NASA SBIR 2026A-I Solicitation

Proposal Details

Proposal Number: CARITL.1.S26A-0301
Subtopic Title: Development of Hydrazine-Compatible Elastomeric Materials for Long-Duration Spaceflight
Proposal Title: Hydrazine and Radiation Durable Elastomers for Long-Duration Space Propulsion Systems

Small Business Concern

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

Summary Details

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

Hydrazine compatible elastomers have been identified as one of NASAâ€™s Critical At-Risk Industrial Technologies (CARITL). Deep space mission propulsion systems rely on heritage AF-E-411 rubber in the form of seals, gaskets, diaphragms, and long-duration hydrazine-based propellant storage; however, precursors for this 1970s material are no longer available. NanoSonic is an advanced materials company in Southwest VA that specializes in elastomeric seals for extremely harsh chemical, thermal, and radiation environments. Typical filled elastomers reinforce polymers against wear and abrasion; however, some constituents can degrade both mechanical performance as well as solvent compatibility. Hydrazine compatibility is critical as decomposition can result in concomitant gaseous products that interfere with monopropellant motor operation. NanoSonic has recently developed an advanced wear resistant and hydrazine compatible elastomer exhibiting < 0.1% weight uptake after 24 hr, per combined mechanical and swelling measurements. In this NASA SBIR program, modern hydrazine compatible elastomers shall demonstrate survivability under representative multi-year mission conditions via vacuum, permeation, thermal cycling and accelerated aging via dynamic mechanical analysis (DMA) time-temperature superposition (TTS) upon pre- and post- radiation exposure at Brookhaven National Laboratoryâ€™s NASA Space Radiation Laboratory (BNL NSRL).

Duration: 6

Proposal Details

Proposal Number: CARITL.1.S26A-0324
Subtopic Title: Development of Hydrazine-Compatible Elastomeric Materials for Long-Duration Spaceflight
Proposal Title: Efficient Compounding and Qualification of Hydrazine-Compatible Elastomers for Spaceflight

Small Business Concern

Firm: Applied Nanotech Inc.
Address: 8200 Cameron Road, Austin, TX, 78754-3832

Summary Details

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

This Phase I SBIR proposal aims to develop a custom, non-proprietary ethylene propylene diene monomer (EPDM) elastomer to replace the obsolete AF-E-411 legacy compound used for dynamic seals and valve seats in hypergolic propellant systems. The aerospace supply chain is currently vulnerable due to the discontinuation of AF-E-411's chemical precursors, which forces reliance on incompatible materials that cause catastrophic failure modes like catalytic gas evolution, catalyst bed poisoning, and chemical embrittlement. The proposed technology utilizes modern metallocene-catalyzed base resins, ultra-pure silica fillers, and peroxide curing systems to eliminate these degradation pathways. The goal is to create a drop-in replacement that relies exclusively on domestic, commercially available precursors while matching heritage mechanical benchmarks (2100 psi tensile strength, 200 PLI tear strength) and ensuring chemical compatibility with anhydrous hydrazine.

Duration: 6

Proposal Details

Proposal Number: CARITL.1.S26A-0600
Subtopic Title: Development of Hydrazine-Compatible Elastomeric Materials for Long-Duration Spaceflight
Proposal Title: Testing AF-E-411 Rubbers

Small Business Concern

Firm: Virtucon Earth and Space, LLC
Address: 12505 Guinevere Rd., Glenn Dale, MD, 20769-8943

Summary Details

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

Virtucon Earth and Space, LLC proposes to do a comprehensive study to replace AF-E-411. We will examine the materials being used commercially, and find replacement materials for the Nordel 1636. The PI and Co-I have previously done multiple compatibility tests per NASA-STD-6001 Test 15, and will do them again on the potential materials, as well as a range of material tests. Our Consultant Ian Ballinger has gone through this process for other AF-E materials multiple times.

Duration: 6

Proposal Details

Proposal Number: CARITL.1.S26A-0605
Subtopic Title: Development of Hydrazine-Compatible Elastomeric Materials for Long-Duration Spaceflight
Proposal Title: Closing the Qualification Gap: Validated Lifetime Prediction for Hydrazine-Compatible Elastomers in Long-Duration Spacefligh

Small Business Concern

Firm: Karax LLC
Address: 16922 Thorngate Rd, East Lansing, MI, 48823-9779

Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 2 - 5
Technical Abstract (Limit 2000 characters):

Karax LLC proposes K-Load-Hydrazine, a physics-informed neural network (PINN) framework that converts short-duration NASA-STD-6001B Test 15 data into validated 1-, 5-, and 15-year service life projections for ethylene propylene terpolymer (EPT) elastomers in hydrazine propulsion service. No validated computational method currently bridges the 48-hour Test 15 beaker screen and the multi-decade lifetime requirement of NASA-STD-5017 â€” the gap that has locked NASA into AF-E-332 and AF-E-411 heritage materials for five decades despite known precursor supply risks. Phase I delivers four objectives: (O1) development of a new hydrazine damage module (Î¨HZ) by domain transfer from Karax's validated Hâ‚‚S framework, alongside adaptation of existing thermal modules (Î¨TI, Î¨TO) to EPT chemistry; (O2) adaptation of the mechanical preload module (Î¨Mech) to space seal and bladder geometries; (O3) integration into the K-Fail remaining useful life engine; and (O4) a standalone screening software prototype trainable from standard Test 15 characterization inputs. All Phase I validation uses published data only â€” the 11-year Columbia OV-102 AF-E-332 orbital tear-down and the 154-day EPT-10 hydrazine immersion record â€” with predictions locked before validation data is loaded. Physical testing and radiation modules are scoped to Phase II. K-Load-Hydrazine enters Phase I at TRL 2 and exits at TRL 5. K-Load is Karax's deployed commercial platform (TRL 7â€“8, released February 2025), validated across six multi-stressor combinations. On an analogous aggressive-fluid system, K-Load demonstrated 15â€“60Ã— greater long-term accuracy than Arrhenius extrapolation. Phase I applies this architecture to hydrazine service for the first time, delivering the first validated framework capable of converting multi-temperature Test 15 data into defensible multi-decade EPT elastomer lifetime projections.

Duration: 6

Proposal Details

Proposal Number: COSMO.1.S26A-0022
Subtopic Title: High Performance Detector Technologies
Proposal Title: High Thermal Conductance Grids for X-Ray Microcalorimeter Optical Blocking Filters

Small Business Concern

Firm: Photon Foils
Address: 8091 Park View Dr, Ventura, CA, 93001-1001

Summary Details

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

Cooled soft X-ray focal plane detectors encounter signal loss due to hydrocarbon accumulation on their blocking filters. Future soft X-ray telescopes, such as newAthena and Lynx, will suffer this loss unless a filter decontamination method is employed. The XRISM Resolve frame heating method can be employed for Lynx filters if the thermal conductance is increased by about 10X. In Phase I we will fabricate a 180mm single-crystal SiC filter grid which provides this increased conductance. Phase I will test this grid's launch vibration durability and verify sufficient EMI shielding. We will use the vibration results, and information collected from the X-ray community, to design prototype Phase II Lynx Main Shell filters. Phase II will improve grid and membrane strength, and construct filters which meet expected Lynx thermal and durability requirements. Full-size filters will be tested for vibration durability and for temperature nonuniformity. Our grid technology employs single crystal silicon carbide, which has higher hardness and thermal conductivity than any other material aside from diamond. In the future, our unique micromachining technology will be used to fabricate X-ray components, MEMS devices, semiconductor vias, membrane-based detectors, transducers and ultrastrong mechanical components. The Phase I funding will be used to demonstrate the feasibility of large SiC grids needed for future X-ray telescopes and spectrometers, in particular Lynx HDXI and LXM. The Phase I research results could also benefit the blocking filters for newAthena X-IFU and WFI, if their current designs prove deficient. Phase II funding will be used to further increase the strength of silicon carbide components, increase membrane strength, and test prototype full filters (SiC grid+membrane+frame).

Duration: 6

Proposal Details

Proposal Number: COSMO.1.S26A-0393
Subtopic Title: High Performance Detector Technologies
Proposal Title: High-Sensitivity III-N Solar Blind FUV Solid-State Detector Technologies

Small Business Concern

Firm: Magnolia Optical Technologies, Inc.
Address: 52 B CUMMINGS PARK, Woburn, MA, 01801-2123

Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 1 - 2
Technical Abstract (Limit 2000 characters):

Magnolia Optical Technologies-Georgia Institute of Technology team in this Phase I SBIR (as well as in succeeding Phase II) will develop the wide-bandgap III-N semiconductor materials and device technologies for the creation of the next generation of high-sensitivity far- ultraviolet (FUV) solar-blind avalanche photodetectors (APDs) for a variety of NASA missions. We will exploit the inherent advantages of the direct-bandgap AlGaN alloy epitaxial structures grown on high-quality bulk AlN substrates to develop solar-blind far-UV and near-UV single-photon detectors and arrays to create the next generation of the semiconductor photomultipliers (PMs). We will develop improved AlGaN FUV APD device designs, epitaxial growth processes, and device processing technologies to create a robust technology that can be further developed for large-area arrays in future development. We will develop III-N PMs that have improved UV sensitivity, reliability, low noise, and UV quantum efficiencies ~40-80%, solar-blind response ratios >105 and optical gains >106 under reverse bias near avalanche breakdown. The Phase I development will focus on individual detectors and 4X4 arrays of APDs with FUV AlGaN APD zero bias responsivity >0.1A/W or EQE>70% at <200 nm. Additionally, in Phase II, we will demonstrate Geiger-mode (GM) NUV/ FUV AlGaN single-photon avalanche detectors (SPADs) operating at <200 nm with SPDE ~10%. These materials and device technologies can be scaled to large-area III-N APD arrays flip-chip bonded to Si CMOS read out ICs to provide advanced FUV photodetector system performance and imaging capabilities.

Duration: 6

Proposal Details

Proposal Number: COSMO.1.S26A-0454
Subtopic Title: High Performance Detector Technologies
Proposal Title: An ASIC for Segmented SNSPD Readout

Small Business Concern

Firm: Pacific Microchip Corp.
Address: 5601 W Slauson Ave, Culver City , CA, 90230-4650

Summary Details

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

Future NASA UV, visible/NIR, and emerging soft-X-ray astrophysics instruments require scalable, low-noise, photon-counting detector arrays, but segmented Superconducting Nanowire Single-Photon Detector (SNSPD) array scaling is limited by cryogenic wiring, heat load, timing jitter, readout power, and backend data volume. Pacific Microchip Corp. (PMCC) proposes to develop a 64-channel cryogenic readout ASIC for SNSPD arrays. The ASIC will support 32Ã—32 segmented arrays with a scalable path to larger formats, operate down to the 4 K cryogenic stage, and target less than 1 mW per readout channel to reduce cryocooler burden. The device will integrate configurable low-noise analog front ends, programmable-gain pulse amplifiers, high-speed comparators, TDCs, row/column pulse correlation, event building, calibration logic, PVT monitoring, an embedded RISC-V processor for calibration/control, and high-speed packetized data output. The front end will support 50 Î©-compatible or high-impedance input configurations, >5 GHz bandwidth, 0â€“20 dB programmable gain, and programmable thresholds to preserve timing fidelity for representative SNSPD pulses with sub-100-ps rise times and sub-mV to millivolt-level amplitudes. Timing extraction will use an 8 GHz clock, DLL-calibrated delay cells, and a 3.9 ps nominal TDC bin. Event data will be compressed into compact 43-bit packets and transmitted through a high-speed serial output supporting up to approximately 298 million aggregate events per second. The ASIC will be implemented in mature CMOS technology, designed with radiation-tolerant practices and packaged in an LTCC BGA package for cryogenic cycling reliability. Phase I will establish feasibility through detector-to-ASIC requirements traceability, representative SNSPD pulse modeling, critical circuit design, preliminary layout, calibration

planning, and a Phase II plan for fabricated and tested prototypes.

Duration: 6

Proposal Details

Proposal Number: COSMO.1.S26A-0615
Subtopic Title: High Performance Detector Technologies
Proposal Title: VIPER-S (Versatile Imager Platform with Enhanced Radiation hardness - Stacked)

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):

Alphacore is developing VIPER-S (Versatile Imager Platform with Enhanced Radiation hardness - Stacked), a next-generation stacked image sensor designed to meet NASA's most demanding ultraviolet, visible, and near-infrared imaging needs. VIPER-S directly addresses the highest-priority gap identified in the COSMO.1.S26A solicitation: large-format, radiation-hardened detectors that can be tiled into very large - ultimately gigapixel-class - focal plane arrays for future flagship observatories such as the Habitable Worlds Observatory. The core innovation is a four-sides-buttable, stacked backside-illuminated image sensor in an advanced 65 nm process. By placing the photodiodes on one wafer and all support circuitry on a bonded second wafer, VIPER-S eliminates the dead space at sensor edges that has historically limited the size of space-based imagers. Multiple sensors can be tiled together with virtually no gaps, enabling array sizes far beyond what any single chip can provide. The design is also engineered to withstand the harsh radiation environments of deep-space and Earth-orbit missions. Alphacore already has many of the key building blocks of the stacked image sensor designed and verified. This Phase I will advance the complete design to a tape-out-ready state, ready for immediate fabrication at the start of Phase II.

Duration: 6

Proposal Details

Proposal Number: EVA.1.S26A-0060
Subtopic Title: Advanced Spacesuit Architectures, Technologies, and Designs for Mars Exploration
Proposal Title: A lightweight, highly mobile, customized planetary EVA suit architecture

Small Business Concern

Firm: David Clark Company Incorporated
Address: 360 Franklin St., Worcester, MA, 01604-4916

Summary Details

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

Planetary Extravehicular Activity (EVA) spacesuits must provide the crewmember significant mobility to enable exploration and optimize performance. Current designs for Lunar applications provide that required mobility, but their architectures are too heavy for higher g environments like Mars. Mars gravity is more than twice that of the Moon, which dramatically alters the design space for EVA suit architectures. Mass is a much more significant design driver for Martian architectures than it is for the Moon. The proposed innovation therefore places the appropriate significance on mass to create as lightweight an EVA suit architecture as possible, while still enabling significant pressurized mobility. Emphasis is placed on low mass and high mobility designs, trading maintainability, logistics, sizing, and other considerations that have historically driven suit mass. Customizing each suit to each crewmembers anthropometry is one of the key enablers of a lightweight, high mobility EVA suit. Suit fit is critical to optimizing suit performance. Resizing features, common-sized components, and fleet sizing certainly have their advantages, but come with a mass penalty. These will be eliminated with a custom suit architecture. Additionally, additive manufacturing and mass-optimized softgoods/hardgoods interfaces will be used to dramatically lower suit mass. The proposed project will further the development from concept in a laboratory

environment, focusing on integration and development of wearable mockups. The ultimate goal of this project â€“ achievable in phase II - is to develop a useable, wearable, pressurizable prototype.

Duration: 6

Proposal Details

Proposal Number: EVA.1.S26A-0100
Subtopic Title: Advanced Spacesuit Architectures, Technologies, and Designs for Mars Exploration
Proposal Title: Lightweight, Shear Thickening Fluid Enhanced Hybrid Composite Structures

Small Business Concern

Firm: STF TECHNOLOGIES LLC
Address: 18 Shea Way, Newark, DE, 19713-3448

Summary Details

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

New lightweight and durable spacesuit material solutions are needed to enable extended Martian surface exploration missions. We propose a hard composite technology that utilizes integrated shear thickening fluid (STF) enhanced energy absorbing layers to mitigate damage upon impact, impart anti-leak properties, and decrease component weight. The proposed innovation targets a material solution for the hard upper torso (HUT) that increases durability with the same or reduced weight vs. current state-of-the-art. The STF treated textile layers, when used as a core in a composite sandwich structure, absorb the energy of the impact via enhanced viscous dissipation, allowing the material to withstand greater impact energies without any through-thickness damage to the composite structure that would sustain leakage. Here we propose new hybrid energy absorbing layers consisting of STF intercalated into highly aligned discontinuous IM7 carbon fiber (TuFF â€“ Tailored Universal Feedstock for Forming) with the goal of further reducing weight and/or increasing impact energy dissipation capacity to account for

the increased gravity on Mars vs. the Moon. TuFF composites offer a combination of fiber and biaxial stretch properties that, when imbibed with STF, can potentially deliver unique energy absorbing capabilities while also contributing to overall stiffness. Further, we propose a new integration of hollow glass microspherr We propose to use machine learning tools to efficiently refine composite design parameters to optimize durability, weight, and overall structural properties. Using proven high strength composite materials in combination with the energy absorbing benefits of STF treated materials, we propose to design a new lightweight and durable composite structure capable of the 600J impact requirements for Mars suits.

Duration: 6

Proposal Details

Proposal Number: EVA.1.S26A-0493
Subtopic Title: Advanced Spacesuit Architectures, Technologies, and Designs for Mars Exploration
Proposal Title: Martian Exploration Lightweight EVA Space Suit

Small Business Concern

Firm: SoloSuits
Address: 1906 Pepper Hill Way, Houston, TX, 77058-2319

Summary Details

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

Mars demands a spacesuit that existing designs simply cannot provide. Current EVA suits engineered for microgravity or lunar operations weigh between 35 and 70 kg, a crushing burden on a planet where 0.38-g gravity and abrasive perchlorate-laced regolith rewrite the rules of suit design. Solosuits LLC proposes the Martian Exploration Lightweight EVA Space Suit (MaxEMU): a front-entry, all-soft pressure garment subsystem (PGS) weighing just 11.75 kg; an approximately 75â€“83% mass reduction over legacy systems. MaxEMU achieves this through a convergence of innovations: ultra-high-molecular-weight polyethylene (Dyneema) axial restraints offering five times the tensile strength of conventional nylon

webbing at a fraction of the weight; additive-manufactured engineering plastic ventilation components; bionic composite clamp rings bonded with urethane resin; and a patented four-contact-point bearing design with integrated dust seals and in-situ maintainability; a critical feature no prior EVA suit offers. A novel Three-Plane-Closure front-entry system enables self-donning and doffing without ground crew support, eliminating heavy entry frames and pressure-sealing via a pressure-assisted rolled-appendix mechanism proven across hundreds of thousands of sealing cycles. Phase I will fabricate and test a full-scale Lower Torso Assembly (LTA) at 40 kPa operating pressure and 80 kPa proof pressure, validating mobility ranges, leak rates, and bearing durability. A parallel thermal insulation trade study will down-select Mars-applicable materials for Phase II. The team brings unbroken lineage across Orlan, EMU, xEMU, and three original prototypes - ready to suit up humanity for Mars.

Duration: 6

Proposal Details

Proposal Number: EVA.1.S26A-0501
Subtopic Title: Advanced Spacesuit Architectures, Technologies, and Designs for Mars Exploration
Proposal Title: Lightweight Space Suit Hardware for Martian Exploration

Small Business Concern

Firm: Air-Lock, Inc.
Address: 108 Gulf St, MIlford, CT, 06460-4845

Summary Details

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

Air-Lock, Inc. proposes innovative light weighting technologies for next-generation spacesuits optimized for Mars surface exploration. Future Mars missions demand suits that dramatically reduce mass while maintaining mobility, durability over extended durations, and on-surface serviceability. This SBIR Phase I effort focuses on four key innovations that build on Air-Lockâ€™s decades of experience

supplying bearings, helmet assemblies, Body Seal Closures (BSC), and connectors for EMU, xEMU, and other EVA programs. Core innovations include: â€¢ Ultra-light Bearings: Elimination of fasteners and clamp rings via direct restraint attachment and bladder bonding; exploration of single dynamic seal designs with damage tolerance testing to maximize weight savings while preserving pressure integrity and restraint functionality. Custom per-crewmember sizing replaces modular fleet approaches. â€¢ Lightweight Waist Entry System: Optimized BSC architecture for waist-entry suits with reduced structural demands, enabling direct soft-goods (fabric) attachment to both upper and lower torso assemblies. â€¢ Integrated Helmet System: Optimization and light weighting of proven Pressure Bubble architecture enabling direct soft-goods (fabric) attachment. â€¢ Reduced Mass Water Connectors: Lighter, more ergonomic LCVG-to-PLSS cooling line connections with improved flow performance and crew usability. Phase I funding will support engineering analysis, trade studies, CAD modeling, proof-of-concept fabrication, and targeted testing (including pressure, leakage, and damage tolerance) to advance these concepts to TRL 2â€“4. Deliverables include detailed models, weight savings estimates, and prototype performance data to inform Phase II development. The resulting technologies target NASAâ€™s Mars exploration programs while offering broader commercialization potential for lunar EVA, LEO operations, and other human spaceflight suits where mass reduction is critical.

Duration: 6

Proposal Details

Proposal Number: EXPAND.1.S26A-0031
Subtopic Title: Flight Demonstrations of Commercial In-Space Logistics, Robotic Manipulation, and Automation Systems for Future Space Operations
Proposal Title: Investigating a Real-Time Weld Alignment and Beam-Steering Control Approach for In-Space Electron Beam Welding

Small Business Concern

Firm: ThinkOrbital Inc
Address: 5721 Arapahoe Ave, Boulder, CO, 80303-1339

Summary Details

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

ThinkOrbital proposes a feasibility study to investigate a real-time weld alignment and beam-steering control approach for in-space electron beam welding. The technology is intended to enable robotic manipulators used in orbital assembly, construction, servicing, and production support to perform precision welding even when the manipulator has placement error, vibration, flexure, or oscillation. The innovation uses sensor feedback to identify weld seam position or reference markers, detect manipulator misalignment, and command ThinkOrbitalâ€™s electronically steerable electron beam welding system to keep the weld spot aligned with the seam. ThinkOrbitalâ€™s existing electron beam welding system operates at 20 kV and 2 kW, has demonstrated full penetration of 6.25 mm aluminum, and can electronically steer the beam across an approximately 8 mm by 8 mm area. The weld spot must generally remain within approximately 0.1 mm of the seam to support consistent weld quality. Phase I funding will support robotic arm tolerance and oscillation characterization, industrial weld-tracking and sensor state-of-the-art assessment, space-viable sensor evaluation, preliminary control-loop architecture definition, straight-line weld-seam following modeling or benchtop demonstration, and a Phase II/III maturation and flight demonstration roadmap. Target markets include NASA in-space servicing, assembly, and manufacturing missions; Commercial Low Earth Orbit destinations; orbital construction and logistics; commercial station developers; in-space servicing and refueling providers; orbital manufacturing companies; and national security space customers.

Duration: 6

Proposal Details

Proposal Number: EXPAND.1.S26A-0064
Subtopic Title: Flight Demonstrations of Commercial In-Space Logistics, Robotic Manipulation, and Automation Systems for Future Space Operations
Proposal Title: Upgrade Module Using OneLinkâ„¢ for Satellite Servicing Missions

Small Business Concern

Firm: Enduralock LLC
Address: 14847 W 95th St, Lenexa, KS, 66215-5220

Summary Details

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

Enduralock proposes a satellite upgrade module built around our OneLinkâ„¢ autonomous docking interface, enabling standardized onâ€‘orbit hardware augmentation and refueling across LEO, GEO, cislunar space, and deepâ€‘space missions. The module integrates mechanical docking, power/data transfer, and fluid transfer through a single interface, providing a plugâ€‘andâ€‘play method for delivering new power systems, comms hardware, sensors, compute upgrades, modular subsystems, and propellant to existing spacecraft. This capability addresses a critical gap in current ISAM solutions, which lack a unified, small satellite compatible servicing interface and require robotic arms or missionâ€‘specific fixtures. The proposed effort directly aligns with NASAâ€™s priorities in inâ€‘space logistics, modular architectures, and cooperative servicing standards by enabling repeatable, lowâ€‘risk hardware installation and lifeâ€‘extension operations without spacecraft redesign. OneLinkâ„¢â€™s demonstrated misalignment correction, robust mechanical hardâ€‘dock, and highâ€‘reliability fuel transfer substantively reduce Phase I technical risk and allow the project to focus on requirements generation, architecture definition, and missionâ€‘level feasibility analysis rather than interface invention. Phase I funding will: generate validated system requirements through stakeholder engagement; analyze applicable standards to ensure interoperability; develop an initial system architecture using digital engineering; and deliver a mission case study demonstrating operational benefits and costâ€‘effectiveness. Primary target markets include NASA and other government agencies pursuing ISAM capabilities, commercial satellite operators seeking costâ€‘effective lifeâ€‘extension and performance upgrades and emerging inâ€‘space logistics providers requiring cooperative servicing interfaces. By standardizing upgrade and refueling operations, the module becomes an enabling technology for scalable, sustainable orbital infrastructure.

Duration: 6

Proposal Details

Proposal Number: EXPAND.1.S26A-0094
Subtopic Title: Flight Demonstrations of Commercial In-Space Logistics, Robotic Manipulation, and Automation Systems for Future Space Operations
Proposal Title: Multiple-Downmass Hangar for Affordable and Frequent Commercial Sample Return

Small Business Concern

Firm: Gravitics Inc
Address: 4150 152nd Street NE., Marysville, WA, 98271-8980

Summary Details

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

An important part of the logistics system for future Commercial LEO Destinations (CLDs) is the ability to regularly and affordably return scientific research samples and manufactured materials to Earth. While existing commercial ISS cargo vehicles such as the SpaceX Dragon capsule provide semi-regular downmass opportunities to the ISS, future CLD stations will need more frequent downmass opportunities than can be provided by Dragons alone. To address this shortfall, Gravitics proposes developing a hangar facility capable of storing, loading samples into, and deploying multiple small reentry vehicles, as an upgrade to the Cargo Vehicles Gravitics is already developing for Axiom and other CLD developers. This multi-downmass hangar solution provides station operators with several benefits: â€¢ Return Frequency: With multiple reentry vehicles per hangar, Gravitics can support monthly or even higher cadence sample returns, enabling more rapid iteration loops for research and microgravity manufacturing. â€¢ Affordability: By bulk launching the reentry vehicles as part of a bulk cargo mission, the launch cost per reentry vehicle can be reduced significantly, while also reducing the cost and complexity of the reentry vehicles as they do not need to be capable of long-duration free-flight or rendezvous/proximity operations. â€¢ Integrated Solution: By combining low-cost bulk cargo upmass with multiple downmass systems in the same cargo vehicle, Gravitics can simultaneously address both major CLD cargo logistic needs. â€¢ Reentry Vehicle Agnostic: The hangar can support a wide range of reentry vehicle types and sizes, enabling CLD operators to take advantage of the latest innovations, and evolve as customer return needs evolve. The proposed Phase I effort will mature the Multiple-Downmass Hangar design to a CoDR level of maturity, including maturation of the sample loading system, raising the hangarâ€™s TRL from 2 to 3. During Phase II, Gravitics will refine the hangar design to a PDR

Duration: 6

Proposal Details

Proposal Number: EXPAND.1.S26A-0116
Subtopic Title: Flight Demonstrations of Commercial In-Space Logistics, Robotic Manipulation, and Automation Systems for Future Space Operations
Proposal Title: Photonic GIRAF: Photonically Sensorized Long-Reach Robotic ManipulatorsÂ

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): 3 - 4
Technical Abstract (Limit 2000 characters):

FOS will develop Photonic GIRAF with Greatly Increased Reach for Adaptive Fieldwork â€" a hybrid vision+tactile long-reach robotic manipulator combining fiber-optic Fiber Bragg Grating (FBG) sensing with a deployable composite-boom arm â€" to give small lunar rovers an instrumented 3 m+ reach for surface outfitting tasks. Prior work on long-reach booms (Stanford GIRAF prototype that won the 2025 iSpaRo best paper award) used a camera alone, achieving <15 mm endpoint accuracy at 1.8 m but leaving the boom blind to physical contact. Photonic GIRAF complements the camera with multipoint FBG sensors bonded along the boom and into the end-effector, adding real-time tactile sensing of contact forces, surface textures, and temperatures, plus direct boom-shape and vibration measurement â€" all coupled through a low-temperature rotary optical coupler at the shoulder. The hybrid architecture provides force-aware closed-loop control in shadow, glare, and dust-loaded conditions where vision alone degrades, and enables lunar tasks such as cable routing, solar-panel cleaning, anchor implantation, and tactile material classification. In Phase I, IFOS will partner with Stanford University's Center for Design Research (Prof. Mark Cutkosky) to: (1) define the FBG sensor architecture and low-temp rotary-coupler interface; (2) develop optical fiber and FBG integration in the slit-tube composite boom; (3) demonstrate distributed deflection sensing; (4) demonstrate FBG vibration sensing complementing or replacing the endpoint accelerometer; (5) demonstrate end-effector tactile sensing on a cable-routing task with camera+FBG fusion; and (6) deliver a Phase II flight-demonstration plan with Honeybee Robotics (Blue Origin) targeting CLPS integration similar to HBR's rover on Firefly Aerospace's Gruithuisen Domes CLPS mission. Heritage: IFOS LiteSense FBG interrogators are flight-operating outside ISS on the MISSE Science Carrier.

Duration: 6

Proposal Details

Proposal Number: EXPAND.1.S26A-0387
Subtopic Title: Flight Demonstrations of Commercial In-Space Logistics, Robotic Manipulation, and Automation Systems for Future Space Operations
Proposal Title: Vision-Language Planning of Force-Grounded Skills for Autonomous Space Robotics Operations

Small Business Concern

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

Summary Details

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

Sustained operations in cislunar space and on lunar and Martian surfaces will require routine contact-rich robotic manipulation: installing Orbital Replacement Units (ORUs), mating modular truss joints, and outfitting habitat infrastructure. The current state of the art handles free-space pick-and-place, but the contact step (sliding into a soft-dock guide, seating against a capture mechanism) still depends on pre-staged scripts that cannot absorb realistic pose error or unanticipated contact events. PickNik proposes a vision-language-planned library of force-grounded assembly skills for autonomous in-space operations. A Vision-Language Model (VLM) plans by selecting from a library of force-grounded skills (move-to-contact, slide-along-surface, force-conditioned alignment, spiral-search insertion, mate-connector); the skills execute in real time against a hardened hybrid Cartesian velocity/force controller with arbitrary task frame, per-axis mode selection, online payload estimation, and gravity compensation; and structured failure descriptors close a re-plan loop back to the planner. Phase I delivers (i) the extended controller, (ii) the force-grounded skill library, and (iii) a high-fidelity simulation demonstration of four NASA-relevant assembly capabilities including: ORU installation onto a soft-dock receptacle; mating with a partially occluded receptacle; snowflake-joint mating as a lunar surface truss-assembly; and a multi-step assembly sequence requiring autonomous recovery from intermediate skill failures via the planner-to-skills failure feedback loop. Phase II matures the stack on a 7-DOF Kinova Gen3 ground bench and delivers a basic in-space flight demonstration on NASA Goddard's Fly Foundational Robots (FFR) program, for which PickNik is

the contracted on-board flight software provider. Phase III extends to FFR2/FFR3 follow-on missions and to lunar surface truss assembly under PickNik's active LASAR program heritage.

Duration: 6

Proposal Details

Proposal Number: EXPAND.1.S26A-0551
Subtopic Title: Flight Demonstrations of Commercial In-Space Logistics, Robotic Manipulation, and Automation Systems for Future Space Operations
Proposal Title: Multiuse Glovebox Facility with Telerobotic Manipulation (MGF-T) for Commercial LEO Destinations

Small Business Concern

Firm: TEC-MASTERS, INC
Address: 1500 PERIMETER PARKWAY NW, HUNTSVILLE, AL, 35806-3520

Summary Details

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

Tec-Masters proposes the Multiuse Glovebox Facility with Telerobotic Manipulation (MGF-T), a modular next-generation glovebox designed for future Commercial Low Earth Orbit Destinations (CLDs). The MGF-T addresses a critical capability gap created by the planned retirement of the International Space Station and the lack of equivalent glovebox-class research infrastructure planned for commercial stations such as Voyager Technologies Starlab, Vast Haven-2, Axiom Space Axiom Station, and Blue Origin Orbital Reef. The MGF-T combines proven ISS Microgravity Science Glovebox (MSG) and Life Sciences Glovebox (LSG) heritage with advanced telerobotic and autonomous capabilities. The system supports three operational modes: traditional crewed glovebox operations, remotely operated robotic manipulation using anthropomorphic robotic hands, and autonomous execution of routine science and maintenance tasks. This architecture enables continuous science operations during both crewed and uncrewed mission phases. Funding will support development of the modular robotic interface,

integration architecture, prototype testing, autonomous operations capability, and validation of safety and containment systems adaptable across multiple CLD platforms. Target markets include NASA and commercial microgravity research programs supporting biotechnology, pharmaceuticals, materials science, fluid physics, combustion science, and life sciences. The MGF-T also supports CLD operators seeking scalable research infrastructure that increases utilization and reduces dependence on crew availability. By enabling science operations during uncrewed periods, the MGF-T increases potential research throughput and supports long-term commercial LEO sustainability.

Duration: 6

Proposal Details

Proposal Number: EXPAND.1.S26A-0627
Subtopic Title: Flight Demonstrations of Commercial In-Space Logistics, Robotic Manipulation, and Automation Systems for Future Space Operations
Proposal Title: Subscale Lunar Articulating Mirror Array

Small Business Concern

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

Summary Details

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

Outward Technologies proposes the continued development of the Lunar Articulating Mirror Array (LAMA) through a sub-scale technology flight demonstration on the lunar surface. LAMA functions as a dynamic, variable focal length Fresnel solar concentrator composed of lightweight mirror elements. The technology achieves real-time pointing control and focal length adjustments via an innovative mechatronic design. The primary purpose of this technology is to capture and redirect ambient sunlight to deliver direct, high-efficiency solar-thermal process heat capable of selectively melting and liquid-phase sintering native lunar regolith. The Phase I funding will be used to develop a preliminary payload design weighing

less than 4 kg, execute a comprehensive techno-economic feasibility analysis, define a detailed concept of operations (CONOPS), and deliver a flight demonstration mission plan targeted for a launch window within five years. The target markets for this innovation encompass the emerging cislunar ecosystem, including government agencies like NASA and ESA, Commercial Lunar Payload Services (CLPS) primes such as Astrobotic and Blue Origin, and commercial space construction and ISRU companies.

Duration: 6

Proposal Details

Proposal Number: GO.1.S26A-0014
Subtopic Title: ASCENT Thruster Pre-heat Optimization
Proposal Title: Rapid ASCENT Propellant Thruster Response (RAPTR)

Small Business Concern

Firm: Igneon Aerospace LLC
Address: 428 Barrington Hills Dr, MADISON, AL, 35758-7543

Summary Details

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

The Advanced Spacecraft Energetic Non-Toxic (ASCENT) propellant offers a high-performance, low-toxicity alternative to hydrazine, enabling "fuel-and-go" satellite operations. However, its adoption is hindered by a high ignition threshold (420 Â°C), traditionally requiring 20 - 30 minutes of energy-intensive pre-heating. Igneon Aerospace proposes the Rapid ASCENT Propellant Thruster Response (RAPTR), a novel 22 N thruster architecture designed to achieve ignition temperatures in under 120 seconds. The innovation lies in a dual-bed reactor (Heat Bed and Catalyst Bed) featuring an integrated internal heater. By moving the heat source from the exterior shell directly into the internal flow path, RAPTR minimizes heated mass and utilizes radiative heat transfer to reduce energy consumption by up to 68%. The Phase I effort focuses on high-fidelity thermal modeling, material selection for harsh oxidative environments (utilizing TZM and

advanced ceramics), and bench-top vacuum testing of the integrated injector-heater assembly. This technology addresses critical gaps in Tactically Responsive Space (TRS), providing the rapid-start capabilities of hydrazine with the safety and logistics advantages of green propulsion.

Duration: 6

Proposal Details

Proposal Number: GO.1.S26A-0275
Subtopic Title: ASCENT Thruster Pre-heat Optimization
Proposal Title: Multi-Zone Geopolymer-Composite Heater for ASCENT Thruster Pre-heat Optimization

Small Business Concern

Firm: HiFunda LLC
Address: 825 N 300 W, Salt Lake City, UT, 84103-1459

Summary Details

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

The proposed innovation is a multi-zone geopolymer-composite heater for ASCENT (AF-M315E) monopropellant thrusters in the 25â€“110 N class. ASCENT offers higher density-specific impulse, lower toxicity, and better storability than hydrazine, but heater performance remains a key barrier to scaling beyond laboratory thrusters. Existing heaters have high peak power demand, long warmup times, poor thermal uniformity, and significant parasitic heat loss, limiting use in small spacecraft, lunar landers, and deep-space missions. This project introduces a heater architecture with independently controlled axial heating zones and a thermally engineered composite structure that improves heat transfer into the catalyst bed while reducing heat loss to surrounding hardware. The composite enables spatial tailoring of thermal conductivity, promoting rapid radial heat spreading near the catalyst interface and stronger insulation at the outer boundary. The result is improved temperature uniformity, shorter warmup, and lower power consumption than conventional metallic or monolithic ceramic heaters. Its

cylindrical geometry fits common catalyst-bed designs, and the fabrication approach uses scalable, low-temperature processing to produce integrated heater structures with precise dimensional control. Phase I will establish feasibility by developing the multi-zone heater design, validating composite thermal behavior, and fabricating a representative prototype for testing under relevant vacuum and thermal conditions. Experimental results will refine thermal models and assess uniformity, warmup rate, and power efficiency. Successful demonstration will support Phase II development of a flight-representative heater assembly for green-propulsion systems serving small spacecraft, lunar exploration, and deep-space missions.

Duration: 6

Proposal Details

Proposal Number: GO.1.S26A-0423
Subtopic Title: ASCENT Thruster Pre-heat Optimization
Proposal Title: Alternative Heating Device for Pre-Heat Optimization

Small Business Concern

Firm: Apollodyne LLC
Address: 200 Powder Mill Rd., Wilmington, DE, 19803-2907

Summary Details

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

Apollodyne proposes to develop a compact, microwave-driven heater architecture for rapid catalyst-bed preheating in spacecraft thrusters. The technology uses a microwave-responsive heat-generation layer and an optimized high-conductivity thermal pathway layer that transfers heat into the catalyst bed. This approach is intended to reduce thruster warmup time, lower preheat power requirements, improve localized thermal delivery, and provide a scalable alternative to conventional resistive catalyst-bed heaters. The proposed funding will be used to fabricate the layers of the novel heater design and characterize the resulting heat-generation. Temperature response will be quantified using non-contact optical spectroscopy and pyrometry methods, building on established approaches that

combine time-resolved spectroscopy, multi-color pyrometry, and high-speed imaging to determine reaction or surface temperatures. The initial target market is NASA and government-funded spacecraft propulsion, where compact thermal management, reduced startup energy, and reliable catalyst-bed activation are critical for small spacecraft. The same heater platform has dual-use relevance for defense spacecraft, responsive maneuver systems, green monopropellant thrusters, propulsion OEMs, and adjacent aerospace applications requiring rapid localized heating of catalytic or reactive beds. Successful completion of this effort will establish the technical basis for a Phase II prototype heater module.

Duration: 6

Proposal Details

Proposal Number: GO.1.S26A-0472
Subtopic Title: ASCENT Thruster Pre-heat Optimization
Proposal Title: Heating Of Thrusters Reduced On Demand (HOTROD)

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): 2 - 4
Technical Abstract (Limit 2000 characters):

Benchmark Space Systems (BSS) proposes the development of a catalyst bed preheating technology for ASCENT thrusters known as Heating Of Thruster Reduced On Demand (HOTROD) to converge on a reduced power profile able to comply with a majority of commercial standard buslines and mission sets. BSS has substantial experience in preheating catalyst beds across a wide variety of catalyst types (pebble bed, monolithic) and propellants (HTP, ASCENT). Over the course of the work plan, BSS will investigate several concepts for improving the efficiency of ASCENT catalyst bed preheating and decide on one or multiple to progress further. The propellant known as ASCENT provides comparable or better performance to hydrazine and logistical advantages that enable small spacecraft to include

significantly higher delta-V than previously baselined for many missions. BSS intends to support the proliferation of ASCENT throughout the space industry with end-to-end offerings from initial mission planning and propulsion system delivery, to rapid fueling at the launch site, along with maneuver planning and operational support - similar to the successful HTP propulsion business that BSS has created.

Duration: 6

Proposal Details

Proposal Number: INSTALG.1.S26A-0019
Subtopic Title: â€‹In Situ Instruments and Instrument Components for Lunar and Planetary Science
Proposal Title: Multi-Modal, Robust Nuclear Spectrometer

Small Business Concern

Firm: Radiation Monitoring Devices, Inc.
Address: -

Summary Details

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

RMD proposes developing a radiation-tolerant, low-temperature gamma-ray and neutron spectrometer for lunar and planetary science. The instrument combines gamma-ray spectroscopy, thermal and epithermal neutron detection, and charged-particle discrimination into a single, low-power sensor head. It improves on prior systems such as LMAP MNS and LVISE GRNS, which require multiple sensor heads and rely on scintillators that degrade at extreme low temperatures and under radiation. The new design replaces the scintillator with proven new materials in a compound scintillator configuration, where all the scintillators share one photodetector, with pulse-shape discrimination enabling event-by-event particle identification. This system directly supports NASA goals such as mapping lunar water-ice in permanently shadowed regions (PSR), where the conditions can exceed -100 Â°C. The energy of the neutrons will be affected by the water-ice, and the detector will be capable of directly measuring neutron energy to measure the

impact, yielding concentration of water as well as burial depth. It also enables subsurface elemental analysis crucial for understanding lunar geology and identifying concentrations of elements, such as thorium, iron, uranium, silicon and aluminum minerals. The proposal includes optimizing electronics-either improving the existing FPGA-based readout or adapting a low-power analog architecture-to reduce power consumption below 3 W, with long-term goals approaching 2 W. The scintillator stack will be evaluated for integration into multiple sensor head form factors already developed and flown. The resulting instrument aims to significantly enhance capability for future Artemis, CLPS, and planetary missions.

Duration: 6

Proposal Details

Proposal Number: INSTALG.1.S26A-0098
Subtopic Title: â€‹In Situ Instruments and Instrument Components for Lunar and Planetary Science
Proposal Title: Compact High-Pressure Microfluidic Valves

Small Business Concern

Firm: LabSmith, Inc.
Address: 151 Lindbergh, Livermore, CA, 94551-9497

Summary Details

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

LabSmith proposes to develop a family of space-qualified high-pressure microfluidic switching and selector valves with pressure ratings up to 70 MPa â€” more than triple the 22 MPa rating of LabSmith's current commercially-available valves. The proposed valves will deliver significant reductions in size, mass, and power compared to existing high-pressure microfluidic valves used in NASA applications, directly addressing the National Academy of Sciences' decadal strategy priority to reduce mass, size, and power in in situ instruments. The Phase I effort will focus on four objectives: developing a high-pressure test apparatus and qualification protocol; empirically evaluating a matrix of novel valve design

modifications; improving simulation fidelity using test data; and producing prototype high-pressure valves for delivery to NASA. The work leverages a patent-pending two-part valve architecture in which a metal shell encases compliant Vespel wetted components, enabling higher preloads and substantially greater pressure ratings than the current design. Target NASA applications include high-performance liquid chromatography (HPLC), ion chromatography, supercritical fluid extraction and chromatography, and pressurized liquid extraction for planetary science instruments â€" including JPL's SCHAN instrument, for which LabSmith valves are already in use. Beyond NASA, the developed technology addresses a $5.6B and growing commercial HPLC market, where the miniaturization and power advantages of LabSmith's valve architecture are highly differentiated. Prototype valves with a minimum 32 MPa rating will be delivered to NASA at the conclusion of Phase I.

Duration: 6

Proposal Details

Proposal Number: INSTALG.1.S26A-0323
Subtopic Title: â€‹In Situ Instruments and Instrument Components for Lunar and Planetary Science
Proposal Title: Lunar and Martian Infrared Analyzer (LUMINA)

Small Business Concern

Firm: Leiden Measurement Technology LLC
Address: 1230 Mountain View Alviso Road, Sunnyvale, CA, 94089-2237

Summary Details

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

The LUnar and Mars INfrared Analyzer (LUMINA) is a high-resolution extended short-wave infrared (xSWIR) hyperspectral microscope optimized for both Mars missions (e.g., characterizing potential habitability and searching for past life (e.g., microfossils)) and lunar missions (e.g., volatile prospecting in support of science and/or In-Situ Resource Utilization (ISRU)). Leiden Measurement Technology

(LMT) will design it to detect and characterize H2O and CO2 ices; identify minerals and salts (including perchlorates); and detect astrobiologically-relevant classes of organic molecules in regolithâ€“ all at the single-grain level. LUMINAâ€™s resolution will be better than 8Î¼m, allowing it to image and quantify the composition of individual regolith grains. On the heavily-gardened Moon, this capability allows it to image more than 90% of the mass fraction of regolith particles. LUMINA illuminates samples with orders of magnitude more light than traditional approaches, greatly increasing signal-to-noise and data acquisition rates. It utilizes a novel light engine: a polychromator that employs a digital micromirror device, allowing it to illuminate a sample with an arbitrary combination of wavelength bands. Utilizing Hadamard transform spectroscopy, LUMINA acquires stacks of photomicrographs while sequencing through all possible band combinations, generating a hyperspectral data cube. LUMINA will have a spatial resolution better than 8Âµm; a field-of-view of ~1.6mm x 2.0mm; a spectral coverage spanning least 1.0Âµm â€“ 2.5Âµm with ~4nm resolution. Its final build volume will be ~108mm x 108mm x 175mm. It draws heritage from the OptiDrill and LIfE (NASA ARC) microscopes. LUMINA offers the automated microscopy market an optical platform for extreme environments. In addition to being well-suited for CLPS, CMPS, and Discovery-class missions, LUMINA's technology, including its light engine, will be sold to other manufacturers and for infusion into lunar prospecting equipment.

Duration: 6

Proposal Details

Proposal Number: INSTALG.1.S26A-0410
Subtopic Title: â€‹In Situ Instruments and Instrument Components for Lunar and Planetary Science
Proposal Title: Cold Cathode Electron Sources for Lunar and Planetary Mass Spectrometers

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): 2 - 3
Technical Abstract (Limit 2000 characters):

Cold cathode electron emitters can replace hot filament cathodes in mass spectrometers and other instrumentation that use electron impact ionization. Hot filament cathodes have a high power draw and must be run continuously due to slow warm-up times to get to operating temperatures. This project advances cold-cathode tunneling electron emitter technology by increasing the emission efficiency, lowering the power draw, and increasing the lifetime over previous generation devices. Through fabrication step improvements, additional layers, and substrate engineering, this project will produce devices with power draw <0.05 Watts, tunneling to emission efficiencies over 1%, allow fast on-off behavior for low duty cycle operation, and provide multiple redundant emitters on a single die. This project will develop and optimize a fabrication process for improved emitter devices at MIT.nano with multiple substrates, optimizing the processing to arrive at high tunneling current, long lifetime emitter devices. These will be tested for high emission performance and fast on/off dynamics on the way to developing pulsed, high emission current emitters with >100 ÂµA of emission current and redundant on-die devices to extend mission capabilities in NASA mass spec instrumentation.

Duration: 6

Proposal Details

Proposal Number: INSTALG.2.S26A-0054
Subtopic Title: Suborbital Instruments and Sensor Systems
Proposal Title: Compact laser spectrometer for in situ quantification of stratospheric HCl

Small Business Concern

Firm: Aerodyne Research, Inc.
Address: 45 Manning Rd, Billerica, MA, 01821-3976

Summary Details

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

Technical Abstract (Limit 2000 characters):

We propose a compact, light, low-power spectrometer to measure stratospheric HCl autonomously from aircraft with an uncertainty of 15 pptv (parts per trillion by volume) and a response time of 1 s. Compared to instruments with similar or inferior performance, the proposed spectrometer weighs 3X less (20 kg) and consumes 8-12X less power (50 W). HCl is the main stratospheric reservoir for the anthropogenic chlorine that catalyzes ozone layer destruction, and so it tracks the ongoing impact of chlorofluorocarbon (CFC) emissions. It is measured from orbit by the ACE-FTS and MLS instruments, which have shown departures from HClâ€™s long-term decline, and which require validation by suborbital sensors. The proposed spectrometer would also constitute a new compact, low-power fiberoptic instrument platform for high-precision measurements of many other trace gases both at altitude and on the ground â€” including numerous pollutants (e.g. SO2, NO, C2H6, ethylene oxide) and all greenhouse gases. It would be a breakthrough for remote (e.g. solar-powered) field sites, mobile measurements (from small aircraft or small vehicles), and multi-sensor networks. The goal of Phase I is to demonstrate the feasibility of the proposed spectrometer by: (1) demonstrating spectroscopic measurement of HCl with the target performance using a mid-IR fiber-coupled laser, (2) demonstrating a 1 s HCl response time at stratospheric pressure and humidity in the laboratory, and (3) designing a robust, lightweight prototype to be built and tested in Phase II.

Duration: 6

Proposal Details

Proposal Number: INSTALG.2.S26A-0361
Subtopic Title: Suborbital Instruments and Sensor Systems
Proposal Title: In-Situ Polarized Hyperspectral Volume Scattering Function (VSF) Sensor

Small Business Concern

Firm: Sequoia Scientific, Inc.
Address: 2700 Richards Road, Bellevue , WA, 98005-4200

Summary Details

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

This Phase I project is aimed at assessing the feasibility (engineering, scientific) of an in-situ hyperspectral, volume scattering function (VSF) sensor. The VSF is a critical inherent optical property (IOP) that describes how light interacts with water and its constituents, with broad-reaching implications for ocean color remote sensing validation, biogeochemistry studies, and phytoplankton research. The proposed sensor aims to expand the spectral and angular range and resolution of traditional VSF sensors/measurements, unlocking new capabilities to support next-generation hyperspectral satellite missions (e.g., PACE, GLIMR, SBG). The instrument will utilize a broadband light source coupled to a filter for selectively scanning wavelengths and polarizing optical components for setting and rotating polarization states of the incident light. The source beam will then travel through the liquid sample, scattering light. An array of detectors in the near-forward, side, and near-backward directions will measure the scattered light, with a target angular range of approximately 0-180 degrees. The sensor, while initially designed, built, and tested on the benchtop in this Phase I project, will ultimately be packaged in a submersible housing for in-situ measurements while also working in flow-through configurations for ship-based measurements. The Phase I project will focus on performing optical/mechanical modeling and ray tracing simulations to predict sensor performance and inform key tradeoffs (e.g., light source, detector architecture) in the sensor design. We will then assemble and critically test key components and subsystems, benchmarking against the simulation results. Next, we will assemble and characterize (e.g., light throughput, spectral range/resolution, angular range/resolution) a comprehensive sensor breadboard on the bench. Finally, we will measure different particle standards and compare results with Mie theory afor TRL 4 validation.

Duration: 6

Proposal Details

Proposal Number: INSTALG.2.S26A-0478
Subtopic Title: Suborbital Instruments and Sensor Systems
Proposal Title: Multispectral In-line Digital Imager for Airborne Aerosol Composition Profiling

Small Business Concern

Firm: CloudSci LLC
Address: 430 N College Ave, Fort Collins, CO, 80524-2675

Summary Details

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

Measurements of cloud and aerosol particle size, morphology, and composition are critical to understanding cloud formation, aerosol radiative forcing, and mineral dust transport. Existing lightweight instruments for small uncrewed aerial systems (UAS) and tethered balloon systems (TBS) rely on single-particle light scattering, which provides no morphological information, depends on assumptions about particle shape and refractive index, and cannot measure above approximately 3 micrometers. Imaging instruments that directly measure particle size and shape exist for crewed research aircraft but are too large and power-hungry for small autonomous platforms. This leaves a significant gap in the ability to characterize super-micron aerosol and cloud particle populations from UAS and TBS platforms, limiting validation of NASA Earth science missions including PACE and the forthcoming Atmosphere Observing System constellation. CloudSci LLC proposes to develop the Multispectral In-line Digital Imager (MIDI), a compact open-path holographic aerosol probe designed for deployment on both UAS and TBS platforms. MIDI uses digital holography to image individual particles in the approximately 5 to 100+ micrometer size range, providing direct measurements of particle size and shape without the sampling losses and inlet artifacts that affect conventional techniques. The instrument incorporates a multispectral imaging approach to provide compositional discrimination capability beyond what single-wavelength instruments can achieve, and an autonomous detection mode that enables long-duration unattended operation on tethered balloon deployments. Phase I will demonstrate the core optical system, validate particle sizing against reference standards, characterize instrument performance under representative platform vibration and motion conditions, and conduct an initial UAS hover integration test. Target applications include NASA and DOE airborne science programs, atmospheric research, and a

Duration: 6

Proposal Details

Proposal Number: INSTALG.2.S26A-0531

Subtopic Title: Suborbital Instruments and Sensor Systems
Proposal Title: Hyperspectral Polarimetry, Irradiance, and Radiance System for Gimbal Enabled Autonomous Radiometry of the Sea and Sky (Hy-PIR GEARSS)

Small Business Concern

Firm: BIOSPHERICAL INSTRUMENTS, INC.
Address: 5340 RILEY ST, SAN DIEGO, CA, 92110-2621

Summary Details

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

The Hy-PIR GEARSS project principle objective is to innovatively address an ocean color capability gap by designing an autonomously orienting, compact, low-power gimbal driven frame system that can be deployed on fixed platforms, drone group 1 and above, as well as through legacy methods such as onboard research vessels, aircraft, or buoys, greatly expanding the operational envelope for ocean color validation and research activities. The envisioned system will provide a hyperspectral range exceeding 340â€“900 nm with â‰¤3 nm FWHM spectral resolution with measurement of the polarization state of upwelling sea and sky radiance, together with downwelling irradiance â€” a data suite directly supporting the validation of data products from PACE, Landsat, and GLIMR. The funding will be used to pursue the principal objective through the execution of technical objectives that include the design and integration of a filter wheel for polarimetric measurements, a three-axis gimbal stabilization system, and an independent solar azimuth tracking system. Risk and scope for the project are constrained because of the spectrometer module, its fore optics for both radiance and irradiance, and the entire surface irradiance instrument follow directly from the NASA funded Hy-OPS ADVSR project. This significantly reduces effort required for the surface irradiance subsystem, allowing a primary development focus on the above water radiometry, polarimetry, and GEARSS platform components. This also confers a substantial scientific benefit for the community of users of either system, namely that the spectral resolution, bandpass shape, stray light characteristics, and other performance metrics systems are substantially identical between the systems, allowing for improved intercomparison of data sets and collaboration between researchers. Target markets include NASA, international space agencies, university research, and commercial interests that rely upon ocean color data products.

Duration: 6

Proposal Details

Proposal Number: LIVEP.1.S26A-0224
Subtopic Title: Energy Storage for Long-Duration Missions
Proposal Title: Modular Lunar Surface Batteries with Extreme Thermal Tolerance and Night Operability

Small Business Concern

Firm: TDA Research, Inc.
Address: 4680 Table Mountain Drive, Golden, CO, 80403-2346

Summary Details

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

Further development of advanced rechargeable batteries is required to enable and extend lunar surface operations for mobility, scientific exploration, habitats, and ISRU operations. State-of-the-art lithium-ion batteries (LIB) suffer significant capacity loss below room temperature (20 Â°C) and generally do not operate below -40 Â°C. NASA needs new battery modules that can safely provide >200 Wh/kg (at 20 Â°C) while also operating in ambient conditions as low as -200 Â°C. These batteries must be capable of surviving exposure to multiple lunar day/night cycles, preferably many years. NASA has standardization concepts for modular batteries that allow for mission interoperability. For example, Advance Modular Power Systems (AMPS, led by GRC) seeks to standardize a chassis, a backplane and several power system components including batteries for streamlined lunar power system development. Also, GRC, JSC and JPL have begun an effort dubbed â€œSafe, Innovative, Interoperable Modular Power for Lunar Explorationâ€ (SIIMPLE) to guide the development of energy storage modules that are plug-and-play with common interfaces and standardized battery management systems for multi-year survivability and night operability. In this project, TDA Research will develop safe and low temperature tolerant 18650 cells that combine high temperature stability with cyclability down to -40 and -60 C, and CubeSat battery modules into a 9-in-series sub-module 1kWhr modular battery housed inside a 6U CubeSat chassis generating nominally 120 Volts. The module will have a battery management system (BMS) and electric connections compatible with the NASA-proposed AMPS and SIIMPLE hardware. By adopting and modifying commercial-off-the-shelf (COTS) hardware and combining our next generation low temperature cells, we anticipate being able to deliver prototypes and commercial products after the first year of a potential follow-on Phase II project, and rapidly , and prepare

them for future lunar mission infusion.

Duration: 6

Proposal Details

Proposal Number: LIVEP.1.S26A-0231
Subtopic Title: Energy Storage for Long-Duration Missions
Proposal Title: Biocidal Coatings to Enhance Regenerative Fuel Cell Longevity

Small Business Concern

Firm: GVD Corporation
Address: 45 Spinelli Place, Cambridge, MA, 02138-1046

Summary Details

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

This proposal introduces a non-leaching biocidal coating developed via initiated Chemical Vapor Deposition (iCVD) to prevent biofouling, preserve water quality, and extend service lifetimes within ultra-high-purity (UHP) water systems for lunar and Martian regenerative fuel cells. The technology integrates contact-kill chemistries with amphiphilic surface topographies to eliminate microbial contamination inside complex UHP fluid channels. Phase I funding will be used to optimize precursor chemistry and validate the deposition process in collaboration with the Microbial Integration Group (eLMIG) at Boston University, who will perform advanced biological characterization. Target markets include aerospace fluid infrastructure, semiconductor UHP water systems, commercial medical devices, and data center liquid cooling applications.

Duration: 6

Proposal Details

Proposal Number: LIVEP.1.S26A-0260
Subtopic Title: Energy Storage for Long-Duration Missions
Proposal Title: Extreme-Temperature Lithium-Ion Battery Modules Enabling Reliable Power for Lunar Surface Missions

Small Business Concern

Firm: Elementium Materials, Inc.
Address: 444 Somervile Ave, Somerville, MA, 02143-3260

Summary Details

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

Elementium proposes development of a high-performance battery module exceeding 200 Wh/kg for lunar surface and space applications, directly addressing the thermal and energy density limitations of current space-rated energy storage. State-of-the-art carbonate-based electrolytes freeze and lose ionic conductivity at temperatures well above those encountered during lunar night, forcing module designers to allocate significant mass to resistive heaters, radioisotope units, and multi-layer insulation systems that reduce net usable energy density. Elementium's IonPro Arctic electrolyte replaces conventional carbonate-based formulations with a low-freezing-point, weakly solvating chemistry that enables stable charge and discharge operation down to -60 Â°C without active thermal management, while delivering high voltage stability up to 4.45 V and improved thermal runaway onset characteristics. Phase I funding will be used to finalize a modular subpack design integrating IonPro Arctic with a silicon/NMC pouch cell architecture targeting cell-level energy densities of approximately 400 Wh/kg, and to demonstrate technical feasibility of achieving greater than 200 Wh/kg at the module level. The pouch cell format and electrolyte improvements reduce the traditional cell-to-pack knockdown penalty by enabling a simpler, more compact thermal management subsystem that can be standardized across mission profiles, directly supporting NASA's Advanced Modular Power Systems objectives. Primary target markets include NASA lunar surface systems (rovers, habitats, EVA suits), spacecraft and satellite integrators requiring wide-thermal-range energy storage, and defense platforms operating in extreme environments. The technology addresses a persistent gap identified in NASA's own energy storage assessments and positions Elementium to supply next-generation space-qualified battery modules for sustained lunar exploration and beyond.

Duration: 6

Proposal Details

Proposal Number: LIVEP.1.S26A-0467
Subtopic Title: Energy Storage for Long-Duration Missions
Proposal Title: Reliable Electroformed Bellows Pump for High-Pressure Deionized Water

Small Business Concern

Firm: Faraday Technology, Inc.
Address: 315 Huls Drive, Englewood, OH, 45315-8983

Summary Details

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

Faraday Technology and PSI will develop a high-pressure bellows pump that can supply high-purity deionized water at high pressures for long periods of time without maintenance. These pumps are intended for use in regenerative fuel cells, which will supply power to manned missions on the moon and beyond. Our solution is a modification of a successful pump design from PSI which has already demonstrated 100 million cycles of successful fatigue performance while pumping low-lubricity fuels at high pressures. This design consists of a positive-displacement pump design, in which a thin, electroformed Ni-alloy bellows separates the pumped fluid from hydraulic oil, which lubricates the mechanical components of the pump, leading to reduced contamination and superior long-term performance. Based on this work, PSI has created preliminary designs for a bellows pump that meets NASAâ€™s requirements. In Phase I, Faraday and PSI will produce a benchtop prototype of the pump, sufficient to demonstrate the feasibility of the pumpâ€™s design and materials for delivering high-pressure and high-purity water. In addition, Faraday will develop a noble metal coating for the bellows and demonstrate its compatibility with deionized water. In Phase II, we will deliver a complete prototype pump with our coating technology to NASA. Long-term testing of the Phase II prototypeâ€™s performance and compatibility with deionized water will be carried out in a laboratory environment relevant to the application. Work beyond Phase II will include long-term evaluation of the design, iterative improvements as necessary, and further testing to increase TRL and facilitate integration of the pump into flight-capable regenerative fuel cell systems as well as commercial and DOW systems.

Duration: 6

Proposal Details

Proposal Number: LIVEP.2.S26A-0207
Subtopic Title: Mars and Lunar Power Transfer Technology Development
Proposal Title: Laser Power Beaming for Lunar Rovers

Small Business Concern

Firm: Teravec Technologies LLC
Address: 10271 Green Holly Ter, Silver Spring, MD, 20902-5811

Summary Details

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

A laser power beaming system is proposed that is scalable, lightweight, and modular to support various rover/lander sizes and mission needs. Initial tests at White Sands resulted in world-records for power (800+ W) as well as distance (8+ km). The multi-day tests included dust storms and shock/vibration testing. The field-proven technology is further advanced for highest-efficiency, radiation hardness, and rover integration.

Duration: 6

Proposal Details

Proposal Number: LIVEP.2.S26A-0381
Subtopic Title: Mars and Lunar Power Transfer Technology Development
Proposal Title: Functional Electrostatic Regolith Mitigation for optical-power Interfaces (FERMI)

Small Business Concern

Firm: Volta Space Technologies U.S., LLC
Address: 8641 Old Dominion Dr, Mc Lean, VA, 22102-1100

Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 2 - 4

Technical Abstract (Limit 2000 characters):

Volta Space Technologies proposes the integration of Clear Solar Corporationâ€™s ClearAdvantage electrodynamic dust shield (EDS) technology with Voltaâ€™s optical wireless power transmission (OWPT) architecture to enable sustained, dust-tolerant wireless power transfer for long-duration lunar operations. The proposed system supports kilometer-scale optical power beaming capable of delivering hundreds of watts to kilowatt-class lunar assets while maintaining high optical transmission efficiency in abrasive lunar dust environments. Phase I funding will support system requirement definition, interface development, concept design, coupon fabrication, and benchtop testing of EDS-enabled optical receiver and transmitter surfaces. The effort will evaluate transparent conductive electrodes, dielectric layers, segmented activation zones, and integrated cleaning architectures designed to preserve optical coupling efficiency while minimizing impacts to thermal performance, electrical isolation, and end-to-end power transfer efficiency. Testing will characterize dust removal efficiency, transmission losses, cleaning repeatability, and integration risks under representative lunar dust exposure conditions. The technology addresses a critical challenge for NASA Artemis and commercial lunar infrastructure: maintaining reliable optical power transmission during long-duration surface operations. Target applications include lunar rovers, ISRU systems, landers, habitats, communications infrastructure, and distributed lunar power networks supporting both government and commercial missions.

Duration: 6

Proposal Details

Proposal Number: LIVEP.2.S26A-0432
Subtopic Title: Mars and Lunar Power Transfer Technology Development
Proposal Title: High Power mulit-kw Laser for Lunar/Mars Space Optical Power Transfer

Small Business Concern

Firm: Fibertek, Inc.
Address: 13605 Dulles Technology Drive, Herndon, VA, 20171-4603

Summary Details

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

Fibertek proposes developing a space-capable laser for optical power transfer for orbit to surface and surface to surface application for Mars and the Moon. The space laser has commercial and NASA applications. Optical Power beaming is enabling technology for power distribution to mobile assets, like rovers, robots, science exploration missions. The technology will be critical to power construction and mining equipment particularly in permanently shadowed regions, providing lifeline support and surviving the nigh power across large landscapes. This SBIR will develop a space laser design capable of long-range (0.1 to 20 km), with 4,000 W of laser power, scalable to 10 kW with traceability to future Lunar and Mars missions. Particular attention is focused on meeting the environmental mission demands, securing high reliability, and improving overall power transfer efficiency relative to the state of the art. The program aims to rapidly mature a space laser for a potential 2031-2030 space tech demo mission. The laser will be designed to meet space launch and lunar surface environmental requirements.

Duration: 6

Proposal Details

Proposal Number: LIVEP.2.S26A-0479
Subtopic Title: Mars and Lunar Power Transfer Technology Development
Proposal Title: High Power Density Kilowatt AC-DC Converter with Self-Diagnostics

Small Business Concern

Firm: Yank Technologies
Address: -

Summary Details

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

NASA is actively seeking innovative solutions to enable reliable and efficient power transfer systems for the Moon and Mars. As missions continue to become more power intensive, there is a greater need for compact, high-power-density power conversion to reduce mass and increase on-board efficiency. Furthermore, as new hardware systems are incorporated into future NASA products, such as robotic vehicles, there is also a need for fault detection and diagnostics to detect and diagnose system degradation in a resilient and trustworthy manner. The proposed power converter, High Power Density Kilowatt AC-DC Converter with Self-Diagnostics, directly aligns with NASAâ€™s goals by reducing size, weight, and power losses, while simultaneously performing self-calibration and diagnostics to inform the NASA product the operational status of the unit over the lifetime its deployment. By enabling power delivery in a smaller form factor with self-diagnostics, this innovation will contribute to mission longevity, system reliability, and fault detection, addressing key technical gaps in NASAâ€™s roadmap for powering robotic vehicles, robotic end-effectors, and power transmission cabling on lunar and planetary surfaces.

Duration: 6

Proposal Details

Proposal Number: LWS.1.S26A-0238
Subtopic Title: Mars Solar Array Technology (MSAT) Innovations
Proposal Title: Roll-Out Mars Solar Array Technology (ROMSAT)

Small Business Concern

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

Summary Details

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

Power generation on Mars requires novel approaches to overcome the significant environmental challenges of gravity (0.38G), adherent and persistent dust, terrain obstacles, extreme cold, and wind loading from sporadic dust storms. These

challenges are similar to terrestrial solar power generation but require fully autonomous operations with high reliability as with spacecraft power systems. Mars Solar array technology must be designed to be as adaptable as possible across a range of missions to facilitate adoption and maximize the benefit from development funding. Arrays must be agnostic of the landing vehicle approach because they are unknown at this time and proposed options are very different in approach. Therefore, this study emphasizes scalable solutions that are independent of the vehicle and can operate autonomously but will also consider vehicle mounted adaptations. Our team will develop pneumatic structures to facilitate mobility (controlled traverse from ship to a safe deployment location and directional orientation), controlled deployment of the array, and self-deploying features on the array to protect it from wind loads and dust accumulation while maximizing power generation. The Roll-Out Mars Solar Array Technology (ROMSAT) will leverage the low-power benefits of pneumatic structures to move the compact array into place and deploy it while in contact with the terrain to minimize energy required. Low-mass modular components with high packing efficiency will be used to construct dust and wind tolerant structures to elevate and orient the array to mitigate environmental challenges. Moonprint will be supported by Clear Solar who will advance and integrate Electrodynamic Dust Shield technology with alternating phase electric patterns to reject dust from the photovoltaics to optimize power generation capability and ensure long array life with >90% power generation.

Duration: 6

Proposal Details

Proposal Number: LWS.1.S26A-0401
Subtopic Title: Mars Solar Array Technology (MSAT) Innovations
Proposal Title: Adaptable Solar Array Support

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 - 3

Technical Abstract (Limit 2000 characters):

Future Mars missions will require lightweight, scalable, and reliable surface power systems capable of supporting long duration science and exploration activities. Solar arrays remain the most mass efficient option, but persistent Martian dust accumulation significantly reduces power output and has contributed to the premature end of multiple surface missions. Current solar array architectures rely on static planar geometries that collect dust and lack the ability to adapt to changing environmental conditions. This Phase I effort develops and evaluates an adaptive deployable solar array architecture that integrates passive dust mitigation directly into the structural design. The system uses a lightweight, articulated framework that deploys from a compact stowed configuration into an elevated, inclined operational geometry intended to reduce dust residence time, enhance natural wind assisted dust shedding, and improve long duration survivability. The concept is compatible with existing high efficiency photovoltaic technologies and leverages structural configuration changes rather than power consuming active cleaning systems. Phase I funding will be used to define system level requirements for Mars surface environments; develop and down select conceptual deployment architectures; perform analytical modeling of structural behavior, wind response, and dust accumulation tendencies; and fabricate a representative prototype for experimental validation. Testing will evaluate deployment reliability, structural performance, and dust shedding behavior using Mars analog dust to establish technical feasibility. Target applications include Mars surface power systems for robotic missions, precursor infrastructure, and sustained human exploration. Beyond NASA missions, the technology may transition to terrestrial markets such as remote solar installations in high dust environments where passive dust mitigation improves array reliability and reduces maintenance needs.

Duration: 6

Proposal Details

Proposal Number: LWS.1.S26A-0582
Subtopic Title: Mars Solar Array Technology (MSAT) Innovations
Proposal Title: ARCADIA: Adaptive, Resilient Compact Array with Dust-resistant Integrated Architecture

Small Business Concern

Firm: Arinna, Inc.
Address: 901 Gateway Blvd, South San Francisco, CA, 94080-7024

Summary Details

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

Mars surface architectures need 3â€“20 kW of beginning-of-life solar power that survives multi-year operation in a dust-loaded, wind-stressed, sub-zero environment. State-of-the-art reference designs assume ~1 kg/mÂ² blanket areal mass and treat dust as a passive end-of-life driver â€” consuming a disproportionate share of the landed-mass budget and forcing significant margin into the system design. ARCADIA â€” Adaptive, Resilient Compact Array with Dust-resistant Integrated Architecture â€ is an ultralight, dust-resistant, modular solar array for the Mars surface. It targets an ~20Ã— lighter photovoltaic blanket than the NASA reference, â‰¥90% dust-free operation via an integrated electrodynamic dust shield (EDS), and modular 3â€“20 kW scaling through 50 mÂ² tiles on fixed-tilt mounts anchored to Mars regolith with helical-screw anchors sized for 25 m/s wind survival. Five elements are co-designed around a Mars-tuned sizing framework: an atomically-thin transition-metal-dichalcogenide (TMD) photovoltaic blanket, the 50 mÂ² modular tile, integrated EDS electrodes, helical-screw anchoring, and cold-tolerant fold-and-roll packaging. The TMD blanket is reused from a completed NASA SBIR Phase I; ARCADIA pivots that orbital heritage to surface-deployable operation. EDS development is led by subcontractor Clear Solar Corporation with deep active-EDS systems-engineering experience. Phase I delivers analytical and experimental proof-of-concept at TRL 3: a Mars-tuned sizing report quantifying â‰¥10Ã— full-array dry-mass reduction, a TMD + EDS coupon demonstrating â‰¥85% post-cleaning power recovery on JSC Mars-1A simulant, a 50 mÂ² tile interface control document with a sub-scale fold-and-roll demo, and a sub-scale anchor pull-out validation integrated into a Phase II maturation plan. Target markets: NASA HSF Mars surface architectures, Moon-to-Mars reference missions, and Mars Sample Return follow-on; commercial Mars lander providers; and terrestrial dust-prone solar deployments.

Duration: 6

Proposal Details

Proposal Number: LWS.1.S26A-0598

Subtopic Title: Mars Solar Array Technology (MSAT) Innovations
Proposal Title: Scalable Composite Array for Lander based Energy Systems (SCALES) for Mars

Small Business Concern

Firm: Dynovas Inc.
Address: 12250 Iavelli Way, Poway, CA, 92064-6818

Summary Details

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

The Scalable Composite Array for Landerâ€‘Based Energy Systems (SCALES) is a lightweight, modular, and retractable solarâ€‘power architecture engineered to meet NASAâ€™s need for 3â€“20 kW surface power on Mars. SCALES integrates a composite DIABLOâ€‘derived horizontal mast, largeâ€‘area (45â€“300 mÂ²) solarâ€‘membrane wings, hybrid dustâ€‘mitigation systems, and autonomous anchoring to deliver a massâ€‘efficient, terrainâ€‘tolerant power capability. Funding will advance system architecture definition, mast mechanics, PVâ€‘blanket packaging and deployment trades, environmentalâ€‘mitigation subsystems, and a TRL 3 proofâ€‘ofâ€‘concept demonstrator. The Phase I effort establishes the foundation for a Phase II TRL 4/5 integrated prototype and a clear path to mission infusion. Target customers include NASA Marsâ€‘surface missions, space lander/rover/infrastructure providers, and early infrastructure nodes requiring compact stowed volume, high areaâ€‘toâ€‘mass performance, and survivability in dustâ€‘dominated environments.

Duration: 6

Proposal Details

Proposal Number: ORBECON.1.S26A-0105
Subtopic Title: Catalyzing High-Throughput In-Space Production of Semiconductors and Quantum Materials (CHIPS-QM)
Proposal Title: Coupon-Scale Microgravity RF-Inductive Bridgman Growth of Low-Defect Î²-Gaâ‚‚Oâ‚ƒ Semiconductors

Small Business Concern

Firm: Bryka Inc
Address: 549 Cedar Street, Newington, CT, 06111-1814

Summary Details

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

Bryka Inc. proposes a compact, sealed furnace for producing high-quality gallium oxide (Î²-Gaâ‚‚Oâ‚ƒ) semiconductor coupons in low-Earth-orbit microgravity. On Earth, gravity causes melted material to swirl and settle during crystal growth, creating defects that reduce electronic performance. Brykaâ€™s RF-inductive Bridgman process uses controlled heating, slow solidification, and an oxygen/argon environment to create cleaner, more uniform material. The purpose of the technology is to enable stronger, lighter, and more reliable electronics for satellites, defense systems, aircraft, sensors, power converters, and other applications operating in harsh environments. Phase I funding supports furnace design, thermal and electrical modeling, ground-based coupon testing, and material-quality measurement. The funding market includes NASA InSPA, ISS/LEO commercialization, space power electronics, wide-bandgap semiconductors, aerospace electronics, defense electronics, renewable-energy systems, and future orbital manufacturing services.

Duration: 6

Proposal Details

Proposal Number: ORBECON.1.S26A-0430
Subtopic Title: Catalyzing High-Throughput In-Space Production of

Semiconductors and Quantum Materials (CHIPS-QM)
Proposal Title: MESA-Q: Microgravity Engineered Semiconductor Device Architecture and Production for Quantum Computing and Quantum Sensing Applications

Small Business Concern

Firm: United Semiconductors LLC
Address: 10571 Calle Lee, Los Alamitos, CA, 90720-2542

Summary Details

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

The proposal unites three currently separate technical threads: antimonide band engineering, space-based materials manufacturing, and scalable solid-state quantum hardware. NASA's mission pull is strongest for quantum sensing: gravity-gradient mapping, inertial navigation without GPS, cryogenic detectors, compact low-SWaP sensor front ends, and radiation-aware electronics for science missions. The novelty in the proposed technical approach is that microgravity can significantly improve the atomic scale materials properties that dominate quantum-device yield. If validated, the result would be a specialty supply chain for ultra-low-noise III-V quantum chips and quantum sensors. The proposed effort will demonstrate a pathway for microgravity crystal growth and device processing on ISS (in Phase 2) for a selected class of novel III-V antimonide semiconductor quantum structures. These III-V antimonide quantum-device structures have numerous applications, including NASA-relevant cryogenic quantum sensing, with a transition path to spin-orbit and topological quantum-computing hardware. The proposed demonstrator is a layered antimonide quantum-device coupon fabricated first in microgravity and then in a terrestrial environment. The baseline stack is: semi-insulating AlGaInSb substrate and buffer/barrier; GaInSb or InSb quantum channel; AlGaInSb or AlSb upper barrier; optional InAs/GaSb broken-gap bilayer; in situ or post-growth superconducting Al; ALD Al2O3 or HfO2 gate dielectric; Ti/Au or NbTiN gates. The proposed demonstrator is a layered antimonide quantum-device coupon fabricated first on Earth and then in a microgravity-compatible growth experiment.

Duration: 6

Proposal Details

Proposal Number: ORBECON.1.S26A-0498
Subtopic Title: Catalyzing High-Throughput In-Space Production of Semiconductors and Quantum Materials (CHIPS-QM)
Proposal Title: Microgravity Plasma-Enhanced Hydrogen Annealing of Semiconductor Materials

Small Business Concern

Firm: Single Crystal Diamond
Address: 101 Franklin St, Douglas, MA, 01516-2334

Summary Details

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

Single Crystal Diamond, Inc. proposes to develop and validate a plasma-enhanced rapid thermal process (PE-RTP) hydrogen annealing method for microgravity diamond and advanced semiconductor materials. This innovation combines hydrogen annealing, rapid thermal ramp and quench control, plasma-enhanced activation, and microgravity processing into a highly efficient, repeatable post-growth manufacturing step. By bringing terrestrially grown diamond wafers to orbit for rapid annealing, this approach captures the defect-repairing and uniformity benefits of the space environment while achieving a 10 to 100x reduction in required energy and dwell time compared to full in-space crystal growth. Phase I funding will be used to establish technical feasibility, measurable material-performance value, refined understanding of the processing parameters that will best utilize the microgravity environment, and an ISS flight-demonstration plan for this high-throughput architecture. The team will conduct rigorous ground experiments using an existing in-house plasma reactor to isolate and optimize the interrelated effects of thermal profiles, hydrogen reactions, and plasma treatments. The project will yield a ground-validated process window, a comprehensive controls-based material data package quantifying pre- and post-anneal changes, and a preliminary proof-of-concept plan for a low Earth orbit (LEO) demonstration on already-funded plasma reactor hardware. The target market encompasses the rapidly growing demand for premium, high-value semiconductor and quantum diamond wafers where terrestrial manufacturing limits device performance. Key applications span defense and commercial sectors, including quantum magnetometers for GPS-denied navigation, quantum computing and networking devices, radiation-hard electronics and detectors for oncology, and advanced power electronics for

modernized grids and electric vehicles.

Duration: 6

Proposal Details

Proposal Number: ORBECON.1.S26A-0504
Subtopic Title: Catalyzing High-Throughput In-Space Production of Semiconductors and Quantum Materials (CHIPS-QM)
Proposal Title: Metal Fluoride Purification and Microgravity Fiber Preform Manufacturing for Fiber Memory Loops in Quantum Computing

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): 3 - 4
Technical Abstract (Limit 2000 characters):

Outpost Technologies is developing an integrated ultra-high-purity precursor processing and microgravity preform manufacturing architecture for heavy metal fluoride (ZBLAN) optical fiber targeting photonic quantum computing applications. Optical attenuation in fiber memory loops and delay-line systems is the dominant performance bottleneck limiting computational depth and scalability in photonic quantum computers. ZBLAN fiber has a theoretical minimum loss of ~0.02 dB/km versus 0.14 dB/km for silica at 1550nm, but the best terrestrial ZBLAN achieves only a few dB/km due to contamination and gravity-driven structural defects during production. Prior microgravity ZBLAN programs demonstrated orbital processing benefits but remained limited by contamination in terrestrially fabricated preforms. Outpost's architecture addresses this upstream gap through two integrated stages: (1) ultra-purification of binary metal fluoride precursors targeting less than or equal to 10 ppb per 3d transition metal and O-H impurity species, and (2) microgravity glass-melt preform fabrication that eliminates buoyancy-driven convection, sedimentation, and phase separation introduced by gravity on Earth. Phase I funding will establish the technical foundation for this approach: designing the purification

process suite and analytical verification framework, developing the terrestrial melt baseline, defining an ISS-compatible microgravity payload concept, and establishing the standardized comparison methodology and Phase II go/no-go criteria. Target markets include photonic quantum computing companies requiring ultra-low-loss fiber memory loops and delay lines, with signed MOUs from PsiQuantum and Xanadu validating near-term demand. Adjacent markets include quantum networking, infrared sensing, directed energy, and next-generation telecommunications.

Duration: 6

Proposal Details

Proposal Number: SPWX.1.S26A-0268
Subtopic Title: â€‹â€‹Advanced Data-Driven Applications for Space Weather Research-to-Operations-to-Research (R2O2R)
Proposal Title: "DAFFS-4pi" for Full-Heliosphere Solar Event Forecasting

Small Business Concern

Firm: NorthWest Research Associates, Inc.
Address: 1100 NE 45th Street, Seattle, WA, 98105-4696

Summary Details

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

There is presently no operational facility that issues quantitative flare forecasts for regions of the Sun that are not directly visible from Earth, yet strong flares originating from solar active regions that are near-, at-, or just-beyond the solar limbs (the "limb sectors") can be impactful to Earth's ionosphere and (for the west-limb sector especially) be the originating sources of Geo- and Moon-relevant Coronal Mass Ejections and Solar Particle Events. These limb-sector flares almost universally result in forecast "misses" or False Negatives. There is similarly no facility to issue forecasts or provide solar situational awareness for the rest of the Heliosphere. Missions located away from the Sun-Earth line are effectively blind to hazards and risks from solar energetic events. The Martian ionosphere also reacts to

solar flares, with potential communications impacts. NWRA proposes to address these operational shortcomings with "DAFFS-4pi", a full-heliosphere forecasting facility for solar flares. A recent proof-of-concept (Leka+2026) invoked a surface flux transport model with active-region tracking for multi-parameter input to the NWRA Classification Infrastructure (NCI; based on nonparametric discriminant analysis). Quantitative validation demonstrated significant improvement for predicting Earth-detectable solar flares originating from the limb-sector. Phase-I research will solidify the TRL-2 concept, explore innovations for evaluating active regions with coronal models plus EUV imaging (adding redundancy), initiate additional validation frameworks, and prepare for integration with NWRA's TRL-6 "Discriminant Analysis Flare Forecasting System (DAFFS)". Phase-I will end at a TRL-3 in preparation for Phase-II. Target markets for DAFFS-4pi include multiple NASA offices (CCMC, SRAG, M2M), NOAA/SWPC, commercial entities concerned with HF fadeouts (airlines) and those involved in Lunar and Martian missions.

Duration: 6

Proposal Details

Proposal Number: SPWX.1.S26A-0310
Subtopic Title: â€‹â€‹Advanced Data-Driven Applications for Space Weather Research-to-Operations-to-Research (R2O2R)
Proposal Title: Transitioning Physics-Based Thermospheric Data Assimilation for Next-Generation LEO Drag Forecasting

Small Business Concern

Firm: LEOcast Space LLC
Address: 3953 Hawthorne CIR, Longmont, CO, 80503-7658

Summary Details

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

This proposal develops a prototype cloud-based framework for physics-based thermospheric density nowcasting and forecasting using the Iterative Driver

Estimation and Assimilation (IDEA) system coupled with multiple physical models of the thermosphere. The effort directly supports NASA FY26-27 SBIR topic SPWX.1.S26A by advancing transition of an advanced space weather research capability toward operationally relevant deployment. Atmospheric drag is the dominant source of orbit prediction uncertainty for satellites operating in Low-Earth Orbit (LEO). Existing operational drag models rely heavily on empirical atmospheric specifications that perform poorly during geomagnetic disturbances and cannot fully exploit emerging commercial observational datasets. The proposed effort addresses this gap by combining physics-based thermospheric modeling with assimilation of neutral density observations derived from commercial GNSS-enabled satellite constellations. Phase I will focus on establishing a prototype cloud-computing architecture for IDEA, prototyping ingestion and processing workflows for GNSS-derived density observations, evaluating retrospective workflow performance and scalability, and defining a roadmap for future operational forecasting and commercialization. Validation activities will assess system performance relative to independent datasets and model baselines. The proposed technology is intended to support future operational space weather forecasting, space traffic coordination, conjunction assessment, orbit prediction, maneuver planning, and satellite operations. Target markets include government space weather centers, civil and commercial Space Situational Awareness (SSA) providers, satellite owner/operators, and future commercial forecasting services. The effort establishes a pathway toward transition of advanced thermospheric forecasting capabilities from research environments into scalable operational and commercial applications.

Duration: 6

Proposal Details

Proposal Number: SPWX.1.S26A-0367
Subtopic Title: â€‹â€‹Advanced Data-Driven Applications for Space Weather Research-to-Operations-to-Research (R2O2R)
Proposal Title: Machine-learned NO and CO2 Cooling Rate Profiles and Global Power for Improved Real-Time Thermospheric Density Specification

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): 1 - 3
Technical Abstract (Limit 2000 characters):

Satellite orbit prediction is critically impacted by the neutral thermosphere and its response to geomagnetic storms. A key feature of that response is the combined energetics of geomagnetic input and radiative cooling through molecules like nitric oxide (NO), which provides cooling power that reaches hundreds of gigawatts following a geomagnetic storm. Therefore, understanding NO cooling and its evolution during storms is critical to nowcasting and forecasting neutral density and satellite drag. We propose to address this need by developing a machine-learned model (MLM) to nowcast the radiative cooling rate profiles of NO and CO2 at 115-250km and 100-140km respectively in units [Wm-3], using a ~24-year dataset of NO and CO2 cooling rates from the Sounding of the Atmosphere using Broadband Emission Radiometry (SABER) instrument aboard NASA TIMED. The MLM will improve over previous machine-learned attempts in several ways, including through the use of Space Environment Technologyâ€™s (SET) commercial S10, Y10 and M10 indices to derive input features. The MLMâ€™s output will be volumetrically integrated to calculate a combined global NO and CO2 cooling power, and we will operationalize this calculation to create the real-time Global Cooling Power (GCP) index. The purpose of GCP index is to serve as an input driver in next-generation models of thermospheric density, so that they may better account for changes in NO and CO2 cooling power, and in particular account for enhanced cooling in the recovery phase of geomagnetic storms (â€œovercoolingâ€). To validate the utility of GCP index, we will re-train SETâ€™s machine-learned HASDM-Sol model of thermospheric density using GCP index as an input feature, then its quantify its impact on performance. This innovation has applications within civilian and commercial satellite operations, defense, and space traffic management which enable our path toward commercialization.

Duration: 6

Proposal Details

Proposal Number: SPWX.1.S26A-0460
Subtopic Title: â€‹â€‹Advanced Data-Driven Applications for Space Weather Research-to-Operations-to-Research (R2O2R)
Proposal Title: FlareFirst: A Real-Time Tool for Solar Flare Prediction

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): 3 - 4
Technical Abstract (Limit 2000 characters):

Flare prediction is of critical importance to protect space-based assets, both human and hardware. FlareFirst is a breakthrough tool that uses extreme ultraviolet emission fluctuations in real-time observations to determine when and where a flare is likely to occur, how significant a flare it will be, and whether it poses a radiation risk due to solar energetic particles. We propose to develop this tool, based on our recent study introducing the method on a set of over 50 major flares on the solar limb. This study showed that emission fluctuations were significantly larger in 60-80% of the flares, and the peak in these fluctuations occurred 1-3 hours before flare onset. This opens up a new possibility to move into true flare forecasting, rather than current operational now-casting which publish alerts once a flare has begun. We will test the method on a larger set of events, and apply metrics to demonstrate its effectiveness in the Phase I. For the Phase II, we will participate in the NASA CCMC flare scoreboard, and then streamline and package FlareFirst for use by governmental agencies or private space companies. Additionally during this stage, we will collect spacecraft anomaly data and conduct a study on which solar flare-related phenomena present the most risk to spacecraft. Our innovation has already proven to be of interest to the private space industry, and will also be of significant interest to NASA departments such as the Moon to Mars Office and the Space Radiation Analysis Group, as well as NOAA and the United States Space Force and Air Force.

Duration: 6