ reverse turbo-Brayton cryocooler compressors and turboalternators that require maintenance-free operation up to 400,000 RPM for an operational lifetime of 50,000 hours. At these speeds, traditional rolling element bearings fail due to the friction between the rotating and stationary components and require frequent maintenance due to lubrication requirements. Mainstream proposes a hybrid magnetic bearing system that offers non-contact operation at speeds up to 400 kRPM. The hybrid system employs passive magnetic components to reduce the size, weight, and power required while the remaining active components provide the controllability that is necessary to maintain stable operation in the presence of dynamic loads. In Phase I, Mainstream designed, fabricated, and tested a passive thrust bearing with an axial capacity of 7.9 lbf and stiffness of 350 lbf/in and an active radial bearing with a capacity of 3.5 lbf at a current density of 6 A/mm2. In Phase II, Mainstream will optimize the bearing design, develop the active control architecture, and demonstrate bearing performance up to 400 kRPM to bring the technology to TRL 6.

Duration: 24

Proposal Details

Proposal Number: Z-GO.01-1004
Subtopic Title: In-Space Propulsion Technologies
Proposal Title: Robust Highly-Multiplexed Fiber Optic Sensor Array for Cryogenic Fluid Management

Small Business Concern

Firm: Opterro
Address: 46608 Landing Pkwy, Fremont, CA, 94538-6420

Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 5 - 7
Technical Abstract (Limit 2000 characters):

Opterro's Cryo-Tempâ„¢ system is the only distributed FBG cryogenic temperature sensing platform validated to 4 K â€” 5Ã— below NASA's 20 K minimum requirement â€” with â‰¤1-cm spatial resolution over a 56-point array on a single optical fiber. The GFRP-coated FBG sensor array achieves 15â€“50Ã— temperature sensitivity enhancement over bare silica fiber, combined with a patented PIC-based broadband interrogator monitoring 1,600 FBG sensing points across 16 independent fiber channels. No competing solution combines this sensing density, spatial resolution, and validated sub-20 K performance. In Phase I, Opterro demonstrated the Cryo-Tempâ„¢ system to 4 K at Fermilab's cryogenic test facility â€” a factor of 5 below NASA's Z-GO.01 minimum temperature requirement â€” establishing a validated performance margin no competing small-business team has achieved on a distributed, sub-centimeter-resolution FBG array. Opterro's interrogator technology is currently deployed on the International Space Station (SpX-32) for a planned 6-month mission, providing space-grade hardware design, environmental qualification, and operational reliability heritage that no other small-business cryogenic sensing team possesses. Phase II advances Cryo-Tempâ„¢ from TRL 5 to TRL 6â€“7 through: (1) FEA-optimized moisture-insensitive GFRP-FBG sensor array (≥100 points, ≤1-cm resolution, ≥50 thermal cycles to 4 K); (2) space-grade AI-powered d*SenseÂ® hybrid interrogator (1,600 FBG + 32 electrical channels, Â±0.1 K at 20 K); (3) laboratory cryogenic qualification at Opterro and Fermilab; and (4) environmental field qualification on a rocket propulsion fuel tank at Lockheed Martin Space's Gateway Center, with LMS as Phase II subcontractor. The team uniquely combines Opterro's ISS flight heritage, Fermilab's NIST-traceable 4 K cryostat infrastructure, Pultron Composites' pultruded GFRP manufacturing, and LMS's Artemis-program engineering and test access.

Duration: 24

Proposal Details

Proposal Number: Z-GO.02-1008
Subtopic Title: In-Space Propulsion Technologies
Proposal Title: High Temperature Carbon Radiator

Small Business Concern

Firm: Antares Nuclear, Inc.
Address: 19501 Prairie Ave, Torrance, CA, 90503-1683

Summary Details

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

Antares proposes to develop a lightweight, high-temperature carbon radiator panel technology for nuclear electric power generation in space with an integration method to titanium and an adhered, spectrally selective coating with high thermal emissivity and low solar absorptivity. The technology combines a manufacturable carbon-based high-conductivity radiator substrate, titanium integration as a proxy for future Ti-Water heat pipes, and a refined fully inorganic ZrSiOâ,,, thermal-control coating designed to meet Nuclear Electric Propulsion (NEP) heat-rejection requirements. Phase I demonstrated a repeatable ZrSiOâ,,, coating process with high thermal emissivity, Îµt â‰ˆ 0.925, while identifying two remaining technical gaps: reducing solar absorptivity, Î±s â‰ˆ 0.368, and achieving durable coating adhesion to carbon-based radiator substrates after high-temperature cycling. Phase II funding will be used to down-select a scalable carbon radiator architecture, improve coating optical performance toward Î±s â‰¤ 0.20 while maintaining Îµt â‰¥ 0.90, develop the coating-to-radiator interface, mature titanium-to-panel integration, fabricate and test coupons and subpanels, build an up to ~1 mÂ² representative coated radiator panel, and validate the integrated titanium, radiator panel, and coating subsystem in vacuum with correlated thermal models. The resulting technology will provide a path toward lightweight, highly conductive radiator panels operating near 700 K with survivability toward 750 K, reducing radiator area, mass, and stowed volume for future high-power space nuclear systems. Target markets include NASA space nuclear propulsion and fission surface power programs, national-security high-power spacecraft, commercial nuclear-electric spacecraft, high-power satellite buses, lunar surface infrastructure, and future in-space industrial systems requiring compact, high-temperature heat rejection.

Duration: 24

Proposal Details

Proposal Number: Z-GO.03-1006
Subtopic Title: In-Space Propulsion Technologies
Proposal Title: High Thermal Performance Booms and Integrated ACS

Small Business Concern

Firm: Opterus Research and Development, Inc.
Address: 5645 Kitty Hawk Dr, Loveland, CO, 80538-7298

Summary Details

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

Solar sail missions operating inside 0.40 AU require deployable booms capable of surviving extreme thermal environments far beyond the limits of current high strain composite structures. Opterus proposes to develop high thermal performance variants of its Penta Boom and SSTM boom architectures to enable lightweight, thermally robust solar sail systems for near Sun missions. The effort will integrate advanced coatings, alternative materials, and refined structural designs to reduce absorptivity, increase emissivity, and maintain mechanical performance under elevated temperatures. Phase II will mature these booms through detailed thermal mechanical modeling, material and coating optimization, and subscale prototype fabrication. Testing will validate survivability under representative solar flux, assess long duration stowage and deployment behavior, and confirm structural integrity across the near Sun operating regime. Target markets include NASA heliophysics missions, deep space observatories, solar weather sentinels, and commercial or government spacecraft requiring large, lightweight deployable structures capable of operating in high temperature environments. The resulting technology expands the accessible region for solar sail spacecraft and enables new mission classes that demand high temperature capable, low mass deployable booms.

Duration: 24

Proposal Details

Proposal Number: Z-GO.03-1007
Subtopic Title: In-Space Propulsion Technologies
Proposal Title: Ultra-Thin, Flexible InGaP Solar Arrays Embedded In Solar Sails for Power Generation

Small Business Concern

Firm: MicroLink Devices, Inc.
Address: 6457 W Howard St, Niles, IL, 60714-3301

Summary Details

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

Solar Sails have demonstrated compelling propellant-less propulsion capabilities that enable many near Earth and deep space scientific missions. This technology uses momentum imparted to the spacecraft from the reflection of solar photons to provide thrust. Solar sails are extremely large (>1600m2 for Solar Cruiser) and light-weight structures. Effective spacecraft control requires Attitude Control System (ACS) components at the outer reaches of the solar sail. Due to the size of the sail, having these ACS components independent from the spacecraft bus is desirable, as it reduces cabling mass and complexity. Providing power to these distributed ACS components requires PV devices that are low-mass, high-performance, radiation-hard, and stable in near sun environments. Amorphous Si (<10% AM0 eff.) and CIGSe (<16%) have been tested, but their already low efficiency drops at high temperatures. To address this need, MicroLink Devices proposes to develop single-junction (SJ) epitaxial lift-off (ELO) Indium Gallium Phosphide (InGaP) PV that can be embedded in solar sail material and operate in either low solar intensity (<1,000W/m2, beyond earthâ€™s orbit) or high solar intensity (up to 15,000W/m2, or Mercuryâ€™s orbit) environments. ELO removes the PV device structure from the growth substrate, providing ~50x mass reduction, ~30% cost reduction, and results in very flexible PV. It allows for a back surface that reflects ~80% of solar photons (> 650nm), provides thrust, enables low temperature operation in near Sun environments (~50Â°C cooler vs. conventional space PV), and simplifies power management and distribution. High efficiency is expected under operating conditions (>18% AM0 eff., >900 W/kg) with excellent radiation tolerance (<4% drop at 1 x1015 e/cm2, 1 MeV electrons).

Duration: 24

Proposal Details

Proposal Number: Z-LAND.01-1002
Subtopic Title: Entry, Descent, and Landing Systems
Proposal Title: Wireless Instrumentation for Sensing of Parachute Systems (WISPS)

Small Business Concern

Firm: Interdisciplinary Consulting Corporation
Address: 2405 NW 66th Ct, Gainesville, FL, 32653-1633

Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 5 - 7
Technical Abstract (Limit 2000 characters):

The Interdisciplinary Consulting Corporation (IC2) proposes to develop a battery-operated, low power, compact, time synchronized, wireless data acquisition (DAQ) system specifically designed for instrumenting Entry, Descent, and Landing (EDL) parachute systems. This system will enable model validation and identification of potential failure modes, while ensuring minimal impact on the parachute system being instrumented. The proposed system leverages a distributed wireless sensor network to address challenges associated with sensor installation, including technological, logistical, weight, and cost barriers. By utilizing wireless communication, the system simplifies installation and significantly mitigates the issues of wires being installed alongside parachute suspension lines. Additionally, it allows for increasing the number of installed sensors by easing cable routing restrictions and minimizing weight. Reducing cable routing requirements not only minimizes installation effort compared to current systems but also offers greater flexibility in sensor placement. While the primary target application is EDL parachute system instrumentation, the systemâ€™s capabilities also support other applications requiring environmentally hardened, low-power, battery-operated, time-synchronized wireless instrumentation. The Phase II effort will extend the Phase I prototype system to more robustly meet the needs of instrumentation system users by: (1) supporting multiple wired sensors per wireless sensor node; (2) expanding the number of supported sensor types; (3) optimizing the wireless environment (e.g., antennas) and parameters for the existing Phase I wireless communications systems; (4) adding a second wireless data communications capability that extends the operating range and further lowers power requirements; and (5) updating the device enclosures and other hardware as needed for enduring operation in harsh environments.

Duration: 24

Proposal Details

Proposal Number: Z-LAND.01-1012
Subtopic Title: Entry, Descent, and Landing Systems

Proposal Title: Autonomous Paragliders for Martian Landings

Small Business Concern

Firm: Outpost Technologies Corporation
Address: 1601 Colorado Ave , Santa Monica , CA, 90404-3318

Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 4 - 5
Technical Abstract (Limit 2000 characters):

Outpost Technology Corporation proposes to advance its autonomous single-skin paraglider system for Mars Entry, Descent, and Landing (EDL) from a Phase I preliminary design to a flight-validated system demonstrated in Mars-analog atmospheric conditions. The Z-LAND system is a steerable, lift-generating subsonic descent system guided by an onboard autonomous GNC architecture, directly addressing NASA subtopic Z-LAND.01's requirement for a precision paraglider capable of delivering a 600 kg payload at Mach 0.26 terminal descent velocity on Mars. Phase II funding will be used to execute a high-altitude balloon drop test campaign in the 80,000â€“100,000 ft MSL range, validating paraglider deployment, inflation, stable flight, and GNC precision in a Mars-analog environment. Concurrent work will refine the GNC algorithm for low-density atmospheric conditions and produce a full Mars EDL system integration study, including a trajectory simulation, interface control document, and Phase III roadmap. The Z-LAND system's single-skin architecture does not rely on ram-air pressurization, making it uniquely suited to low-density planetary atmospheres where conventional parafoils fail to inflate. Outpost holds the world record for the highest autonomous single-skin paraglider deployment and has demonstrated 11-meter landing accuracy in helicopter drop tests. Target markets include NASA planetary landing programs (robotic science and human Mars exploration) and the commercial Earth return and space logistics market, where the Z-LAND system serves as the core EDL subsystem of Outpost's Carryall vehicle. Outpost holds $286M per year in commercial letters of intent from nine anchor customers including Axiom Space, Blue Origin, and Redwire.

Duration: 24

Proposal Details

Proposal Number: Z-LAND.02-1004
Subtopic Title: Entry, Descent, and Landing Systems
Proposal Title: Multiscale Infusion and Solvent Transport toolkit for Thermal Protection Systems (MIST-TPS)

Small Business Concern

Firm: AnalySwift, LLC
Address: 444 Jennings Street, West Lafayette, IN, 47906-1146

Summary Details

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

The manufacturing of Thermal Protection System (TPS) materials for space applications involves infusing highly porous 3D woven preforms with low-density resins, followed by curing processes that may induce off-gassing, shrinkage, and residual porosity. These coupled multiscale phenomena strongly influence defect formation, thermal protection capability, and structural reliability of TPS components used in extreme aerospace environments. Current TPS process development remains heavily dependent on costly trial-and-error manufacturing because existing simulation tools cannot accurately capture the coupled free-flow, porous-flow, solvent transport, and off-gassing mechanisms characteristic of TPS infusion processes. In Phase I, AnalySwift and Purdue University demonstrated the feasibility of a physics-based multiscale modeling framework for TPS manufacturing. The effort established multiscale infusion modeling capabilities, curing and off-gassing simulations, PBC-based permeability homogenization methods, and an initial GUI framework integrating commercial CFD and FEA software tools. The proposed Phase II effort will develop, validate, and demonstrate the Multiscale Infusion and Solvent Transport toolkit for TPS (MIST-TPS), an integrated multi-physics and multiscale simulation environment for TPS manufacturing. The framework will simulate coupled resin transport, capillary infiltration, solvent evaporation, off-gassing, shrinkage, void formation, and multiscale permeability evolution in 3D woven TPS preforms. The project will also develop ML-aided permeability prediction and calibration capabilities, workflow automation, and an enhanced GUI for process configuration, simulation management, visualization, and optimization. The validated MIST-TPS toolkit will enable optimization of infusion and curing parameters to reduce defects, improve process reliability, accelerate TPS process scale-up, and reduce reliance on experimental iteration for future NASA missions.

Duration: 24

Proposal Details

Proposal Number: Z-LAND.02-1014
Subtopic Title: Entry, Descent, and Landing Systems
Proposal Title: Mixed Gas Generator for Inflatable Decelerators

Small Business Concern

Firm: Anasphere, Inc.
Address: 5400 Frontage Road, Manhattan, MT, 59741-8046

Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 3 - 4
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). The new generators feature more mass-efficient cooling, single-grain construction for reliable zero-g performance, and produce noncombustible gas mixtures. An exceptionally high flow rate capability is a distinguishing feature of these generators. Phase I work demonstrated the basic concepts of the new generator. A test generator with a capacity over 100 normal liters (0C, 1 atm) was demonstrated. Data showed that the key design features of the generator worked as intended. Phase II work will initially focus on improving the uniformity of fabrication processes and thereby improving consistency in generator performance. Several generators will then be built and tested, culminating in a 500 normal liter flight-weight generator initiated by an NSI. Target markets include HIADs used for launch vehicle asset return and payload return from Earth orbit.

Duration: 24

Proposal Details

Proposal Number: Z-LAND.03-1001
Subtopic Title: Entry, Descent, and Landing Systems
Proposal Title: Soil Cohesion Effects on Cratering and Transport of Regolith due to Plume-Surface Interaction

Small Business Concern

Firm: CFD Research Corporation
Address: 6820 Moquin Dr NW, Huntsville, AL, 35806-2900

Summary Details

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

The plume-induced environment from propulsive landing of robotic and human-rated vehicles is one of the top unresolved critical risks for extraterrestrial missions. Primary risks of plume-surface interaction (PSI) are the creation of large craters and high-speed ejecta that can impact and damage the vehicle or surrounding infrastructure. NASA analysts use advanced modeling and simulation (M&S) capabilities to predict the PSI-induced environment, but a critical gap in these tools is soil cohesion. Cohesion, or the ability of soil grains to adhere to one another, dominates in low-pressure, reduced-gravity environments and is a primary driver in the initiation and resistance to motion and suspension and resettlement of soil. In Phase I, CFD Research, in conjunction with University of Central Floridaâ€™s (UCF) Center for Microgravity Research (CMR), took steps to address this shortcoming in the M&S by implementing bulk and preliminary constitutive models for cohesion. Results on the PFGT PSI experiments show dramatic reduction in the erosion and crater depth compared to baseline non-cohesive results. In Phase II, in conjunction with UCFâ€™s Facility for Research On Simulated Topography of Icy Environments (FROSTIE) Lab, the team will expand to relevant PSI conditions geotechnical properties of dry and ice-laden regolith with a series of low-pressure and reduced-gravity experiments that will provide extremely necessary validation data for the additional constitutive cohesion models for both electrostatics, capillary, and cementation forces at these conditions. These constitutive models will be implemented in CFD Researchâ€™s Gas-Granular Flow Solver, Loci/GGFS, with particular focus on ensuring robust and validated models. The resulting experimental data and predictive simulation tool will be delivered to NASA, dramatically improving the PSI simulations and enabling further pathways for model development and validation for any existing simulation tool.

Duration: 24

Proposal Details

Proposal Number: Z-LIVE.01-1037
Subtopic Title: Power Distribution, Generation, and Energy Storage
Proposal Title: High Pressure, In-Situ Hydrogen Sensor For Space Based Regenerative Fuel Cell Systems

Small Business Concern

Firm: Makel Engineering Inc
Address: 1585 Marauder St, Chico, CA, 95973-9064

Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 5 - 6
Technical Abstract (Limit 2000 characters):

Makel Engineering Inc. (MEI) is developing a miniaturized, in-situ hydrogen safety sensor for regenerative fuel cell (RFC) systems and high-pressure oxygen generation assemblies (OGAs) supporting future NASA lunar and Mars exploration missions. RFC systems with high-pressure water electrolyzers are enabling technologies for long-duration surface power generation and energy storage on the Moon and Mars, but safe operation requires reliable hydrogen monitoring within high-pressure oxygen process streams. Existing extractive hydrogen sensing approaches are not well suited for spaceflight applications because sampled gas must either be vented or recompressed, resulting in unacceptable process gas losses, increased system complexity, and additional power consumption. Phase I developed and demonstrated prototype MEMS-based microsensors capable of detecting 0â€“4% hydrogen in saturated oxygen streams at pressures up to 3600 psia under simulated RFC operating conditions, achieving response times below 10 seconds and high accuracy. The technology is based on microfabricated hydrogen sensing elements fabricated on silicon substrates using thin-film processes and has demonstrated high specificity to hydrogen with operational capability from trace concentrations to 100% hydrogen in oxygen or inert gas backgrounds, including elevated temperature and pressure environments relevant to advanced space systems. The Phase II effort will mature this technology into a flight qualifiable

sensing platform optimized for RFC and OGA applications by incorporating condensation mitigation features, long-term calibration stability, and reducing system SWaP through a dual-channel architecture. The sensor package will be designed for direct integration into high-pressure oxygen systems using interfaces similar to compact pressure and temperature transducers. Phase II objectives include demonstrating stable operation under representative RFC flow conditions to advance the technology to TRL 6.

Duration: 24

Proposal Details

Proposal Number: Z-LIVE.02-1010
Subtopic Title: Spacecraft and Platform Subsystems
Proposal Title: High Efficiency, T-form Thermoelectric Space Refrigeration System

Small Business Concern

Firm: Nanohmics, Inc.
Address: 6201 E. Oltorf St., Ste.400, Austin, TX, 78741-0000

Summary Details

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

Future long-duration lunar and interplanetary missions will require highly reliable, energy-efficient refrigeration systems to support crew health, food preservation, biological sample storage, and scientific operations over extended durations. Conventional refrigeration approaches, including vapor-compression and Stirling-cycle systems, present challenges related to mechanical complexity, maintenance requirements, vibration, and operational efficiency in space environments. These limitations motivate the development of alternative cooling technologies better suited for sustained exploration missions. The proposed research effort advances a solid-state refrigeration platform based on thermoelectric cooling integrated within a modular, scalable architecture designed for spaceflight applications. The approach leverages advanced thermoelectric materials and optimized low-current device

operation to improve cooling efficiency and power density relative to conventional thermoelectric systems. The resulting architecture supports flexible integration with spacecraft thermal management systems while minimizing moving parts and associated reliability risks. This effort will be focused on the development and demonstration of a refrigeration subsystem capable of delivering greater than 400 W of cooling near 5 Â°C under representative operating conditions. The system architecture is designed to support extension to subfreezing operation near âˆ’25 Â°C and scalable deployment beyond 1 kW-class cooling capacity. Validation testing under simulated space-relevant environmental conditions will assess thermal performance, reliability, and integration compatibility with spacecraft thermal loops. By advancing scalable, maintenance-free solid-state refrigeration technologies, this work addresses critical needs for future human exploration missions, including long-duration habitation, logistics management, and science support for lunar, orbital, and Mars-class missions.

Duration: 24

Proposal Details

Proposal Number: Z-LIVE.02-1018
Subtopic Title: Spacecraft and Platform Subsystems
Proposal Title: Engineered Solar Reflective Coating with High Infrared Transparency

Small Business Concern

Firm: Plasmonics Inc.
Address: 12605 Challenger Pkwy, Orlando, FL, 32826-2710

Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 3 - 5
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 spacecraft temperature fluctuations, Plasmonics Inc. has been developing a

new class of mission-tailorable, and autoregulating, thermal radiators. The primary limitation with Plasmonics Inc.â€™s current state of the art variable emissivity materials (VEM) is their high solar absorptivity. An ideal VEM surface should have low solar absorptivity, to help mitigate solar loading. The surface should also be conductive to help mitigate electrical charge build up. To address these needs, Plasmonics Inc proposes to develop a new-class of radiator overcoats for VEMs and other similar radiator systems with high solar reflectivity, infrared transparency, and high conductivity. As part of the Phase I SBIR, the team successfully identified a paste-based coating with high infrared transparency and a white-matte behavior in the visible. The Phase II of the program will continue to improve on this initial coating design and rapidly move the technology to maturity. A successful coating will find utility in a wide range of markets with the commercial satellites and smart surfaces as the most promising.

Duration: 24

Proposal Details

Proposal Number: Z-LIVE.03-1012
Subtopic Title: Power Distribution, Generation, and Energy Storage
Proposal Title: Continuous Auger-Based Water Vapor Extraction from Icy Lunar Regolith

Small Business Concern

Firm: AeroFly LLC
Address: 2301 RESEARCH PARK WAY, Brookings, SD, 57006-1724

Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 4 - 5
Technical Abstract (Limit 2000 characters):

AeroFly LLC proposes to mature VADER, the Volatile Auger Dryer Extraction from Regolith system, as a continuous auger-based process for extracting water vapor from icy lunar regolith. VADER accepts icy regolith from an upstream excavation or delivery asset, conveys it through controlled plug and heated sublimation zones, liberates water vapor under low-pressure conditions, routes the

vapor through a filtered outlet interface for downstream capture, and discharges dry tailings. This approach provides an alternative to batch reactors by enabling sustained material flow, controlled residence time, vapor confinement, and continuous vapor generation. Phase II funding will be used to advance VADER from the Phase I hardware and modeling foundation toward a higher-fidelity, relevant-environment volatile extraction subsystem. Planned work includes upgrades to sealing, pressure regulation, vapor-line heating, instrumentation, icy simulant preparation, thermal control, vapor filtration, and tailings discharge. The effort will also evaluate improved heat-transfer concepts including internally heated auger features, advanced auger geometries, and static-heel disruption. Testing will culminate in a CLPS-relevant subscale thermal-vacuum demonstration, with experimental data used to validate DEM, thermal, vapor, and system-level models. The target market is lunar in situ resource utilization, including NASA Artemis surface operations, CLPS-class demonstrations, future lunar infrastructure systems, and commercial lunar mission providers. The same controlled heating, sealed screw-conveyance, and vapor extraction technologies may also support terrestrial applications involving vacuum drying and moisture removal from granular or cohesive materials.

Duration: 24

Proposal Details

Proposal Number: Z-LIVE.03-1017
Subtopic Title: In-Situ Resource Utilization
Proposal Title: High-Test Peroxide Concentrator for Scalable In-Situ Monopropellant Production

Small Business Concern

Firm: Exploration Technology Group Corp
Address: 2010 Chestnut St, San Francisco, CA, 94123-2747

Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 4 - 5
Technical Abstract (Limit 2000 characters):

ETC proposes the Phase II development of a modular hydrogen peroxide concentrator subsystem for in-situ production of propellant-grade high-test peroxide (HTP, >90 wt.% Hâ‚‚Oâ‚‚) from dilute feedstock. The concentrator is the technology bottleneck in any end-to-end HTP production pathway: multiple groups have demonstrated dilute Hâ‚‚Oâ‚‚ production, but no commercially available system exists to concentrate that output to propellant-grade specifications in a compact, field-deployable, or space-deployable form factor. Phase I demonstrated membrane-based concentration to high concentration from a dilute feed, exceeding the targets and advancing the technology from TRL 2 to TRL 4. Phase II funding will support a 24-month program to systematically characterize three candidate concentration technologies under ISRU-representative conditions, down-select the optimal pathway, and scale to a functional prototype at â‰¥100 kg/yr throughput producing propellant-grade Hâ‚‚Oâ‚‚. Durability for lunar production and product purity (assessed against MIL-PRF-16005F military propellant specifications) are key design drivers. Target markets span three segments: (1) NASA ISRU and lunar surface operations, where HTP serves as a storable, non-cryogenic monopropellant for surface hoppers, sample return vehicles, and attitude control systems; (2) commercial space propulsion, serving the growing HTP thruster ecosystem; and (3) defense and terrestrial industrial applications, where a compact on-demand production unit addresses Department of Defense interest in assured domestic HTP supply, reducing dependence on foreign-headquartered chemical companies that currently dominate global Hâ‚‚Oâ‚‚ production.

Duration: 24

Proposal Details

Proposal Number: Z-LIVE.04-1000
Subtopic Title: Mitigation Technologies for the Extreme Lunar Environment
Proposal Title: Multistage Umbilical Disconnect (MUD) System

Small Business Concern

Firm: Paragon Space Development Corporation
Address: 3400 E. Britannia Drive, Tucson, AZ, 85706-9998

Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 4 - 5
Technical Abstract (Limit 2000 characters):

The Multistage Umbilical Disconnect (MUD) is a modular quick disconnect shroud designed to be used with a variety of coupling hardware in Lunar applications to prevent regolith fouling. MUD serves as a scalable protective cover for electrical, fiber optic, pneumatic, or fluid disconnects intended for use on the Lunar surface. Regolith protection is key to achieving lunar moon base permanence. MUD directly addresses multiple functional gaps outlined by NASA for the Moon Base vision, enabling robotic operations, logistics systems, and power systems. The system is defined by three separate subsystems, all functioning together to create a highly effective method of preventing regolith from fouling sensitive internal coupling hardware, and preparing said couplers for their mating procedure. The three systems that comprise MUD are the Environmental Protection Cover (EPC), the hyperboloid, and the internal retraction system. Each system works together sequentially to prepare and mate the internal couplers while protecting the hardware from the lunar environment. The Phase II SBIR effort will focus on design development and extensibility for robotic operations, as well as testing in a relevant environment. Colorado School of Mines will work with Paragon to conduct dirty high-vacuum testing of the quick disconnect system in Phase II. A high-fidelity prototype system will be delivered to NASA at the conclusion of Phase II. Target markets within NASA include robotic rover and EVA operations for connection of scientific payloads, power stations, landers, and habitats. Beyond NASA, MUD has a variety of use cases in industrial and military applications, including mining, hydraulic construction systems, and desert operations, for any umbilical power charging or fluid connections that must remain clean in a hazardous environment.

Duration: 24