NASA SBIR 2026B-I Solicitation

Proposal Details

Proposal Number: AERO.1.S26B-0824
Subtopic Title: Health Management and Sensing Technologies for Sustainable Aviation Fuel Systems
Proposal Title: VECTOR (Vibration, Electrical, and Condition Tracking for Operational Reliability)

Small Business Concern

Firm: MotorVision Inc.
Address: 1921 Adams Rd, Owingsville, KY, 40360-8071

Summary Details

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

VECTOR is a scalable non-invasive predictive maintenance and health management system for hybrid-electric, fully electric, and alternative-fuel aircraft platforms. The system adapts existing MotorVision technologies, including the MotiX sensing platform, MotoScope FFT analysis systems, PowerSTRAP electrical monitoring technologies, Canaryâ„¢ environmental monitoring systems, and the TrueSight TelematiX analytics platform, toward aviation-focused monitoring of electric propulsion systems, structural systems, thermal management systems, and cryogenic fuel infrastructure. Sustainable aviation platforms introduce new challenges associated with highly coupled electrical, thermal, structural, and propulsion systems operating in electrically noisy environments. Existing aircraft monitoring approaches often rely on invasive instrumentation requiring modification of flight-critical systems, increasing integration complexity and certification burden. VECTOR addresses this challenge through a modular retrofit-capable sensing architecture capable of monitoring aircraft subsystem health without invasive integration into control systems. Phase I activities will define sensing requirements, evaluate aviation-relevant hardware integration, collect representative operational datasets, and develop predictive maintenance algorithms using vibration, thermal, environmental, and electrical signature analysis. Particular emphasis will be placed on FFT-based spectral analysis, multi-modal sensor fusion,

anomaly detection, and AI-assisted analytics for detection of degradation and fault conditions in sustainable aviation systems.

Duration: 6

Proposal Details

Proposal Number: AERO.1.S26B-0931
Subtopic Title: Health Management and Sensing Technologies for Sustainable Aviation Fuel Systems
Proposal Title: High Frequency Duel TMR sensor Diagnostics for EAP motors

Small Business Concern

Firm: En'Urga Inc.
Address: 1201 Ste. A, Cumberland Ave., West Lafayette, IN, 47906-0000

Summary Details

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

Enâ€™Urga Inc. proposes to evaluate the feasibility of using duel Tunneling Magneto-Resistance (TMR) sensors (MCSA and MFSA) for high-frequency fault diagnosis of motor (e.g., insulation failure) within high-noise Electrified Aircraft Propulsion (EAP) environments. Key Technical Challenges (Phase I) 1. Noise Suppression: Developing methods to suppress intense high-power inverter switching noise using a dual-TMR sensor configuration (measuring motor current and motor magnetic flux). 2. Fault Correlation: Establishing a direct correlation between high-frequency magnetic field signatures and the onset of partial discharge or insulation breakdown. Phase I Technical Tasks â€¢ Task 1: Sensor Design & Fabrication: Develop dual customized TMR sensors. Sensor 1 will capture dynamic current signatures containing high-frequency inverter switching noise. Sensor 2 will monitor magnetic flux to capture high-frequency signatures of eccentricity, demagnetization, mechanical degradation, and insulation faults. â€¢ Task 2: Noise Cancellation Methodology: Develop differential signal-processing algorithms to isolate and suppress inverter switching noise by comparing the outputs of the duel TMR sensors. â€¢ Task 3: Diagnostic Correlation: Establish the mathematical and

empirical relationships linking high-frequency magnetic flux transients to specific insulation failures and partial discharge events.

Duration: 6

Proposal Details

Proposal Number: AERO.1.S26B-0970
Subtopic Title: Health Management and Sensing Technologies for Sustainable Aviation Fuel Systems
Proposal Title: Integrated Optical Health Management for Cryogenic Sustainable Aviation Fuel Systems and Critical Aircraft Structures

Small Business Concern

Firm: Trilion Quality Systems LLC
Address: 651 Park Avenue, King of Prussia, PA, 19406-1408

Summary Details

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

Sustainable aviation systems using cryogenic hydrogen fuel require new sensing and health-management technologies capable of monitoring distributed thermo-mechanical behavior, early-stage damage, and long-term structural integrity. Existing embedded and point-based sensors do not provide sufficient spatial coverage to detect localized strain concentrations, microcracking, interface degradation, and coupled thermal-structural effects in composite cryogenic fuel tanks, pressure vessels, and adjacent aircraft structures. Trilion Quality Systems proposes an Integrated Optical Health Management (OHM) system combining 3D Digital Image Correlation (3D-DIC), infrared thermography, digital twin integration, and AI/ML-assisted anomaly detection to provide non-contact, full-field monitoring of cryogenic sustainable aviation fuel systems and aircraft structures. Phase I will focus on a representative composite cryogenic fuel structure subjected to simulated fueling or cryogenic thermal cycling, with synchronized measurement of full-field strain, deformation, and thermal response. A secondary demonstration will apply the same sensing architecture to a representative composite aircraft

structure, such as a blade or dynamically loaded composite specimen, to establish broader aircraft applicability. The work builds on extensive aerospace heritage in full-field optical measurement, including structural, thermal, cryogenic, pressure, and autofrettage testing of composite overwrapped pressure vessels (COPVs). Trilionâ€™s experience includes work with General Dynamics, Rocketdyne, Relativity, and SpaceX, where full-field DIC is ideally suited to understanding structural integrity under coupled loading conditions. Phase I will integrate measured data into Trilionâ€™s Xi Digital Twin framework to enable baseline comparison, anomaly tracking, and future prognostics development, supporting NASA Glenn and NASA Langley mission interests. in hydrogen fuel systems and advanced composites.

Duration: 6

Proposal Details

Proposal Number: AERO.2.S26B-0194
Subtopic Title: Quiet Performance-Aircraft Propulsion Noise
Proposal Title: Advanced In-Situ Diagnostics for Combustor Noise and Thermoacoustic Instability in Aircraft Engines

Small Business Concern

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

Summary Details

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

Aircraft noise remains a key constraint on aviation growth, driving demand for tools that predict, diagnose, and reduce propulsion noise and enable early-stage and system-level evaluation of engine designs and operating conditions. Propulsion-noise diagnostics exist for dominant fan and jet sources, but not for combustor and turbine noise. As fan and jet noise is reduced through high-bypass architectures and nacelle treatments, combustor-driven core noise and turbine-generated indirect noise increasingly dominate the remaining acoustic signature. A key diagnostic

limitation is that the combustor interior remains the least-instrumented engine station, and high-bandwidth, time-resolved pressure measurements under realistic combustor conditions are not routinely available. Robust in-situ combustor pressure sensing would enable separation of combustion-driven noise from other sources, validation of next-generation prediction tools for system-level noise assessment, and targeted mitigation via combustor geometry optimization, fuel-injection tuning, and active instability control. The long-term objective is to leverage Sporian Microsystems prior technology development to create a high-bandwidth pressure sensor with substantially increased operating temperatures and combustor-specific packaging to enable reliable direct in-situ measurements in combustor environments. The Phase I effort will focus on: working with NASA and industry stakeholders to define system requirements pathways for application within NASA; evaluating revised hardware/electronics architectures and designs; and proof of principle testing and demonstration of feasibility using benchtop-scale prototype hardware. If successful, Sporian will be well positioned for the Phase II efforts focused on full system prototyping and relevant environment demonstrations. This work will be done though a collaboration between Sporian Microsystems and the Advanced Propulsion and Power Lab at Virginia Tech.

Duration: 6

Proposal Details

Proposal Number: AERO.2.S26B-0224
Subtopic Title: Quiet Performance-Aircraft Propulsion Noise
Proposal Title: Cost Effective Large Eddy Simulation Capability for Turbofan Core Noise

Small Business Concern

Firm: Volcano Platforms Inc.
Address: 422 Portage Ave, Palo Alto, CA, 94306-2212

Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 1 - 4
Technical Abstract (Limit 2000 characters):

This Phase-I SBIR effort will develop a cost-effective, high-fidelity computational capability for predicting turbofan engine core noise using Volcano ScaLES. The proposed technology addresses a critical challenge in next-generation aircraft propulsion systems, where combustor-generated noise is becoming a dominant contributor to overall engine noise as fan and jet noise are reduced through modern high-bypass-ratio engine designs. The project is intended to extend ScaLES capabilities to include advanced turbulent combustion modeling, non-reflective boundary conditions, and reduced-order combustor-to-nozzle coupling methodologies that can enable predictive simulation of both direct and indirect combustion noise mechanisms. Phase-I funding will support development, validation, and demonstration of these new physics capabilities using representative combustor and jet-noise benchmark configurations relevant to NASA and the aerospace industry. The resulting software capability is intended for use by engine manufacturers, aerospace OEMs, government laboratories, and research organizations seeking practical high-fidelity simulation tools for low-noise propulsion-system design, combustor development, and aeroacoustic analysis. In addition to commercial turbofan applications, the technology is also relevant to military propulsion systems. By leveraging modern GPU hardware and scalable Cartesian-grid LES methods, Volcano ScaLES aims to eliminate laborious grid generation bottlenecks with turnaround times to deliver simulation turnaround times and computational costs substantially lower than traditional high-fidelity CFD approaches, enabling broader industrial adoption of predictive aeroacoustic simulation technologies.

Duration: 6

Proposal Details

Proposal Number: AERO.2.S26B-0394
Subtopic Title: Quiet Performance-Aircraft Propulsion Noise
Proposal Title: Hybrid High-Fidelity and Data-Driven Prediction Framework for Open Rotor Aeroacoustics

Small Business Concern

Firm: Technology in Blacksburg, Inc.
Address: 265 Industrial Drive, Christiansburg, VA, 24073-2538

Summary Details

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

Open rotor engines offer transformative efficiency for sustainable aviation but face severe acoustic penalties due to the lack of an enclosing nacelle. Mitigating these penalties requires rapid, high-fidelity acoustic design space exploration. Techsburg, with a subcontract to the University of Notre Dame, proposes a hybrid computational and data-driven prediction framework. This tool anchors a Physics-Guided Neural Network (PGNN) surrogate model using feature extraction from scale-resolving Computational Aeroacoustics (CAA) paired with ground-truth experimental data. Phase I refines and validates the computational methodology. Leveraging recent breakthroughs in native GPU computing within the PowerFLOW lattice-Boltzmann method (LBM) solver, accurate aeroacoustic simulations of open rotors can now be completed in under 24 hours. A critical innovation is a novel constrained turbulence approach, coupling externally-generated atmospheric turbulence fields with PowerFLOW to accurately resolve highly transient atmospheric turbulence ingestion noise (TIN) and blade-wake interaction (BWI) noise. To validate this numerical framework, a dedicated acoustic measurement campaign will be executed at Notre Dame's Open Rotor Advanced Noise Control Fan (OR-ANCF) rig, utilizing a new shaft extension for distortion-free data collection. By applying LBM source segregation techniques to mathematically isolate facility-dominant effects from cruise-relevant noise, the framework acts as a numerical filter. These validated workflows and physical measurements lay the foundation for training the Phase II PGNN surrogate model, providing propulsion OEMs with a rapidly executable tool to accelerate the design of quiet, efficient propulsors.

Duration: 6

Proposal Details

Proposal Number: AERO.3.S26B-0600
Subtopic Title: Advanced Thermal Management for High-Efficiency Engine Cycles
Proposal Title: HELIX - High-Effectiveness Low-pressure-drop Integrated sCOâ,, eXchangers

Small Business Concern

Firm: Step Function LLC

Address: 58 Foggwood Rd., Fairfield, CT, 06824-1684

Summary Details

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

Step Function LLC proposes to develop the heat-exchanger (HX) technology required to make a closed supercritical COâ,, (sCOâ,,) waste-heat-recovery (WHR) bottoming cycle viable on an advanced single aisle aircraft engine (e.g., PW GTF or GE LEAP). A modern high-bypass turbofan rejects ~12 MW of thermal energy through its core exhaust at cruise; recovering even a fraction of that heat into fan shaft and aircraft electrical power offers a step-change in propulsion-system efficiency, but only if the four required HXs (primary core-exhaust, fan-stream rejection, high-temperature recuperator, and HPT first-stage NGV cooling loop) can be built at acceptable mass and pressure drop. The HELIX innovation is to design these HXs as multi-functional load-bearing engine structural elements â€" integrating the hot-side HX into the rear turbine frame (TRF) and the cold-side HX into fan-stream structures (OGVs, bifurcation struts, cowl liner, fan-frame manifold) â€" combined with advanced lower pressure drop heat transfer surfaces. An integrated mission model projects a > 10% mission fuel-burn reduction on a 2,000 nm narrow-body mission, at a net mass penalty of +245 kg per engine for the advanced configuration. The six-month Phase I funds five technical tasks plus project management: (T1) mature an integrated cycle / HX / weight / mission-fuel-burn model; (T2) CFD-coupled topology optimization of cold- and hot-side HX geometries within structural and Î"P/P envelopes; (T3) fabricate and characterize 4+ AM and OSF coupons in low-pressure air-air tests for j, f, and j/f; (T4) re-anchor the cycle model to measured data and develop OEM/turbomachinery partnerships; (T5) deliver a Phase II prototype specification. The primary target market is narrow-body commercial aviation via engine-OEM licensing; secondary markets include regional/business jets, aero-derivative industrial gas turbines (likely first revenue), and ground-based sCOâ,, WHR.

Duration: 6

Proposal Details

Proposal Number: AERO.3.S26B-0855
Subtopic Title: Advanced Thermal Management for High-Efficiency Engine Cycles
Proposal Title: Smart 2-Phase Heat Exchangers for LH2 Cooling in Advanced

Propulsion Systems for Aircraft

Small Business Concern

Firm: Tech4Imaging LLC
Address: 1910 Crown Park Court, Columbus, OH, 43235-2404

Summary Details

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

Tech4Imaging (T4I) proposes to develop a smart 2-phase heat exchanger for LH2 cooling in advanced propulsion systems for aircraft. This novel device optimizes heat transfer without exceeding thermal runaway limitations. This is done using capacitance sensors embedded inside a micro channel heat exchanger to detect void fraction and flow regime evolution. The proposed smart heat exchanger works in a flow control architecture to inform engine and fuel control systems how to fluctuate LH2 or other coolant flow throughout the complex thermal control system (TCS). Whether LH2 is used for combustion, a fuel cell, or a closed coolant loop, this smart 2-phase heat exchanger will optimize critical thermal energy transfer reducing TCS weight by up to 50-75%. For phase I, T4I proposes to design, build, and conduct a proof-of-concept test to definitively tie capacitance measurements to a CHF warning. Additionally, a conceptual design of a fully integrated propulsion cooling system will be developed, and calculations will be performed to confirm the expected mass savings of 50-75% of the TCS with and without the smart 2-phase heat exchanger. We will assess scalability to aviation propulsion requirements and identify key technical risks and mitigation strategies for phase II. The targeted markets are cryogenic heat exchange systems in aviation. Because 2-phase flow boiling is a ubiquitously useful phenomenon, adjacent markets are large and varied including non-LH2 flow boiling coolant systems in aviation, hypersonic engine cooling, data center cooling, nuclear thermal systems, space propulsion, automotive EV thermal management, industrial process heat exchangers, semi-conductor manufacturing cooling, medical devices, power electronics and grid infrastructure, and test facilities.

Duration: 6

Proposal Details

Proposal Number: AERO.3.S26B-1002
Subtopic Title: Advanced Thermal Management for High-Efficiency Engine Cycles
Proposal Title: Integrated Loop Heat Pipe Cooling for High-Power-Density Axial Flux Aviation Motors

Small Business Concern

Firm: Technology Holding LLC
Address: 5187 S Ascension Way, Murray, UT, 84123-2996

Summary Details

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

Technology Holding LLC (THL), in collaboration with Georgia Institute of Technology (GT), proposes a multi-bore (honeycomb) carbon fiber capillary wick integrated into a loop heat pipe (LHP) architecture specifically designed for thermal management of high-power-density aviation axial-flux electric motors. The innovation places chopped multichannel hollow carbon fibers (each containing approximately 7 internal bores of 2â€“3 Âµm diameter) inside hollow copper motor windings, creating a bi-modal pore structure that generates high capillary pressure through micro-scale intra-fiber bores while maintaining low hydraulic resistance through macro-scale inter-fiber voids. This passive two-phase system will achieves heat transfer coefficients of 10,000â€“100,000 W/(mÂ²Â·K), an order of magnitude above conventional single-phase liquid cooling, while the carbon fiber wick at 1.15 g/cmÂ³ replaces sintered metal wicks at 8.9 g/cmÂ³, significantly reducing system mass. The Phase I effort will fabricate and characterize the novel CF wick, integrate it into a subscale LHP evaporator representative of a single hollow copper motor winding, and demonstrate stable two-phase heat acquisition at heat fluxes relevant to megawatt-class motors (â‰¥10 W/cmÂ²). A validated thermal-hydraulic model will predict full-scale motor performance. The work advances the technology from TRL 2 to TRL 3â€“4, establishing feasibility for Phase II multi-tube/winding prototyping and motor integration testing.

Duration: 6

Proposal Details

Proposal Number: AERO.4.S26B-0108
Subtopic Title: Flight Test Measurement Technologies
Proposal Title: Integrated Modular Platform for Aerial Characterization, Telemetry, and Sensing (IMPACTS)

Small Business Concern

Firm: American GNC Corporation
Address: 888 Easy Street, Simi Valley, CA, 93065-1812

Summary Details

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

NASA Armstrong Flight Research Center is currently in need of test technologies that improve real-time data acquisition, onboard processing, telemetry, and management of heterogeneous measurements from flight vehicles and associated test infrastructure. To address this need, American GNC Corporation (AGNC) and Penn State Universityâ€™s Applied Research Laboratory (Penn State ARL) propose the Integrated Modular Platform for Aerial Characterization, Telemetry, and Sensing (IMPACTS), a low-SWaP, modular, open-source-based architecture for acquiring, processing, prioritizing, recording, and disseminating flight-test data from UAVs and related aerial research platforms. IMPACTS provides the common telemetry processing and data management layer that integrates sensor, vehicle-state, structural, power, avionics/data-bus sources, and off-board measurement sources into synchronized, time-stamped and prioritized flight-test data products. By establishing an open and flexible data telemetry platform, IMPACTS reduces barriers to acquiring and analyzing in-flight data for unmanned aerial vehicles (UAV), thus advancing NASA advanced air mobility efforts. This system builds upon hardware from our Flexible Aerial Systems Testing with Reconfigurable and Expandable Payload (FAST-REP), a sensing payload that provides UAVs with cost-effective flight data collection and in-situ testing of embedded software. This Phase I effort advances that foundation by emphasizing areas specified by NASA AFRC, namely high-efficiency digital telemetry, low-latency and near-real-time processing using open-source operating systems and middleware, real-time integration of onboard/off-board data sources, recording of avionics/data-bus architectures, and representative optical sensing data streams. The result will be a proof-of-concept airborne and ground-test architecture that can be matured in Phase II into a hardware and software product suitable for NASA relevant-environment ground and

flight testing.

Duration: 6

Proposal Details

Proposal Number: AERO.4.S26B-0187
Subtopic Title: Flight Test Measurement Technologies
Proposal Title: Flight-Integrated SAFS Architecture

Small Business Concern

Firm: RH Technologies, LLC
Address: 722 Reeves Dr, Grand Forks, ND, 58201-4920

Summary Details

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

RH Technologies LLC (RHT) proposes to develop a compact, vibration-resilient, flight-integrated Self-Aligned Focusing Schlieren (SAFS) payload for non-intrusive in-flight optical flow diagnostics. SAFS is a NASA-developed diagnostic that provides simplified alignment, vibration resistance, and near-planar density-gradient visualization relative to traditional schlieren systems. RHT is the sole commercial provider/licensee of SAFS and has already demonstrated strong commercial traction across NASA, government, academic, and industry customers. NASA flight testing needs improved methods for visualizing shock waves, boundary-layer transition, shock/boundary-layer interactions, flow separation, plumes, and other density-gradient structures in real flight environments. Existing in-flight schlieren approaches often require external observers, specialized ranges, restrictive viewing geometries, or are degraded by vibration and structural flexing. RHTâ€™s proposed payload addresses these limitations through compact ruggedized optics, self-aligned vibration-resilient architecture, onboard camera/illumination synchronization, local data storage, low-bandwidth monitoring/telemetry, and modular packaging for aircraft pod, UAV, or vehicle-integrated configurations. During Phase I, RHT will define NASA-relevant requirements, develop compact optical/mechanical and data-system architectures, build and demonstrate a flight-representative SAFS prototype

in laboratory testing, assess environmental and data-handling risks, and produce a Phase II roadmap for relevant-environment or flight demonstration.

Duration: 6

Proposal Details

Proposal Number: AERO.4.S26B-0473
Subtopic Title: Flight Test Measurement Technologies
Proposal Title: AltiZoom-256: A Low-SWaP-C, SiPM-Array LiDAR Receiver ASIC for UAV Flight-Test Altimetry, Terrain Hazard Mapping, and Precision Landing-Zone Assessment

Small Business Concern

Firm: SenseICs Corporation
Address: 1275 Kinnear Rd, Columbus, OH, 43212-1180

Summary Details

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

SenseICs Corporation proposes to develop AltiZoom-256, a low-C-SWaP, high-channel-count LiDAR receiver ASIC architecture optimized for SiPM-array-based sub-centimeter altimetry, UAV sensing, airborne topographic mapping, and flight-test measurement applications. Unlike SenseICsâ€™ prior NASA ACT-22 DARSoC work focused on atmospheric sensing and cloud profiling, AltiZoom-256 advances a new precision altimetry receiver architecture emphasizing dense detector-array readout, amplitude-independent timing, and scalable parallel return acquisition for compact airborne sensing systems. The proposed effort will create a NASA-relevant receiver technology enabling compact, arrayable LiDAR payloads for terrain-relative navigation, airborne elevation mapping, landing-zone assessment, environmental monitoring, and flight-test instrumentation. AltiZoom-256 integrates timing-jitter-optimized Constant Fraction Discriminator (CFD) intellectual property licensed from The Ohio State University to reduce amplitude-dependent timing error and improve ranging precision across varying terrain reflectivities and environmental conditions. AltiZoom-256 will support

scalable multichannel acquisition through a tiled receiver architecture expandable to 256 parallel channels, enabling dense parallel LiDAR return capture while maintaining low size, weight, and power consumption. The architecture interfaces directly with solid-state Silicon Photomultipliers (SiPMs), enabling high photon sensitivity, fast timing response, and compact time-of-flight acquisition while reducing dependence on bulky photomultiplier tubes, discrete receiver electronics, and high-voltage support systems. The resulting platform establishes a compact, flight-compatible LiDAR receiver architecture adaptable across future NASA airborne sensing missions and commercial geospatial and aerospace markets.

Duration: 6

Proposal Details

Proposal Number: AERO.5.S26B-0031
Subtopic Title: Improved Material Discovery through Leveraging Novel Modeling and Experimental Approaches
Proposal Title: Multiscale Materials Modeling and Experimental Validation Framework for Discovery-to-Deployment Acceleration

Small Business Concern

Firm: Solvus Global
Address: 104 Prescott Street, Worcester, MA, 01605-1703

Summary Details

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

Solvus Global, in partnership with Texas A&M University (TAMU) and with transition guidance from Pratt & Whitney, will develop a Multiscale Materials Modeling and Experimental Validation Framework for Discovery-to-Deployment Acceleration. The proposed Phase I effort will integrate TAMUâ€™s BIRDSHOT materials discovery framework with Solvusâ€™ automated cold spray additive manufacturing (CSAM), process optimization, and multiscale characterization capabilities to create a closed-loop designâ€“fabricateâ€“testâ€“learn workflow for Nb-based refractory alloys, including refractory high-entropy alloys (RHEAs). This

framework directly supports NASAâ€™s need to accelerate discovery, validation, and eventual qualification of advanced high-temperature materials for future aeronautics applications across subsonic, supersonic, and hypersonic flight regimes. Pratt & Whitneyâ€™s involvement will provide industry-relevant performance targets and transition guidance to ensure the work is aligned with real propulsion material needs.

Duration: 6

Proposal Details

Proposal Number: AERO.5.S26B-0674
Subtopic Title: Improved Material Discovery through Leveraging Novel Modeling and Experimental Approaches
Proposal Title: Constraint-Driven Multiscale Topology Optimization for Continuous-Fiber Thermoplastic Aerospace Structures

Small Business Concern

Firm: ARRIS Composites, Inc.
Address: 745 Heinz Avenue, Berkeley, CA, 94710-2732

Summary Details

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

ARRIS Composites operates a commercial topology optimization solver that simultaneously optimizes density field and 3D fiber orientation for continuous-fiber thermoplastic composites; to our knowledge, no other commercially available tool offers this combination. In its current form, the solver treats directional stiffness targets (EA, EIyy, EIzz, GJ) as post-process filters rather than in-loop optimization variables, requiring manual iteration to meet multi-axial stiffness targets. ARRIS proposes to extend the existing Python-Abaqus solver so that directional stiffness targets are enforced as in-loop optimization variables, with multiscale stiffness homogenization evaluated at each iteration across three length scales: the fiber-matrix constituent scale, the aligned-fiber preform scale, and the structural part scale. The work is responsive to the AERO.5.S26B Structural composites topic

(â€œNonlinear models and model applications at, and across, all relevant length scalesâ€) and supports the modeling priorities in NASAâ€™s Vision 2040 roadmap. Phase I will deliver the constrained solver, demonstrate convergence on a multi-axial load case for a representative aerospace component cross-section across three tolerance regimes (Â±20%, Â±10%, Â±5%), and quantify weight-versus-stiffness-error trade-offs against an unconstrained baseline. Expected TRL at Phase I completion is 3â€“4, with a clear path to TRL 5â€“6 fabrication-and-test validation in Phase II via ARRISâ€™s Additive Moldingâ„¢ process.

Duration: 6

Proposal Details

Proposal Number: AERO.5.S26B-0894
Subtopic Title: Improved Material Discovery through Leveraging Novel Modeling and Experimental Approaches
Proposal Title: AI/ML-Augmented Digital Twin with In-Situ Process Monitoring for Accelerated Laser Powder Bed Fusion (L-PBF) Qualification of GRX-810

Small Business Concern

Firm: North American Manufacturing Pros LLC
Address: 29176 Highway 53, ardmore, AL, 35739-8716

Summary Details

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

GRX-810 is NASAâ€™s only licensed, printable Ni-based ODS superalloy, offering dramatic improvements in creep life and high-temperature performance over conventional alloys. However, commercial adoption in propulsion and aviation is limited by inconsistent formation and verification of the critical intragranular nano-Yâ,,Oâ,*f* dispersoid microstructure during LPBF. The root challenge is that Yâ,,Oâ,*f* dissolves in the melt pool and re-precipitates according to local cooling rate â€” a relationship that lacks sufficient quantified data for reliable process control or in-situ qualification. NAMPros and subcontractor Laser Fusion Solutions propose a sensor-guided solution using vector-by-vector laser control and LFSâ€™s

multi-modal in-situ sensor suite (LWIR thermography, optical tomography, recoater imaging, and high-speed video). NAMPros operator expertise from active NASA GRX-810 production will supply labeled training data for a physics-informed ML surrogate model that predicts dispersoid state from real-time thermal signatures. Phase I Objectives include a 12â€“15 condition designed build campaign, synchronized sensor data capture, SEM/EBSD characterization, development of a preliminary surrogate model with quantified uncertainty, and delivery of a complete Phase II transition package. Intended Use of Funding: The $225,000 effort will produce a validated GRX-810-specific prediction capability, directly addressing Vision 2040 Gaps #2 (real-time characterization), #4 (uncertainty propagation), and #5 (V&V data) in ICME-compatible format. Target Markets: The four GRX-810 licensees (with Powder Alloy Corporation as anchor partner), NASA propulsion programs, and commercial aviation hot-section components. This work will enable in-process qualification, reduce destructive testing costs, and accelerate GRX-810 adoption across NASA and industry.

Duration: 6

Proposal Details

Proposal Number: AERO.6.S26B-0160
Subtopic Title: Wind Tunnel Test Measurement Technologies
Proposal Title: An Ultra-Compact, High-Temperature, High-Bandwidth Pressure Sensor for Hypersonic Wind Tunnel Applications

Small Business Concern

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

Summary Details

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

As NASA advances new vehicle concepts and integrated experimentalâ€“computational workflows, there is a growing need for wind tunnel diagnostics that improve data quality, measurement capability, and test efficiency. In

hypersonic environments, extreme temperatures, chemical effects, short test durations, calibration challenges, high costs, and integration difficulties limit conventional sensors, increasing test complexity and widening the gap between available experimental data and NASAâ€™s need for high-fidelity, computationally integrated testing. On-body pressure sensors are critical in hypersonic wind tunnel testing because they directly measure surface loads governing performance, heating, and structural response quantities difficult to infer from off-body diagnostics. Fast-response provides time-resolved data needed to capture transient phenomena and validate high-fidelity models. There is a need for compact pressure sensors capable of operating in extreme-temperature, chemically reactive hypersonic flows while providing robust, in-situ measurements directly at the point of interest with very high bandwidth. The sensors must support high spatial resolution and straightforward integration into existing test facilities and data systems. Thus, the long-term objective of the proposed effort is to develop an ultra-compact, high-temperature, high-bandwidth surface/on-body pressure sensor technology suitable for hypersonic and high-enthalpy flows, such as those in NASA test facilities. Phase I efforts will include: 1) working with stakeholders to define system requirements; 2) evaluating revised hardware/electronics architectures and designs; and 3) proof of principle testing and demonstration using benchtop-scale prototype hardware. If successful, Sporian will be well-positioned for the Phase II efforts focused on full system prototyping and relevant environmental testing/demonstration.

Duration: 6

Proposal Details

Proposal Number: AERO.6.S26B-0186
Subtopic Title: Wind Tunnel Test Measurement Technologies
Proposal Title: A Quantitative, Next-Generation SAFS Framework

Small Business Concern

Firm: RH Technologies, LLC
Address: 722 Reeves Dr, Grand Forks, ND, 58201-4920

Summary Details

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

Technical Abstract (Limit 2000 characters):

RH Technologies (RHT) proposes developing a quantitative, next-generation self-aligned focusing schlieren (SAFS) framework to transform the technology from a qualitative visualization tool into a predictive, scalable measurement platform for NASA wind-tunnel applications. The overarching purpose of this technology is to enable quantitative or semi-quantitative measurements, improve the understanding of key performance metrics like depth-of-focus and sensitivity, and facilitate scalable designs for larger fields-of-view and high-speed volumetric measurements. The Phase I funding will be utilized to establish the technical feasibility of this framework over a six-month period. The funding on this effort will be used to support RHT's R&D efforts for characterizing and advancing the SAFS core technology. The proposed work plan includes the following developments: 1) developing analytical and optical ray-trace models to accurately capture and predict SAFS performance, 2) characterizing the system's sensitivity and depth-of-focus relationships, 3) demonstrating a preliminary calibration method using controlled refractive-index gradient objects, 4) conducting scalability studies for future architectures, such as large-FOV and plenoptic/volumetric systems, 5) completing a wind-tunnel integration assessment and formulating a transition plan for a Phase II demonstration. The commercialization strategy targets a diverse aerospace and research market. Primary target markets include NASA wind tunnel and propulsion facilities, Department of War laboratories, aerospace primes, engine manufacturers, and hypersonic test organizations. Additional markets include advanced air mobility developers, universities, private wind-tunnel operators, and potentially the biomedical and industrial sectors. The resulting commercial pipeline will include products ranging from software and calibration modules to large-FOV hardware and high-end volumetric systems.

Duration: 6

Proposal Details

Proposal Number: AERO.6.S26B-0555
Subtopic Title: Wind Tunnel Test Measurement Technologies
Proposal Title: Magnetron Sputtered High Temperature Sensors

Small Business Concern

Firm: LAMINAREDGE AEROSPACE LLC
Address: 724 South Tejon St., Colorado Springs, CO, 80903-4055

Summary Details

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

Today's hypersonic ground-test inventory relies on hand-wound Schmidt-Boelter gauges that are limited to 660F and exhibit 50-250 ms response times, or coaxial thermocouples that carry lead times up to 26 weeks and face integration challenges with novel test article geometries and materials. LaminarEdge Aerospace and Ahmic Aerospace propose to replace legacy sensor fabrication techniques with DC/RF magnetron sputtering, depositing refractory thermoelectric alloys like Pt-Rh, W-Re, ITO/In2O3 and ceramic dielectrics like Al2O3 and YSZ in generating high-temperature Seebeck effect sensors. Sub-5-um shadow-mask patterning enables both drop-in Schmidt-Boelter spiral geometries and novel interdigitated multilayer thermopile stacks, yielding sensors that survive continuous operation above 1500F with ultra-fast response times. Phase I will optimize sputtering parameters for single- and multi-junction fabrication, develop validated FEA performance models, prototype both S-B and embedded thermocouple designs, and characterize performance through high-temperature furnace survivability trials and Mach 6 shock tube testing. Sensor package designs will be optimized for high temperature facilities at NASA Langley, Ames and Marshall, and commercialized to target the broader hypersonic community including key US government, university, and commercial ground test facilities. The resulting sensors will enable material property matching with test article structures, reducing a key driver of uncertainties in existing heat transfer datasets, and relieve a critical bottleneck in test schedule lead times. Successful development will enable direct heat-flux measurement in NASA's most severe test environments, sharpen boundary-layer transition and CFD validation datasets, and reduce TPS mass-budget uncertainty for reentry and high-speed vehicle programs.

Duration: 6

Proposal Details

Proposal Number: AERO.7.S26B-0010
Subtopic Title: Airspace Operations and Safety
Proposal Title: An Observation-Only Control Plane for NAS Data Supply Chains

Small Business Concern

Firm: NIRA, INC.
Address: 400 Virginia Ave SW, Washington, DC, 20024-2701

Summary Details

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

The future National Airspace System (NAS) is becoming a federated data ecosystem in which operational information flows across FAA systems, commercial cloud infrastructure, airlines, airports, defense organizations, third-party data providers, and international partners. This evolution enables scalable airspace automation but creates a critical assurance gap: consumers often cannot determine whether a data product remains authoritative, complete, current, unmodified, and fit for operational use after it traverses multiple systems and trust boundaries. NIRA and Embry-Riddle Aeronautical University propose CONTRAILS â€" Control Plane for Trusted Aviation Information Logistics and Supply Chain â€" an observation-only Control Plane for NAS data supply chains. CONTRAILS separates the operational Data Plane, where products continue to flow through SWIM, AIXM, FIXM, IWXXM, and provider-owned APIs, from a read-only Control Plane that exposes provenance, custody, dependency, quality, completeness, degradation, and fitness-for-purpose evidence. The architecture does not command aircraft, modify operational systems, or replace existing aviation exchange standards. Phase I will advance CONTRAILS from TRL 2 to TRL 3 by defining a minimum data-supply-chain evidence model, Zero Trust Data Envelope pattern, Data Bill of Materials, graph-backed Control Plane, and representative read-only APIs. NIRA will prototype these concepts using selected NAS data products or representative message samples, demonstrate degradation-aware observability through dashboard scenarios, and define a bounded AI evaluation concept showing how future AI-enabled tools could consult Control Plane evidence without making autonomous operational decisions.

Duration: 6

Proposal Details

Proposal Number: AERO.7.S26B-0322
Subtopic Title: Airspace Operations and Safety
Proposal Title: Airport Surface Surveillance and Alert Monitor

Small Business Concern

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

Summary Details

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

Every day, the FAA records an average of five runway incursions across the United States. Most are minor. Some are near-catastrophic. A small number are fatal. What nearly all of them share is a common root cause: someone â€” a pilot, a controller, a vehicle operator â€” did not have an accurate, timely picture of what was happening on the airport surface. The technology to fix that problem has existed for decades at the nation's largest airports. The challenge is that it exists at only 35 of them. The Robust Analytics â€“ Cignus Consulting Team proposes the Airport Surface Surveillance and Alert Monitor (ASSAM) to offer a solution for airport surface surveillance and alerting that can be deployed to hundreds of airports and thousands of aircraft. This Phase I project will demonstrate the technical and operational feasibility of a multi-sensor fusion solution that integrates three complementary data sourcesâ€”ADS-B Out position data, computer vision (CV) derived from airport cameras, and ATC tower audio processed through automatic speech recognition (ASR) and natural language parsing, into a coherent surface surveillance picture with aircraft intent. The solution architecture will also enable position broadcasting from ground vehicles, although these will likely not be tested at an airport during Phase I due to time limitations. Unlike position-only approaches, the incorporation of ATC audio enables the architecture to extract issued taxi clearances and correlate them against observed tracks, transforming the system from a surveillance tool into a situational awareness and deviation-detection capability. This project will demonstrate a proof of concept using live data to provide airport surface surveillance and alerts for non-cooperative aircraft and vehicles at a non-ASDE-X airport. Target markets are hundreds of small and medium airports and the aircraft that operate from them.

Duration: 6

Proposal Details

Proposal Number: AERO.7.S26B-0377
Subtopic Title: Airspace Operations and Safety
Proposal Title: Resilient Operations Service for Advanced Air Mobility (ROSA)

Small Business Concern

Firm: Mosaic ATM, Inc
Address: 540 Fort Evans Road NE, Leesburg, VA, 20176-3379

Summary Details

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

The Resilient Operations Service for Advanced Air Mobility (ROSA) supports safe contingency management when AAM operations encounter degraded communications, route constraints, vertiport disruption, weather impacts, or other off-nominal events. ROSA integrates four existing capabilities into a Phase I proof-of-concept service: â€¢ Fuser-enabled operational data fusion â€¢ A Toolkit for UAM Communications Management (TUCM)-informed air-ground communications-risk assessment â€¢ An operational digital twin that mirrors current and predicted AAM system state â€¢ A contingency-response decision layer that ranks candidate mitigations and explains recommendations The Phase I prototype will compare ROSA against a baseline rule-based response in which an operator selects the nearest apparently feasible alternate without fused-state awareness, communications-risk assessment, digital-twin prediction, or downstream network-impact analysis. ROSA will use representative AAM data, including flight intent, aircraft state, planned routes, vertiport status, route availability, airspace constraints, and TUCM-computed communications-risk values. It will estimate off-nominal-event likelihood, compute residual risk, score candidate responses, and recommend actions such as continue, hold, divert, reroute, return to origin, or use backup communications. Phase I success will be measured using detection latency, response-generation time, feasible-mitigation rate, communications-risk exposure, affected operations, conflicts avoided, explanation completeness, and residual-risk characterization.

Duration: 6

Proposal Details

Proposal Number: AERO.8.S26B-0252
Subtopic Title: Fuel to Electric Conversion
Proposal Title: High Efficiency Power Generator for Ultra Long Range UAS

Small Business Concern

Firm: Precision Combustion, Inc.
Address: 410 Sackett Point Road, North Haven, CT, 06473-3168

Summary Details

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

Precision Combustion, Inc. (PCI) is proposing to demonstrate an Advanced Solid Oxide Fuel Cell (A-SOFC)-based ultralight power system for extending the range of a Group 2 UAS by 10x. Our exceptionally power dense A-SOFC is paired with our novel aviation-fuel reforming reactor resulting in a simple, lightweight, efficient system for generating electrical power directly from infrastructure fuels. Platform specific options for using sulfur containing fuels and attaining ultra-high efficiency are also included. The A-SOFC based system overcomes shortcomings of conventional SOFCâ€™s and engines and was developed primarily to overcome challenges associated with aviation. We are collaborating with a transition partner for developing the propulsion system and enabling a UAS flight demo during Phase II. The potential for capabilities enhancement (no signature, longer range, higher payload) is of particular interest to the transition customer. PCIâ€™s system represents a significant advancement in UAS propulsion, leveraging our extensive hybrid system development experience to mitigate risks related to system integration, UAS packaging, performance validation, and manufacturability. Successful proving at this scale will be a precursor for larger unmanned and piloted aviation platforms. We are collaborating with multiple partners towards this end.

Duration: 6

Proposal Details

Proposal Number: AERO.8.S26B-0627
Subtopic Title: Fuel to Electric Conversion
Proposal Title: High-Efficiency Fuel-to-Electric Power Conversion System for UAS: A Lightweight, JP-8-Compatible Turbogenerator Architecture

Small Business Concern

Firm: Odys Aviation, Inc.
Address: 3280 Airflite Way, 2nd floor, Long Beach, CA, 90807-5312

Summary Details

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

The proposed Phase I effort will establish the technical and commercial foundation required to develop a lightweight, aircraft-grade fuel-to-electric conversion system optimized for UAV and hybrid-electric aircraft applications. The effort will mature the existing Odys HE100 turbogenerator architecture through targeted analysis, preliminary design refinement, customer requirement mapping, and prototype planning activities aligned with NASA AERO.8.S26B objectives.

Duration: 6

Proposal Details

Proposal Number: AERO.8.S26B-1034
Subtopic Title: Fuel to Electric Conversion
Proposal Title: HPDG-30 â€“ A 30 kW Aviation-Grade Fuel-to-Electric Genset for UAV and Aircraft Electrification

Small Business Concern

Firm: H3X Technologies Inc
Address: 410 S Arthur Ave, Louisville, CO, 80027-3012

Summary Details

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

The HPDG-30 is a 30-kilowatt aviation-grade electrical generator that integrates the H3X HPDM-30, a high-power-density integrated motor drive matured through prior NASA SBIR contracts, with a fielded two-stroke aviation engine. It delivers onboard fuel-to-electric power for small uncrewed aircraft and other kW-class aerospace platforms, producing a regulated high-voltage DC electrical bus directly from common aviation gasoline (100LL). This integration addresses the gap in lightweight, kilowatt-class electric generators identified in NASA's AERO.8.S26B. The HPDG-30 provides a power-dense, range-extending option for electrified aircraft and uncrewed vehicles that would otherwise be limited to battery-only architectures. The HPDG-30 will deliver 44.1 kg, 0.68 kW/kg, and 700 g/kW-hr SFC, with Phase I trade studies targeting an optimized 33.5 kg, 0.90 kW/kg, and 650 g/kW-hr â€” exceeding the performance of commercially available generators in the 30 kW power class. The HPDG-30 targets 566 Wh/kg of effective specific energy on a one-hour mission and 828 Wh/kg on a two-hour mission, exceeding the ~150 Wh/kg of current aviation-grade lithium-ion battery packs by a factor of 4-6x. Phase I is a six-month feasibility analysis advancing the conceptual design toward an integrated system, identifying pathways to heavy fuels and DO-160G and MIL-STD-704F compliance. Phase I customer engagement with commercial OEM launch partners anchors performance and integration requirements for downstream commercial UAS markets.

Duration: 6

Proposal Details

Proposal Number: COMNAV.1.S26B-0098
Subtopic Title: Flight Dynamics and Navigation Technologies
Proposal Title: Trajectories Computed for Mission Design (TCMD)

Small Business Concern

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

Summary Details

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

On-orbit servicing of spacecraft has become a critical path component of current and future space missions for refueling, re-boosting, and orbital repositioning. Most NASA missions have now been asked to be designed to be serviceable. Currently, no tool exists that enables flight dynamics professionals to design transfers between the Earth-Moon and Sun-Earth systems easily and at a high fidelity. The current methodology is a brute-force approach, resulting in non-optimal solutions. The ability to design transfers easily that will rendezvous at Libration Points will be essential to solve the servicing problem and unlock new extended mission possibilities. Advanced Space envisions our ground mission design tool as an enabling component to NASAâ€™s and the USGâ€™s goals of creating feasible on-orbit spacecraft servicing architectures. TCMD finds feasible low-energy transfer between multi-body systems, provides high-quality initials guesses with high-fidelity tools (GMAT, Copernicus, Monte), and precisely enables this servicing architecture between Sun-Earth and Earth-Moon systems. Our tool will produce transfer designs that reduce delta-V and design iteration, support multi-body, low-energy transfers that are otherwise prohibitively computationally expensive to find in high-fidelity tools, and provide trajectories that can be embedded in onboard guidance for future autonomous operations. Advanced Space is building off the success of its internally developed application named Alexiad, which is a Circular Restricted Three Body (CR3BP) trajectory design tool. The mission design tool enhancements proposed for this Phase I SBIR are focused on blended CR3BP manifolds for low-energy transfers between Earth-Moon and Sun-Earth systems. These designs will determine the size of the servicing vehicle (by defining the required delta-V or propellant needed) and determine where servicing can be done the easiest (whether at the mission orbits themselves, or in an Earth-Moon orbit).

Duration: 6

Proposal Details

Proposal Number: COMNAV.1.S26B-0391
Subtopic Title: Flight Dynamics and Navigation Technologies
Proposal Title: Autonomous Proximity Maneuvers, Navigation and Guidance by UVGS-2

Small Business Concern

Firm: Jaycon Systems LLC
Address: 2300 Commerce Park Dr, Palm Bay, FL, 32905-2619

Summary Details

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

This proposal focuses on developing and demonstrating solutions that support spacecraft navigation and guidance with high degree of autonomy. In particular: Relative navigation and spacecraft proximity operations at unmapped bodies, that can operate in low and variable lighting conditions, will be developed based on UVGS-2 (the micro video guidance sensor), the most recent evolution of AVGS/ SVGS, NASA algorithms to support vision-based proximity operations. Relative position, velocity, attitude, and/or pose control will be estimated based on UVGS-2 and MINS (Multi Sensor Aided Inertial Navigation System). MINS will be used as mathematical and algorithmic framework to achieve 6-DOF state estimation by sensor fusion of UVGS-2 with conventional guidance and navigation sensors. The proposed approach focuses on proximity operations (200 m or less) such as autonomous landing, formation flight and docking. The advantages inherent to MINS and UVGS-2 combine to result in accurate, robust localization and pose estimation based on a sensor suite that includes tracking cameras, IMUs and LIDAR. The technical objectives and proposed deliverables for Phase I are: Integration of UVGS-2 with the MINS sensor fusion framework under ROS. The integration will include the fusion of onboard IMU, UVGS-2 position/attitude estimates, and onboard tracking cameras to provide visual inertial odometry. Development of two demonstrations of successful deployment in the ModalAI Starling-2 quad rotor drone: Formation flight drone maneuver based on UVGS-2. A leader-follower formation flight proximity maneuver will be used to demonstrate success of the sensor fusion approach. Drone landing on a moving rover by UVGS-2. Potential applications and market opportunities of the proposed innovations include robotic applications that require positioning / localization in challenging environments by multi sensor fusion.

Duration: 6

Proposal Details

Proposal Number: COMNAV.1.S26B-0401
Subtopic Title: Flight Dynamics and Navigation Technologies
Proposal Title: LUMEN-SHERIF: Low-illumination, Uncertainty-aware, Meta-adaptive, Explainable Navigation for Hazard Detection and Safe Planetary Landing

Small Business Concern

Firm: NOVUSARC SYSTEMS LLC
Address: 408 Franklin St , Melrose, MA, 02176-1825

Summary Details

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

LUMEN-SHERIF (Low-illumination, Uncertainty-aware, Meta-adaptive, Explainable Navigation) is an onboard-oriented software layer for safe planetary landing perception and navigation support. It is designed to help future lunar, Mars, small-body, and other planetary landers detect hazards, refine DEM-based terrain evidence, assess registration confidence, and rank candidate landing sites under low and variable illumination. The technology does not replace the flight GNC stack; it provides hazard maps, uncertainty maps, learned DEM/keypoint matching evidence, registration-quality metrics, ranked safe-site candidates, and structured evidence packets for downstream TRN/HDA/GNC logic and engineer review. Phase I funding will be used to build a SHERIF-compatible preliminary software prototype. The effort will define interfaces, create a low-light optical/LiDAR/DEM data factory, evaluate U-Net and efficient ViT/hybrid optical hazard baselines, preserve explicit DEM hazard metrics, train learned keypoint descriptors for sequential DEM matching, implement uncertainty-aware fusion and conservative safe-site ranking, generate structured evidence packets, and profile runtime, memory, throughput, and model size on available/proxy compute resources. Success will be measured with hazard recall, false-safe rate, precision/IoU, uncertainty reliability, descriptor match precision/recall, inlier ratio, registration RMSE, top-K safe-site constraint violations, runtime, memory footprint, and model size. The primary target market is NASA precision landing and terrain-relative-navigation maturation, with a Phase II path toward SHERIF/SENSS-compatible SIL/CIL/HIL validation subject to future agreements and availability. Commercial targets include lunar landing providers, planetary robotics, hazardous-terrain autonomous systems, defense autonomy, and autonomy-assurance software.

Duration: 6

Proposal Details

Proposal Number: COMNAV.2.S26B-0272
Subtopic Title: Lunar 3GPP Capability Development
Proposal Title: Cislunar Link Architecture using Adaptive RIS and Intelligent NTN SYstems (CLARITY)

Small Business Concern

Firm: A10 Systems Inc. d/b/a AiRANACULUS
Address: 491 Dutton St., Suite 104, Lowell, MA, 01854-4290

Summary Details

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

NASAâ€™s Space Communications and Navigation (SCaN) program seeks to leverage decades of investment in 3GPP cellular technologies to establish a scalable, interoperable, and cost-effective lunar communications infrastructure. However, the lunar environment presents unique challenges, including severe terrain shadowing, intermittent connectivity, limited infrastructure and Non Line of Sight between the South Pole of the Moon and the Earth. AiRANACULUS, developer of NASA-sponsored CLAIRE, INSPiRE, and FULCRUM technologies, together with Reed Engineering, proposes Cislunar Link Architecture using Adaptive RIS and Intelligent NTN Systems (CLARITY). CLARITY extends terrestrial 4G/5G technologies to the lunar environment through an intelligent architecture integrating 5G Reconfigurable Intelligent Surfaces (RIS), Non-Terrestrial Networks (NTN), Integrated Access and Backhaul (IAB), Wi-Fi, SATCOM, and legacy NASA communications systems. Results from the NASA SBIR Phase II FULCRUM project demonstrated that conventional 4G/5G deployments alone are insufficient to provide reliable coverage across challenging lunar terrain. FULCRUM showed that IAB can significantly reduce coverage gaps and outage probability. Building on this foundation, CLARITY incorporates NTN and RIS technologies to further extend coverage, improve throughput, increase reliability, and enhance resilience for both lunar surface and orbital

communications. CLARITY integrates CLAIRE and INSPiRE technologies, which are scheduled for spaceflight testing, to autonomously optimize heterogeneous networks, mitigate interference and congestion, dynamically reroute traffic, and maintain mission-critical Quality of Service (QoS). Leveraging 3GPP Releases 17, 18, and 19, CLARITY enables resilient trunk links between lunar surface and orbital assets, continuous connectivity at the lunar south pole and far side, and future direct-to-handheld 5G services.

Duration: 6

Proposal Details

Proposal Number: COMNAV.2.S26B-0321
Subtopic Title: Lunar 3GPP Capability Development
Proposal Title: Reprogrammable 4G/5G/6G Network Radios for Lunar Environments

Small Business Concern

Firm: Beamlink Inc
Address: 4207 W Jefferson Blvd, LOS ANGELES, CA, 90016-4112

Summary Details

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

Beamlink proposes the development of a compact, low-size-weight-and-power (SWaP), software-defined LTE/5G-NR communications payload for lunar and cislunar environments. The proposed system builds upon Beamlinkâ€™s existing Bentocell terrestrial LTE/5G-NR platform and adapts it for lunar communications using Rincon Research Corporationâ€™s AstroSDR/ASDR space-oriented SDR platform. The architecture supports a â€œUE-firstâ€ operational mode, allowing the payload to function as compact user equipment capable of synchronizing with external lunar 3GPP infrastructure, while also supporting future software reconfiguration into a local eNB/gNB for lunar surface cellular coverage. Phase I funding will support migration of Beamlinkâ€™s FPGA and software stack to the AstroSDR platform, integration of timing interfaces compatible with NASA

LunaNet concepts, and laboratory validation of LTE/5G-NR synchronization, throughput, latency, EVM (Error Vector Magnitude), ACLR (Adjacent Channel Leakage Ratio), and RF power performance. The project will also establish a roadmap for environmental qualification, including thermal-vacuum, vibration, EMI/EMC, and radiation survivability considerations. The proposed cellular system would be connectable via Ethernet to other payloads and support different antennas and frequencies for various mission types (ranging from 400 MHz to 6 GHz). In the future, the 6G networking stack could also be deployed as part of the same hardware. The technology targets NASA Artemis and LunaNet communications needs while also supporting commercial markets, including disaster-relief communications, private LTE/5G industrial networks, and rural connectivity. The long-term objective is to develop a flight-ready, reprogrammable LTE/5G-NR communications module with significantly reduced SWaP requirements compared to existing terrestrial small-cell systems.

Duration: 6

Proposal Details

Proposal Number: COMNAV.2.S26B-1027
Subtopic Title: Lunar 3GPP Capability Development
Proposal Title: Lunar Advanced Navigation Timing and Relay Network (LANTERN)

Small Business Concern

Firm: Teltrium
Address: 7850 Walker Drive, Suite 200, Greenbelt, MD, 20770-3265

Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 1 - 4
Technical Abstract (Limit 2000 characters):

The Lunar Advanced Position, Navigation, Timing, and Relay Network (LANTERN) system introduces a GNSS-independent, network-centric architecture for high-precision Positioning, Navigation, and Timing (PNT) in sparse lunar environments. Terrestrial 5G systems rely on GNSS-based timing, achieving

synchronization on the order of ~10â€“100 ns. At this level, timing error introduces significant phase misalignment between transmitting nodes, limiting the ability to perform accurate carrier-phase measurements and coordinated network operation across distributed nodes, and is not suitable for lunar deployment where GNSS is unavailable. LANTERN addresses this gap by transforming a distributed set of 5G Next Generation Node B (gNB) stations into a tightly synchronized sensing and calibration network. The core innovation of LANTERN is the transformation of these gNBs into a sub-nanosecond synchronized, self-calibrating network capable of maintaining precise time, frequency, and phase alignment without reliance on GNSS. This is achieved by combining two-way line-of-sight laser optical time transfer, White Rabbitâ€“based synchronization techniques, and a rubidium atomic master clock to realize sub-nanosecond (<1 ns) synchronization across nodes. This level of synchronization enables stable phase relationships between nodes, supporting carrier-phase-based measurements and distributed calibration required for high-precision positioning. Each gNB also functions as a reference receiver, enabling estimation and correction of system-level biases, including timing offsets, phase errors, hardware delays, and environmental effects. User positioning is achieved through fusion of Observed Time Difference of Arrival (OTDOA), Direction of Arrival (DoA), and carrier-phase measurements within an Extended Kalman Filter (EKF), enabling sub-meter to centimeter-level positioning accuracy. LANTERN is compatible with 5G standard hardware leveraging decades of 3G/4G/5G development/operational know-how.

Duration: 6

Proposal Details

Proposal Number: COSMO.2.S26B-0188
Subtopic Title: Cryogenic Systems for Instruments
Proposal Title: Mini 20K Pulse Tube Cryocooler for Small Sat Cooling

Small Business Concern

Firm: CU Aerospace
Address: 3001 Newmark Dr, Champaign, IL, 61822-1474

Summary Details

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

Some small satellite instruments require cooling below 20 K, with size and input power suitable for use in a Small Sat. Some recent instruments, such as the MISE instrument on the Europa Clipper, have used a Lockheed Martin microcryocooler with a mass less than 500 grams. A 2-stage or 3-stage pulse tube cryocooler is well-suited for cooling below 20 K, offering a simple, reliable option with TRL 5 heritage in a larger cryocooler size. CU Aerospace (CUA) will use innovative materials and low-cost cold head design and assembly, coupled with Lockheed Martinâ€™s (LM) industry-leading multi-stage pulse tube expertise, to provide NASA with a low mass (goal of <400 g) cryocooler for cooling below 20 K. Our team proposes to: 1) Perform a thermodynamic trade study of 2-stage and 3-stage cold head configurations optimized for LMâ€™s TRL 8 Micro compressor. 2) Reduce the compressor mass by removing some unnecessary material only needed for high power applications. 3) Generate a solid model of the cold head during Phase I so that it is ready for procurement, assembly, and testing in Phase II. 4) Additively manufacture heat exchangers with arrays of holes for improved flow straightening from aluminum and from GRCop-42 high thermal conductivity alloy. 5) Procure and evaluate explosively-bonded Ti-Al-Ti materials with the potential to reduce cold head mass. This work will leverage a prior NASA SBIR Phase II developing a 3-stage pulse tube cryocooler with higher mass, as well as CU Aerospaceâ€™s past flight hardware development and delivery on programs such as Propulsion Unit for Cubesats (PUC) delivered to the Air Force.

Duration: 6

Proposal Details

Proposal Number: COSMO.2.S26B-0369
Subtopic Title: Cryogenic Systems for Instruments
Proposal Title: Novel High Performance Magnetocaloric Materials to Improve Adiabatic Demagnetization Refrigerators

Small Business Concern

Firm: General Engineering & Research, L.L.C.
Address: 10459 Roselle St Ste A, San Diego, CA, 92121-1527

Summary Details

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

The applications for sub-4K and sub-Kelvin adiabatic demagnetization refrigerators (ADRs) have increased with the growing use of low temperature detectors in space, along with the increasing cost of liquid helium pushing for cryogen free cryocoolers. This has led to a need to improve the performance of these systems, with the major design constraint being the commercially available sub-4K magnetocaloric materials. General Engineering & Research LLC (GE&R) will develop and commercialize a high performance line of magnetocaloric materials with peak functionality at key temperatures (4K, 2K, 1K, 500mK, and sub-500mK) to enable lower cost higher efficiency multistage ADR systems.

Duration: 6

Proposal Details

Proposal Number: COSMO.2.S26B-0457
Subtopic Title: Cryogenic Systems for Instruments
Proposal Title: Efficient 1U CubeSat Cryocooler Electronics for 20 W Rotary Cryocoolers

Small Business Concern

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

Summary Details

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

NASA needs low cost, low mass, low volume, low power, highly efficient, radiation tolerant electronics systems to operate cryocoolers that maintain temperatures above 70 K in orbit, on the moon, and on other planets. Leveraging an existing Creare

design, we propose to develop a new, innovative system to operate low cost, commercially available 40 W rotary cryocoolers such as the Ricor K548. These cryocoolers often come with electronics that are not tolerant of the radiation environments of space. Our system replaces these electronics with a radiation tolerant design. It fits within a 1U CubeSat enclosure and achieves high efficiency while using components that feature inherent radiation tolerance. We will ensure our design satisfies NASAâ€™s EEE-INST-002 parts selection and environmental requirements to confirm that our system can survive launch and last in space for long mission durations. In a follow on effort, we will reach TRL 6â€”as we have already done with three different designs that operate single- or dual opposed sinusoidal linear compressor microcryocooler control electronics systemsâ€”by building our system and demonstrating its operation in a vacuum chamber on Earth. This will lead to deployment of our product in space and eventual demonstration of TRL 9.

Duration: 6

Proposal Details

Proposal Number: COSMO.3.S26B-0352
Subtopic Title: AI for Rapid Development of Space Precision Components
Proposal Title: Davinci: Agentic Multi-Physics Design Automation for Precision Optomechanics

Small Business Concern

Firm: Celedon Solutions Inc.
Address: -

Summary Details

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

Celedon Solutions proposes an AI-enabled agentic design automation framework that addresses NASA's critical need for rapid development of precision space components. The technology employs multiple specialized AI agents that autonomously orchestrate design workflows from requirements ingestion through

verified solutions, targeting a 5Ã— reduction in design cycle time for optomechanical mounts, thermal hardware, and detector packaging. Phase I funding will develop three core capabilities: (1) Requirements Ingestion - natural language and SysML v2 MBSE artifact processing to extract design constraints and performance targets, (2) Multi-Physics Integration - automated orchestration of structural FEA, thermal analysis, and optical performance solvers with autonomous iteration across disciplines, and (3) Manufacturability Feedback - real-time DFM checks and cost estimation integrated into the design loop. The multi-agent system negotiates trade-offs between optical performance, thermal constraints, and manufacturing feasibility without human intervention, generating requirement-traceable verification artifacts. The Phase I effort will demonstrate feasibility through an optomechanical mount case study representative of Roman Space Telescope and Habitable Worlds Observatory precision components. Success metrics include achieving 5 cycle-time reduction compared to traditional workflows, autonomous convergence on validated designs meeting all requirements, and generation of verification reports with full traceability to source specifications. Target markets include NASA astrophysics missions requiring precision optomechanical systems, GSFC digital engineering initiatives, and commercial aerospace companies developing satellite components and optical systems. The framework's open API architecture enables integration with existing NASA tools and workflows, supporting the agency's strategic vision for AI-enabled engineering automation and accelerated development timelines.

Duration: 6

Proposal Details

Proposal Number: COSMO.3.S26B-0797
Subtopic Title: AI for Rapid Development of Space Precision Components
Proposal Title: Agentic Framework for Precision Composite Optomechanical Hardware

Small Business Concern

Firm: M4 Engineering, Inc.
Address: -

Summary Details

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

M4 Engineering proposes to develop an agentic design automation framework for rapid development, verification, fabrication, and testing of precision composite optomechanical hardware for future astrophysics applications. Composite materials are well suited for lightweight precision structures due to their high stiffness-to-weight ratio, low coefficient of thermal expansion, and favorable thermoelastic stability. Automated Fiber Placement (AFP) additionally enables fabrication of highly tailored composite geometries through precise placement of fiber tows. Building on prior NASA-funded composite topology optimization capabilities, the proposed effort will develop an end-to-end workflow that accelerates requirements-driven design generation, embedded analysis, manufacturability assessment, and requirement-traceable verification reporting for manufacturable composite optomechanical structures. The proposed framework will integrate specialized AI agents for problem formulation, geometry generation, model and analysis execution, and automated verification reporting within a modular API architecture compatible with future agentic digital engineering workflows. Phase I efforts will focus on demonstration of the workflow through the design, fabrication, structural testing, and verification of a representative composite optomechanical bench structure. Experimental test data will be compared against workflow predictions to evaluate framework accuracy and demonstrate the potential for significant reduction in requirements-to-verified-hardware development cycle time.

Duration: 6

Proposal Details

Proposal Number: COSMO.4.S26B-0104
Subtopic Title: Instrument Technologies, Free-Form Optics, and Stray-Light Suppression
Proposal Title: ML-Guided Design of Lens-Embedded Photonic Crystals for NASA Instrument Miniaturization

Small Business Concern

Firm: Heroica Technologies, LLC
Address: 115 Palo Alto Dr, Brownsville, TX, 78521-2608

Summary Details

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

Heroica Technologies proposes an ML-guided design framework for lens-embedded photonic crystals (LEPCs) â€“ three-dimensional Fourier-synthesized photonic crystal structures that deliver wide angular acceptance, broadband spectral performance, and high focusing efficiency simultaneously. Conventional refractive microlenses on infrared focal plane arrays (FPAs) are constrained on three axes at once: angular acceptance falls sharply beyond Â±15â€“20Â°, spectral bandwidth is limited by material dispersion, and focusing efficiency typically caps at 50â€“75%. Metasurface alternatives extend one or two of these axes but trade off the others, with reported MWIR achromatic metalens efficiencies as low as 7%. LEPCs occupy a different operating regime. As three-dimensional photonic crystals operating in the diffractive (not resonant) regime, their behavior scales smoothly with the dimensionless ratio a/Î». Preliminary simulations demonstrate that a single LEPC design maintains throughput above 50% and MTF at Nyquist above 0.6 across a/Î» = 0.5â€“0.9 at AOI â‰¤ 30Â°, corresponding to the full SWIR band (1.4â€“2.5 Âµm) at one fabricated lattice constant, or the full MWIR band (3â€“5 Âµm) at another. Rotational symmetry yields polarization insensitivity. Heroica additionally holds a provisional patent on compound LEPCs, monolithic structures integrating multiple lens functions in a single continuous lattice. Phase I will (1) extend Heroicaâ€™s Bayesian optimization framework, which has produced a 3.5Ã— improvement in photonic crystal field of view over the prior state of the art, to LEPC microlens design against a composite figure of merit; (2) validate optimized LEPC performance via FDTD across SWIR and MWIR; (3) conduct a scale-up feasibility study identifying large-area fabrication paths (deep-UV lithography, nanoimprint from MPL masters) and characterizing the design trade-off versus full-MPL designs; and (4) document the Phase II fabrication-and-characterization plan.

Duration: 6

Proposal Details

Proposal Number: COSMO.4.S26B-0209
Subtopic Title: Instrument Technologies, Free-Form Optics, and Stray-Light Suppression
Proposal Title: High-Dynamic-Range Polarimetric Near Infrared Bidirectional Reflectance Distribution Function System for Space-Instrument Coatings and Stray-Light Suppression

Small Business Concern

Firm: Surface Optics Corporation
Address: 11555 Rancho Bernardo Road, San Diego, CA, 92127-1441

Summary Details

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

Surface Optics Corporation proposes to develop a high-dynamic-range, polarization-aware BRDF/BSDF measurement capability for NASA space-instrument coatings and stray-light-control materials. Future observatories such as the Habitable Worlds Observatory require accurate scatter data for mirrors, baffles, masks, gratings, free-form optics, and optical black coatings as coronagraph contrast requirements approach 10â»Â¹â°. SOCâ€™s existing SOC-210 is an enclosed, turnkey BRDF/BTDF platform with angular coverage from 0â€“85Â° and spectral coverage from 400 nm to 14 Âµm, but it lacks polarization-resolved scatter capability, laser-enhanced dynamic range, and optimized sensitivity in the 1.7â€“2.6 Âµm VNIR/SWIR transition region. Phase I funding will demonstrate three brassboard upgrades. First, SOC will add polarization optics and demonstrate s/p polarization-resolved BRDF at selected wavelengths. Second, SOC will integrate a modular 1550 nm laser illumination path with lock-in detection to improve low-BRDF sensitivity. Current broadband NEBRDF is 2.89 Ã— 10â»âµ srâ»Â¹ at 1.54 Âµm; Phase I will demonstrate improvement to approximately 10â»â¸ srâ»Â¹ at 1550 nm, pursue 10â»Â¹â° srâ»Â¹ as a stretch goal, and define a pathway to multiple laser wavelengths in Phase II. Third, SOC will integrate a COTS extended-InGaAs detector and validate broadband BRDF performance across 1.7â€“2.6 Âµm, a region important to future exoplanet spectroscopy. Deliverables include a requirements matrix, polarization-resolved BRDF data, 1550 nm laser/lock-in NEBRDF comparison data, extended-InGaAs characterization and broadband measurement data, and a Phase II system design report. Target markets include NASA observatory programs, defense and aerospace optical systems, commercial space, ground-based observatories, autonomous vehicles, robotics, optical manufacturing, architectural materials, photovoltaics, thermal solar, and other industries requiring accurate angular scatter data.

Duration: 6

Proposal Details

Proposal Number: COSMO.4.S26B-0979
Subtopic Title: Instrument Technologies, Free-Form Optics, and Stray-Light Suppression
Proposal Title: Near-Angle Scatter Metrology of Micrometeoroid Impact Sites on Coronagraph Mirror Coatings for the Habitable Worlds Observatory

Small Business Concern

Firm: Eckhardt Optics LLC
Address: 13025 Fenway Blvd N #330, Hugo, MN, 55038-4421

Summary Details

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

Eckhardt Optics LLC proposes to develop a Near-Angle Array Scatterometer to measure the bidirectional reflectance distribution function (BRDF) of coronagraph mirror coatings damaged by micrometeoroid and orbital debris (MMOD) impacts. The Habitable Worlds Observatory (HWO) must achieve 150â€“210 ppt raw starlight contrast to image Earth-like exoplanets. Near-angle scatter (NAS) from MMOD impact sites on primary mirror coatings is allocated only 5 ppt of the straylight error budget, a limit that cannot be verified without high-dynamic-range, angle-resolved BRDF data at arcsecond angular resolution. No existing scatterometer provides this capability. The proposed instrument uses a point-source illuminator and a high-dynamic-range CMOS image sensor (>120 dB) at the focal plane of a collecting lens to record the full 2-D BRDF in a single snapshot, with no moving parts. The quarter-scale Phase I prototype (30 mm aperture) will achieve BRDF dynamic range â‰¥ 10Â¹â°:1 and angular resolution <11 arcseconds. Although this is insufficient to characterize spatial frequency content of mirror surfaces that drives NAS within the HWO dark hole, it is enough to prove the concept for a reasonable cost. Phase I funding will be used to design, fabricate, and characterize this prototype instrument, measure a set of reference optical samples spanning two decades of surface roughness, cross-validate BRDF-derived power spectral densities against white-light interferometry, and deliver a calibrated BRDF dataset and FRED scatter model inputs.

Duration: 6

Proposal Details

Proposal Number: COSMO.5.S26B-0029
Subtopic Title: Advanced Observatory Technologies: Mirrors, Structures, Systems, Fabrication and Metrology
Proposal Title: ZKxKZ / ZeCoat Active Protection from MicroMeteoroids (ZZ/ZAPMM)

Small Business Concern

Firm: ZKxKZ LLC
Address: 4 Constitution Road, Lexington, MA, 02421-6608

Summary Details

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

ZZ/ZAPMM (ZKxKZ/ZeCoat Active Protection from Micrometeoroids) is an active ballistic shield for spacecraft structures exposed to hypervelocity micrometeoroid impacts. NASA missions such as Habitable Worlds Observatory deploy lightweight mirrors, starshades, and thermal layers that are vulnerable to micrometeoroid damage. Precision mirrors and optical surfaces are particularly sensitive because very small hypervelocity particles can cause coating damage, increased scatter, local figure error, reduced optical throughput, and cumulative mission-degrading damage. Current state-of-the-art protection relies primarily on passive shielding, where increased ballistic protection generally requires increased mass. This creates a major design barrier for large deployable spacecraft, where added mass reduces payload efficiency, packaging margin, deployed area, and mission performance. ZZ/ZAPMM addresses this limitation by adding an active element to the protection system, seeking to break the conventional â€œmore protection means more massâ€ paradigm. The Phase I effort will design, build, and test a proof-of-concept demonstration article to evaluate whether an active protection element can improve micrometeoroid protection without simply adding conventional shielding mass. The program will include system trade studies, preliminary design, fabrication, laboratory demonstration testing, and analytical assessment of mass, packaging, survivability, scaling, and integration considerations. Phase I success will be measured by demonstration of the active elementâ€™s basic function, comparison of protected versus baseline test articles, and identification of scaling considerations for larger spacecraft applications. Key outputs will include proof-of-concept test results, candidate protection architectures, preliminary mass/performance comparisons against passive shielding, key technical risks, and a Phase II roadmap

for prototype development and hypervelocity impact validation.

Duration: 6

Proposal Details

Proposal Number: COSMO.5.S26B-0283
Subtopic Title: Advanced Observatory Technologies: Mirrors, Structures, Systems, Fabrication and Metrology
Proposal Title: Functional Release Coating for Next Generation X-Ray Shell Optic Fabrication

Small Business Concern

Firm: United Protective Technologies, LLC
Address: 142 Cara Court, Locust, NC, 28097-9740

Summary Details

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

Next generation X-ray observatories require substantial optical component research and development to meet the anticipated goals of future X-ray observatory missions. The current shell optic fabrication process does not provide the desired sub 2 arcsec angular resolution to meet the vision in the Decadal Survey on Astronomy and Astrophysics 2020. One chief area of improvement is the shell mirror component of the observatory. This is a Tier 1 technology gap according to the 2024 NASA Astrophysics Division Biennial Technology Gap Prioritization report. There are three primary mirror distortion errors that contribute to this technology gap. This effort focuses on distortion from fabrication errors. The NASA X-ray optic development group at Marshall Space Flight Center is currently developing processes that aim to create a Au release layer between the Ni-P mandrel and the electroformed optic shell as part of the shell optic fabrication process. However, there is evidence that this Au layer may partially diffuse into the Ni-P mandrel, causing increased, uneven surface adhesion between the optic shell and the mandrel. UPT will develop a Au diffusion barrier coating that will be deposited onto the mandrel before the Au is sputtered and act as part of a dual release layer for the

shell optic. The coating will prevent Au diffusion into the mandrel, reducing surface adhesion and produce a more uniform release of the shell from the mandrel. Minimizing optic shell stress. After the shell is released the diffusion barrier coating will remain on the mandrel, ready to replicate another optic shell, and the Au layer will remain on the interior of the shell optic, which will act as a highly reflective coating during observatory operation. This advancement will significantly reduce the fabrication stress or the optic. UPT is and will continue to work closely with MSFC personnel to ensure this technology is advancing the X-ray optical development groups mission.

Duration: 6

Proposal Details

Proposal Number: COSMO.5.S26B-0435
Subtopic Title: Advanced Observatory Technologies: Mirrors, Structures, Systems, Fabrication and Metrology
Proposal Title: Dual-mode Adaptive Resolution Interferometer (DARI)

Small Business Concern

Firm: Advanced Systems & Technologies, Inc
Address: -

Summary Details

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

In response to NASA solicitation COSMO.5.S26 B (Advanced Observatory Technologies: Mirrors, Structures, Systems, Fabrication and Metrology, this proposal, submitted on behalf of Advanced Systems and Technologies Inc. (AS&T Inc.), proposes adoption of a Dual-mode Adaptive Resolution Interferometer (DARI) which affords the combined capabilities of both spatial phase stepped digital speckle pattern interferometry (SPS-DSPI) augmented by Whole Field Laser Doppler Vibrometry (WFLDV), a proprietary technology of AS&T Inc. By exploiting high-speed parallel readout of detector arrays whose spatial resolution is dictated solely by the sampling criteria for the structural deformation of primary

interest, the WFLDV is essentially a spatially homodyne array of autonomous single pixel vibrometers sharing a single common temporally heterodyne reference phase carrier. Together with the SPS-DSPI capability afforded by new commercial CMOS polarization imaging detectors such as the Sony IMX250MZR, DARI seeks to exploit the combined capabilities of both spatial and temporal phase measurement for comprehensive characterization of the static and dynamic behavior of new astronomical telescope mirror designs for deployment by NASA on the Habitable World Observatory. The work program detailed in the proposal combines the expertise of AS&T Inc. scientific personnel with consultancy support from Dr. James E. Millered, former co-founder of 4D Technology Corporation who previously developed a range of unique SPS-DSPI based interferometers used in final qualification of the James Webb Space Telescope (JWST).

Duration: 6

Proposal Details

Proposal Number: ENABLE.1.S26B-0584
Subtopic Title: Laser Welding System and Integrated Real-Time Nondestructive Inspection
Proposal Title: LUNAR-WELD: Vacuum-Hardened Laser Joining with Crystallographic Machine-Learning NDE

Small Business Concern

Firm: Technik Industrial LLC
Address: 4200 Adagio Pl, Round Rock, TX, 78681-1689

Summary Details

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

LUNAR-WELD, a vacuum-hardened, dust-tolerant laser welding system with an integrated, real-time nondestructive evaluation (NDE) inference layer purpose-built for Artemis surface assembly and repair. The single innovation that distinguishes LUNAR-WELD from in-space welding heritage and from contemporary terrestrial industrial laser-welding NDE is the use of a crystallographic, density-correlation

machine-learning representation â€” the Smooth Overlap of Atomic Positions (SOAP) family and its Principal Covariates Classification (PCovC) interpretable supervised method â€” as the engine that maps real-time sensor signatures from a multi-modality NDE stack to defect categories and to a low-dimensional, physically meaningful latent space of fusion-zone microstructural state. LUNAR-WELD addresses a critical NASA need while targeting multi-billion-dollar terrestrial dual-use markets for fully-automated, high-vacuum welding. For NASA, the primary benefit is the elimination of post-weld destructive coupon testing on the lunar surface. An audit-ready, real-time NDE system could reduce the lift-mass penalty associated with qualification by an estimated factor of 5 to 10. In the aerospace MRO sector, Technik envisions deploying modular, remote NDT capabilities. This includes portable vacuum-compatible NDE sensor modules and quadcopter-drone-based inspection systems capable of performing remote, real-time weld evaluation on aircraft structures in the field. Such capabilities would significantly reduce aircraft downtime and enable on-wing or depot-level repairs with minimal disassembly.

Duration: 6

Proposal Details

Proposal Number: ENABLE.1.S26B-1046
Subtopic Title: Laser Welding System and Integrated Real-Time Nondestructive Inspection
Proposal Title: In-Situ and Post Process NDI for Space-Based and Lunar Laser Welding

Small Business Concern

Firm: JENTEK Sensors, Inc.
Address: 121 Bartlett St, Marlborough, MA, 01752-3015

Summary Details

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

JENTEK Sensors, Inc. has developed and transitioned practical nondestructive

Inspection (NDI) solutions for laser welding, that are well suited and adaptable for space and lunar environments. JENTEK is already qualifying and transitioning NDI for laser welding of spacecraft. Furthermore, JENTEK has unique flexible eddy current arrays (called MWM-Arrays) that can operate non-contact and at high temperatures. JENTEKâ€™s current stainless steel laser welding NDI solutions are for thicknesses under 2mm and will be expanded under this program to over 5mm from one side, and to 10mm for two-sided access. Furthermore, under prior Lockheed Martin funding, JENTEK has already demonstrated NDI of titanium alloy electron beam directed energy deposition (EB-DED) welded AM samples in a vacuum environment, proving a major element of the proposed solution needed for lunar environments. Finally, JENTEK has demonstrated MWM-Arrays operating up to 250ËšC, has a pending commercial contract for development of higher temperature MWM-Arrays for operation up to 400ËšC and has demonstrated feasibility for MWM-Arrays operating up to 850ËšC under prior DOE funding. During Phase I, JENTEK intends to reach out to groups that have been funded for lunar laser welding research, and evaluate other lunar welding alternatives such as Friction Stir Welding in vacuum and Electron Beam welding in vacuum. JENTEK will evaluate alternative laser welding technologies and other welding technologies in Phase I and develop a detailed plan for autonomous laser welding with real-time and post welding NDI for Phase II. If a Phase I and Phase II SBIR project is awarded, this team (if augmented by lunar environment specialists and laser welding OEMs) is likely to successfully commercialize and transition lunar and space-based laser welding and associated NDI tools â€“ noting that such a transition fits with the core commercialization and mission-related goals of this team.

Duration: 6

Proposal Details

Proposal Number: ENABLE.1.S26B-1097
Subtopic Title: Laser Welding System and Integrated Real-Time Nondestructive Inspection
Proposal Title: Weld and Verify: Real-Time Weld Intelligence for Lunar Laser Welding

Small Business Concern

Firm: Gradient Industrial Robotics
Address: 2825 Irongate Pl, Thousand Oaks, CA, 91362-5384

Summary Details

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

NASA's Artemis program requires surface manufacturing capabilities for habitat construction, infrastructure assembly, equipment fabrication, and repair. Laser welding is well suited to lunar operations because it can be precise, repeatable, automatable, and less dependent on consumables than many joining methods. The hard part is not only making the weld. It is producing a weld that can be trusted on the lunar surface, with limited astronaut time, delayed Earth review, and no practical path to destructive inspection. Gradient Industrial Robotics Corporation, operating as Advanced Metal Research (AMR), proposes to develop the weld-intelligence layer for a semi-autonomous lunar laser welding system with integrated real-time nondestructive inspection. Phase I will adapt AMR's closed-loop robotic welding, sensing, metrology, controller, machine-learning, and inspection-evidence capabilities to NASA's lunar surface constraints. AMR will define Artemis use cases and requirements, trade laser and NDI architectures, demonstrate terrestrial proof-of-concept weld-and-inspect experiments with synchronized sensing and quality correlation, and produce a preliminary lunar deployment design with mass, power, volume, dust, thermal, autonomy, and Phase II qualification plans. The proposed innovation integrates welding process control, seam tracking, multimodal sensing, nondestructive inspection, supervised autonomy, and digital evidence into one workflow. The system will not claim autonomous weld certification. Instead, it will generate automated quality assessment and qualification-support evidence for astronaut, operator, and NASA review. The Phase I effort will advance the lunar application from TRL 2 to TRL 4 and prepare a Phase II engineering prototype path for thermal-vacuum, dust, materials, NDI, and operational validation.

Duration: 6

Proposal Details

Proposal Number: ENABLE.2.S26B-0080
Subtopic Title: High Performance Onboard Computing
Proposal Title: AURA: An Analog Unified Reconfigurable Accelerator for On-Orbit AI Adaptation

Small Business Concern

Firm: Vellex Computing
Address: 528 Paseo Bella Montana Unit B, San Luis Obispo, CA, 93405-1196

Summary Details

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

AURA (Analog Unified Reconfigurable Accelerator) is a proposed programmable analog coprocessor that accelerates onboard AI model adaptation for NASA spacecraft by solving constrained optimization problems in approximately 1 ms at sub-10 mW. These optimization problems are the core computation underlying perception retraining, anomaly detection, and science data prioritization. Deep-space operations impose a structural constraint: communication latency of up to 24 minutes one-way and power envelopes below 10 W make it impossible to offload AI retraining to ground stations or run conventional digital accelerators continuously. AURA resolves this by encoding optimization problems as the equilibrium state of a reconfigurable analog circuit, converging to the optimal solution in milliseconds without iterative software. A prior laboratory prototype demonstrated a 17,000x speedup at 3 mW for the analog core, establishing TRL 3. The proposed Phase I project produces three deliverables: (D1) a benchmark report characterizing three NASA AI adaptation workloads in circuit simulation, targeting greater than 100x speedup over state-of-the-art iterative solvers at less than 5% error; (D2) a silicon architecture specification covering chip power, performance, and area, radiation hardening for low Earth orbit and cislunar environments, and integration with NASA's HPSC processor; and (D3) a flight software interface specification for NASA's Core Flight System. Phase I funding enables circuit-level validation and architecture definition required to enter Phase II chip fabrication. Target markets include NASA deep-space missions, commercial satellite operators, and defense edge AI platforms where communication latency or power constraints preclude cloud-based model training.

Duration: 6

Proposal Details

Proposal Number: ENABLE.2.S26B-0240
Subtopic Title: High Performance Onboard Computing
Proposal Title: Sophia TILE for GPU-Accelerated Computing with Integrated Thermal Management

Small Business Concern

Firm: Sophia Space
Address: 12744 Milbank St, Studio City, CA, 91604-1309

Summary Details

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

Sophia Space proposes to mature the Sophia Space TILE for GPU-Accelerated Computing with Integrated Thermal Management for NASA high-performance onboard computing missions. The Sophia TILE is a modular orbital edge-computing architecture built from Sophia Blades that combine GPU-accelerated processing, radiation-hardened supervisory control, onboard storage, passive thermal rejection, and power- and thermal-aware workload management. The Sophia Orbital Operating System (SOOS) provides workload orchestration, health monitoring, fault isolation, and self-healing across distributed compute resources. Phase I funding will be used to develop NASA-focused concepts and architectural design. The effort will map NASA mission classes to four integration paths: Blade as a SpaceVPX/PCIe plug-in card, Blade as a hosted payload electronics board, TILE as a self-contained hosted payload, and compute-as-a-service over optical inter-satellite links. The work will identify NASA-specific Blade configuration needs; evaluate candidate applications on a Sophia hardware/software sandbox; and define Phase II specifications, testing, and demonstration plans. Target markets include NASA science and exploration missions, commercial Earth observation, space communications and relay networks, hosted payload missions, commercial space stations, national security space, space domain awareness, and distributed space operations where onboard AI/ML processing, data reduction, autonomy, and low-latency analytics are mission-critical.

Duration: 6

Proposal Details

Proposal Number: ENABLE.2.S26B-0507
Subtopic Title: High Performance Onboard Computing
Proposal Title: Enabling Radiation Tolerant, Enterprise Class NVMe Storage for NASA Systems

Small Business Concern

Firm: The Radiation Team LLC
Address: 625 Strander BLVD, Tukwila, WA, 98188-2900

Summary Details

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

The proposed innovation will enable radiation-tolerant, enterprise-class NVMe solid-state storage for NASA systems. Future exploration, science, autonomy, and lunar infrastructure missions require higher onboard data capacity, throughput, and reliability than legacy space-qualified storage architectures can provide. Commercial NVMe SSDs offer the needed performance, density, and affordability, but are not designed for radiation environments in LEO, MEO, GEO, lunar, and deep-space missions. The Radiation Team will perform radiation characterization of commercial NVMe SSD controllers, state-of-the-art NAND flash, and critical support components. Testing will include proton, heavy-ion, and total ionizing dose exposure to identify single-event effects, functional interrupts, latchup susceptibility, data-path faults, memory errors, retention impacts, degradation thresholds, and recovery behavior. The effort will initially focus on commercial SSDs using the Microchip Flashtec NVMe controller family and current NAND technologies. The resulting data will guide component selection, reliability assessment, and definition of a preliminary radiation-tolerant NVMe SSD architecture. Mitigation concepts will include firmware-based fault detection and recovery, watchdog and reset strategies, enhanced error handling, redundant metadata, health monitoring, radiation-aware memory management, and system-level data protection. The Phase I effort will produce radiation test data, a preliminary SEE/TID reliability assessment for representative NASA missions, and a Phase II roadmap for prototype development. This work will provide NASA a scalable path to affordable, high-speed, high-capacity, radiation-tolerant storage supporting high-resolution imaging, onboard processing, autonomy, communications buffering, lunar surface systems, and future space-qualified data-center architectures.

Duration: 6

Proposal Details

Proposal Number: ENABLE.2.S26B-0531
Subtopic Title: High Performance Onboard Computing
Proposal Title: Towards LUNA-64: Boosting High-Performance Spaceflight Computing platforms with A 64 TOPS, <1W Radiation-Hardened Co-Processor for AI Workloads

Small Business Concern

Firm: Mentium Technologies Inc.
Address: 75 Aero camino, Goleta, CA, 93117-3195

Summary Details

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

Mentium Technologies proposes to define and de-risk Luna-64, a radiation-hardened, 64 TOPS-class AI co-processor designed to augment NASA's High-Performance Spaceflight Computing (HPSC) platform and enable onboard autonomy for future exploration and science missions. Luna-64 integrates four 16 TOPS DNN accelerator cores, each paired with a RISC-V vector engine for DSP-style preprocessing and post-processing, a shared memory hierarchy with ECC protection, and a PCIe Gen3 host interface for seamless integration with HPSC-class processors. The architecture supports multiple execution modesâ€”independent parallel inference, pipelined execution across DNN graph stages, and configurable three-core TMR for high-reliability workloadsâ€”delivering up to 64 TOPS at sub-watt power with projected efficiency exceeding 8 TOPS/W. Luna-64 builds directly on Mentium's proven Luna-1 (2.4 TOPS, ~100 mW, 300 krad TID, SEL â‰¥ 90 MeVÂ·cmÂ²/mg) and Luna-2 (4.2 TOPS, ~130 mW, integrated PCIe), both developed under prior NASA support. Performance projections are calibrated against measured silicon data, not idealized estimates. Phase I (6 months) will deliver a complete architectural study and system specification, including the multi-core organization, memory hierarchy, PCIe dataflow, RISC-V vector subsystem, SDK expansion plan, radiation-aware

reliability strategy, and preliminary floorplan feasibility on GF 22FDX+. Phase II (15 months) will produce verified full-system RTL with FPGA emulation and initial SDK updates. Phase III (18 months) will complete GDS signoff, tape-out, fabrication, packaging, and silicon testing. The co-processor model allows NASA missions to add AI capability incrementally without replacing qualified flight computers. Target applications include onboard data reduction, terrain classification, hazard detection, autonomous navigation, anomaly detection, and distributed sensing across Earth-observing, planetary, cislunar, and deep-space missions,

Duration: 6

Proposal Details

Proposal Number: EVA.2.S26B-0235
Subtopic Title: Mars Exploration Extravehicular Activity (EVA) Suit
Proposal Title: Ultralight Non-Venting Spacesuit Thermal Control

Small Business Concern

Firm: Barrow Green, LLC
Address: 8213 Lilly Stone Drive, Bethesda, MD, 20817-4505

Summary Details

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

Barrow Green (BG), in collaboration with University of Illinois Urbana-Champaign (UIUC), propose to develop a lightweight, compact elastocaloric heat pump and radiator for non-venting spacesuit cooling on the Moon and Mars. Existing solutions require venting water to keep the spacesuit cool, and can become non-functional if clogged by contaminants like dust, which is ubiquitous on the Martian and Lunar surfaces. A passive radiator would be an ideal solution, but even in ideal conditions, there is not enough surface area available for a passive radiator to provide sufficient cooling. The proposed solution uses a novel elastocaloric heat pump to boost the temperature of a radiator built into the cover of the Portable Life Support System (PLSS), allowing it to reject over 60% more heat using the same surface area. By eliminating the need to vent water, our innovation could save up to

800kg of launch mass over the lifetime of the heat pump. In phase I, we will deliver a feasibility study and prototypes of critical subcomponents to show that this approach meets requirements.

Duration: 6

Proposal Details

Proposal Number: EVA.2.S26B-0431
Subtopic Title: Mars Exploration Extravehicular Activity (EVA) Suit
Proposal Title: Spacecraft Water Advanced Membrane Pervaporation Exchanger

Small Business Concern

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

Summary Details

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

This proposal outlines development of Paragonâ€™s Spacecraft Water Advanced Membrane Pervaporator (SWAMPE) for nextâ€generation Martian Exploration Portable Life Support Systems (mxPLSS). SWAMPE enhances thermal control, heat rejection, and water efficiency for EVA systems by using Paragonâ€™s patented Ionomer-membrane Water Processing (IWP) technology. In contrast to conventional porous hollow-fiber designs (SWME), SWAMPE employs a solid Nafion-based membrane, delivering up to 3â€“4Ã— higher performance per unit volume. Its robust design resists contaminants and freeze conditions, making it well-suited to the Martian environment where unique atmospheric pressure and composition challenge conventional evaporative cooling. Phase I funding will advance SWAMPEâ€™s technology readiness by performing experimental tests under pressure and diffusion conditions representative of Mars. The work includes validating pervaporation and system transport models, assessing both active and passive configurations, and defining key metrics for mass, volume, and water efficiency. Funds will also update testing facilities to simulate Martian atmospheres, support parametric tests, and guide a series of design reviews culminating in a

System Design Review (SDR) that prepares the technology for Phase II integration into PLSS architectures. Target markets for SWAMPE include NASAâ€™s human exploration and planetary programs, specifically for missions to Mars as well as future lunar EVA systems and advanced spacesuit development by commercial partners like Axiom Space. The SWAMPE technology addresses the need for compact, efficient, and robust thermal control solutions in environments with tight mass and volume constraints, offering significant improvements over current state-of-the-art designs.

Duration: 6

Proposal Details

Proposal Number: EVA.2.S26B-0484
Subtopic Title: Mars Exploration Extravehicular Activity (EVA) Suit
Proposal Title: Advanced Sorbent Regeneration for Mars EVA

Small Business Concern

Firm: Reaction Systems, Inc.
Address: 17301 W. Colfax Avenue, Golden, CO, 80401-4892

Summary Details

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

Reaction Systemsâ€™ existing technology to sequester CO2 and water for Mars EVAs relies on a high-capacity liquid sorbent that captures these compounds and allows them to be recovered at the end of the EVA. In the proposed work, Reaction Systems will perform a thorough investigation of advanced sorbent regeneration techniques to reduce regeneration time and temperature, which will extend sorbent lifetime and increase cyclic capacity. This will be done utilizing a rapid screening apparatus in which up to 16 sorbents can be tested at a time. As a result, high-throughput screening of many different combinations of sorbent and regeneration conditions can be tested. These results will lead to the selection of the most promising sorbent/regeneration combinations will undergo larger scale testing and multiple absorption/regeneration cycles. It is expected that the primary customers

will be NASA contractors who produce components for life support systems as they aim to address the new challenges involved in Mars operations. Identifying better sorbent regeneration techniques also has direct application in industrial flue gas and direct air CO2 capture, and the results from this project can be leveraged for those markets as well.

Duration: 6

Proposal Details

Proposal Number: EXPAND.2.S26B-0274
Subtopic Title: Orbital Debris Tracking
Proposal Title: Optical Sensor for Five-Centimeter Discovery and One-Centimeter Custody of Orbital Debris

Small Business Concern

Firm: Advanced Nanophotonics, LLC
Address: 4437 Windsor Farm Rd, Harwood, MD, 20776-2200

Summary Details

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

Advanced Nanophotonics LLC (ANP) proposes a novel passive optical ground-sensor architecture that closes two intrinsic capability gaps in U.S. ground-based Space Domain Awareness: autonomous discovery of five-centimeter debris in low-Earth orbit and precision custody of one-centimeter debris once cued â€” neither of which any fielded U.S. optical sensor performs today. Both gaps trace to the same per-pixel signal-to-noise collapse intrinsic to frame-based imaging of small fast-moving targets, where reflected target photons disperse along a streak track while every pixel still accumulates the full sky photon count and full detector read noise. The proposed architecture replaces frame-based imaging with a fundamentally different sensing chain that preserves the photons of a moving target as a coherent signal against the incoherent sky-shot-noise floor, extending ground-based optical custody by approximately one decade in target diameter at fixed aperture. The system is fully passive, requires no transmitter, adaptive-optics loop, or spectrum

licensing, integrating a precision optical front end with a commercial high-speed detector and a kinematically-tuned signal-extraction pipeline. A closed signal-model simulation across the operational solar-depression envelope shows the architecture autonomously discovers 5 cm targets in the under-observed regime and holds custody on a 1 cm target for 91% of a sunlit pass where 10 Hz CMOS frame-subtraction holds 0%, recovering altitude to ~117 m and velocity to ~1.7 m/s from 60 s of arc on a 500 km target from a single ground station without baseline parallax. Phase I delivers a calibrated signal model, a validated detection-and-orbit-determination pipeline, fabricated front-end hardware, and an integrated two-channel laboratory demonstration taking the architecture from TRL 2 to TRL 4. Phase II matures the design to a field-deployable two-channel unit for real-sky validation against tasked debris targets.

Duration: 6

Proposal Details

Proposal Number: EXPAND.2.S26B-0312
Subtopic Title: Orbital Debris Tracking
Proposal Title: Quantum Camera for High Resolution Orbital Debris Tracking

Small Business Concern

Firm: SensorQ Technologies Inc.
Address: 444 Somerville Ave, Somerville, MA, 02143-3260

Summary Details

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

Diffraqtion proposes a ground-based optical system for detecting and determining the orbit of 1 cm orbital debris using the company's quantum camera technology. Conventional optical and radar systems cannot reliably track debris at this size class, leaving the vast majority of approximately 500 million debris objects larger than 1 cm in low Earth orbit untracked and posing an unquantified collision risk to operational spacecraft. The proposed system deploys a tiled array of quantum cameras at the focal plane of a 3m class ground-based telescope. Each quantum

camera uses spatial mode demultiplexing to extract angular position information from photons approaching the quantum information limit, enabling detection and measurement performance beyond what conventional focal-plane imaging achieves within the available photon budget and observation window. The system acquires debris via scene-entry change detection, maintains custody through bright background interference using spatial mode rejection, and determines a custody-quality orbit from sequential observation arcs during a single pass. Phase I funding supports six months of analysis, simulation, and preliminary design work performed entirely by Diffraqtion employees at the company's Somerville, Massachusetts facility. The three technical objectives are a trades and requirements analysis, an early system design analyzed against those requirements, and a Phase II implementation plan for on-sky demonstration at a large observatory telescope. Primary target markets include NASA orbital debris programs, the U.S. Space Force Space Surveillance Network, and commercial space situational awareness operators. The tiled array architecture developed in this Phase I also advances the quantum camera platform toward broader deployment in Earth observation, defense sensing, and scientific instrumentation markets where higher resolution imaging at reduced size, weight, and power creates direct commercial value.

Duration: 6

Proposal Details

Proposal Number: EXPAND.2.S26B-0479
Subtopic Title: Orbital Debris Tracking
Proposal Title: SWIR-CLEAR: SWIR Custody of LEO Debris with an Event-Based Acquisition Receiver

Small Business Concern

Firm: SenseICs Corporation
Address: 1275 Kinnear Rd, Columbus, OH, 43212-1180

Summary Details

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

SWIR-CLEAR: SWIR Custody of LEO Debris with an Event-Based Acquisition Receiver addresses NASAâ€™s need for improved orbital debris tracking technologies capable of acquiring and maintaining custody of faint centimeter-class debris objects in low Earth orbit (LEO). As spacecraft launches and commercial satellite constellations continue to expand, smaller debris objects remain insufficiently tracked despite posing significant risk to satellites and crewed spacecraft. Existing optical and radar systems often struggle with weak-target sensitivity, high-angular-rate motion, and continuous custody maintenance during overhead passes. SenseICs proposes a ground-based extended-band SWIR/eSWIR event-based optical tracking architecture optimized for rapid acquisition and persistent tracking of fast-moving orbital debris. Unlike conventional frame-based EO/IR systems, SWIR-CLEAR leverages asynchronous event-based sensing to reduce latency, lower processing bandwidth, and improve sensitivity to faint transient targets. The proposed system combines a high-sensitivity event-based SWIR imager, real-time event-driven acquisition, and debris-specific track-before-detect processing to support orbit refinement, sensor handoff, and future debris-removal operations. The effort builds upon SenseICsâ€™ AFRL-supported DTS-1024 and EDTS-1024 event-based infrared ROIC developments and extends related SWIR event-based sensing concepts explored for space domain awareness applications. Phase I objectives include modeling representative debris signatures and observation conditions, adapting the event-based ROIC architecture for orbital debris custody, developing event-driven acquisition algorithms, and validating feasibility through laboratory moving-target demonstrations representative of LEO pass dynamics.

Duration: 6

Proposal Details

Proposal Number: EXPAND.2.S26B-0977
Subtopic Title: Orbital Debris Tracking
Proposal Title: Athene â€“ Space-Based 4D Radar for Orbit-Persistent Custody of Centimeter-Class Orbital Debris

Small Business Concern

Firm: MobLobSpace, Inc.
Address: 3259 PROGRESS DRIVE, Orlando, FL, 32826-3230

Summary Details

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

MobLobSpace proposes Athene, an implementation of the 4D Adaptable Radar (4DAR) architecture: a space-based 40 GHz Ka/Q-band active phased-array radar operating from a 400 km low Earth orbit at approximately 100 km slant range to debris targets in the 350â€“800 km altitude band. The name "4D" captures the four simultaneous measurement dimensions recovered from each 50 ms coherent processing interval: range, radial velocity (Doppler), azimuth angle-of-arrival, and elevation angle-of-arrival. Athene is a hosted payload concept. The 4DAR aperture â€” 3m Ã— 1m total â€” consists of a 1m Ã— 1m active transmit/receive center panel containing four identical phase centers. Key derived performance parameters at 100 km slant range: range accuracy Â±0.63 m, radial velocity accuracy Â±0.94 cm/s, azimuth cross-range accuracy Â±37 m, elevation cross-range accuracy Â±112 m. These four simultaneous observables are sufficient for single-pass orbit determination with a position uncertainty three to four orders of magnitude better than the public TLE catalog. The Phase I effort produces the requirements and trades analysis, early design analysis, and Phase II implementation plan called for by EXPAND.2.S26B Phase I deliverables. The complete 4DAR system design â€” carrying over nine validated subsystem studies from a prior NASA Phase I (Contract 80NSSC25C0260, March 2026) â€” provides a uniquely mature analytical basis for this Phase I work. Phase I under this solicitation extends that foundation to the specific debris custody requirements of EXPAND.2.S26B: altitude coverage from 350 to 800 km, debris as small as 1 cm, horizon-to-horizon custody, and orbit determination sufficient to enable re-acquisition by other sensors.

Duration: 6

Proposal Details

Proposal Number: EXPAND.3.S26B-0002
Subtopic Title: Autonomous Onboard Health Management for Small Spacecraft and Distributed Systems
Proposal Title: ORBIT-AFR: Onboard Resilience and Behavior-Inference with Integrated TEAMS Digital-Twin for Autonomous Fault Response and Recovery

Small Business Concern

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

Summary Details

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

The proposed ORBIT-AFR Phase 1 effort addresses the NASA EXPAND.3.S26B solicitation described needs for continuous onboard health management that can detect anomalies, localize or isolate faults, reduce time to impact estimation, and support autonomous safing, mitigation, and recovery while preserving swarm or constellation mission performance. ORBIT-AFR extends QSIâ€™s TEAMS Designer and TEAMS-RT toolset to support small spacecraft operating in hub-and-spokes or distributed architectures. TEAMS Designer will be used to define symptom classes, causal fault/effect models, tests, ambiguity groups, bounded response playbooks, node/hub model partitioning, and compact health-state message content. TEAMS-RT will use the deployable model package at runtime to interpret changed test states, localize likely fault regions, identify degraded functions, estimate time-to-impact, and recommend bounded response or discriminating checks. The Phase I effort will define the ORBIT-AFR architecture, CONOPS, health metrics/KPPs, symptom-class taxonomy, bounded playbook structure, TEAMS model package, runtime evidence schema, node-to-hub health messaging, and Phase II prototype plan. The approach is tailored to SSDS missions such as HelioSwarm-like hub-and-spokes architectures and future Starling-like distributed autonomy missions, where node compute and bandwidth constraints require compact health products rather than continuous raw telemetry. ORBIT-AFR will provide NASA a path toward model-based autonomous fault response that improves resilience to unknown faults, environmental variability, degraded nodes, and limited ground contact.

Duration: 6

Proposal Details

Proposal Number: EXPAND.3.S26B-0097
Subtopic Title: Autonomous Onboard Health Management for Small Spacecraft and Distributed Systems
Proposal Title: Swarm Health-Integrated Executive for Layered Diagnostics

Small Business Concern

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

Summary Details

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

The rapid expansion of small satellite deployments, from individual SmallSats to coordinated multi-spacecraft swarms, is outpacing the health management strategies designed to support them. Todayâ€™s onboard fault management systems were designed largely for single, crewed, or large monolithic spacecraft with reliable ground contact, ample computing resources, and well-characterized failure modes. These designs are insufficient for swarms, where intermittent links, tight computational budgets, and the sheer number of nodes make ground-driven, operator-dependent responses impractical. Advanced Spaceâ€™s proposed solution, entitled Swarm Health-Integrated Executive for Layered Diagnostics (SHIELD), unifies subsystem-level diagnostics, spacecraft-level autonomous recovery, and swarm-level reconfiguration into a coherent, end-to-end AI framework. The architecture advances autonomous Fault Detection, Isolation, and Recovery (FDIR) beyond current rule-based approaches by tightly coupling: (1) subsystem-level fault diagnosis, (2) spacecraft-level autonomous planning and execution, and (3) swarm-level coordination via consensus-based dynamic leader election. This hierarchy continuously detects both known and unknown faults, maintains an integrated health state with runtime safety assurance, and autonomously adapts recovery actions and mission plans based on current health, available resources, and evolving constraints. The primary goal of the Phase I project is to architect, trade, and down select a hierarchical, autonomous FDIR framework for ESPA class small satellites and swarms, encompassing resource aware health monitoring, advanced model based fault diagnosis, and onboard reasoning/planning. This Phase I effort directly addresses the subtopic by (1) detecting anomalies, (2) diagnosing and localizing faults, (3) reducing timeâ€˜toâ€˜effect and improving impact estimation, and (4) enabling autonomous safing and recovery at the subsystem, spacecraft, and swarm levels.

Duration: 6

Proposal Details

Proposal Number: EXPAND.3.S26B-0101
Subtopic Title: Autonomous Onboard Health Management for Small Spacecraft and Distributed Systems
Proposal Title: Decision-Centric Health-State Reasoning for SmallSat Resilience

Small Business Concern

Firm: Uandor, Inc.
Address: 1546 Hampton Hill Cir, MC LEAN, VA, 22101-6018

Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 1 - 4
Technical Abstract (Limit 2000 characters):

Uandor proposes AURORA-HM, an onboard software architecture for autonomous health management of SmallSats and distributed spacecraft systems. Current spacecraft health management depends on static fault tables, threshold checks, and ground-based anomaly review. These methods do not scale well to constellations, intermittent communications, limited downlink, or faults not anticipated during design. AURORA-HM converts telemetry into an evolving health state that captures subsystem dependencies, constraints, competing fault hypotheses, uncertainty, recovery actions, and mission objectives. During Phase I, Uandor will develop a concept of operations, reference SmallSat health model, synthetic telemetry and fault-injection environment, and prototype reasoning engine. The prototype will validate telemetry, detect anomalies, localize affected subsystem regions, generate known and unknown fault hypotheses, estimate time-to-impact across power, thermal, pointing, communications, and mission constraints, and rank mission-authorized low-risk responses. For distributed missions, it will generate reduced health summaries that allow peer spacecraft to reallocate tasks without raw telemetry exchange. The demonstration will evaluate power-thermal coupling, ADCS/payload degradation, communications degradation, unknown composite faults, and swarm node degradation. Success will be measured by traceability from evidence to diagnosis, consequence estimate, and authorized response, plus detection latency, localization quality, time-to-impact error, false positive rate, compute footprint, and swarm task recovery. The expected outcome is a TRL -4 software proof of concept with a path to Phase II validation in a representative onboard environment. NASA applications include SmallSat, cislunar, lunar, and distributed science missions; commercial applications include satellite constellations, defense space, spacecraft bus platforms, aviation autonomy, and critical infrastructure.

Duration: 6

Proposal Details

Proposal Number: EXPAND.3.S26B-0117
Subtopic Title: Autonomous Onboard Health Management for Small Spacecraft and Distributed Systems
Proposal Title: Resilient Onboard AI for Fault Detection, Diagnosis, and Recovery in Small Spacecraft Swarms

Small Business Concern

Firm: Otter Aerospace Inc.
Address: 936-B Seventh St, Novato, CA, 94945-3002

Summary Details

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

Otter Aerospace is developing onboard software that lets small spacecraft swarms detect, diagnose, and recover from faults on their own when ground contact is delayed, limited, or unavailable. Today's spacecraft fault management depends on pre-defined fault lists and ground-based diagnosis, leaving a critical gap: unanticipated faults account for up to 40% of failure modes and represent the largest unaddressed mission risk as small spacecraft swarms proliferate across Earth, lunar, and deep-space environments. The proposed software combines proven physics-based monitoring with modern machine-learning tools that interpret spacecraft telemetry in real time, identify off-nominal behavior, and recommend safe recovery actions. A safety layer ensures the software can only take actions that operators have pre-authorized. When one spacecraft enters a degraded state, the swarm redistributes its tasks, so the overall mission continues. Phase I funding supports a six-month feasibility study covering the operating concept, candidate detection and reasoning approaches, swarm-level coordination, and the path to a flight-grade Phase II prototype suitable for a hosted on-orbit demonstration. The technology targets NASA distributed missions, defense space architectures, and commercial satellite constellations operating across low Earth orbit, cislunar space, and beyond.

Duration: 6

Proposal Details

Proposal Number: EXPAND.3.S26B-0382
Subtopic Title: Autonomous Onboard Health Management for Small Spacecraft and Distributed Systems
Proposal Title: Self-Diagnosis, Cross-Spacecraft Observation, and Joint Task-and-Network Reconfiguration for Health-Aware SmallSat Swarms

Small Business Concern

Firm: TMC Technologies of WV Corp.
Address: 2050 Winners Drive, FAIRMONT, WV, 26554-8423

Summary Details

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

This project proposes a continuous onboard health-management capability for distributed SmallSat systems operating in lunar and cislunar environments. The innovation combines self-diagnosis, peer observation, and optimization-based swarm reconfiguration. Layer 1A compares real-time telemetry against physics-based component models and variational-autoencoder novelty detection, then fuses the results in a Bayesian network that produces a fault-state posterior, including an explicit unknown outcome, and a time-to-effect estimate. Layer 1B allows neighboring spacecraft to corroborate or challenge a degraded spacecraftâ€™s self-report using crosslink RF, optical, radar, astrometric, or other available peer observations. Layer 2 consumes a shared capability descriptor containing fault posterior, peer reports, resource limits, time-to-effect, link quality, and buffer state to jointly re-solve task assignment, orbital configuration, and network routing. Phase I will implement the algorithms and descriptor schema as portable core Flight System applications integrated in the SmallSat Digital Twin environment. The effort will exercise two lunar-relay case studies: a Lunar South Pole relay swarm with progressive solar-array degradation and a far-side science relay with an unknown high-gain antenna pointing anomaly. Fault-injection campaigns will measure detection performance, diagnosis/localization accuracy, peer-detection value, latency, time-to-effect error, reconfiguration latency, implementation footprint, and service-level retention against a no-recovery baseline. The expected result is a validated architecture that enables SmallSat swarms to detect known and unknown faults, estimate mission impact, and autonomously preserve communications and data-delivery service when nodes degrade. Phase I matures the framework toward TRL 5 in a relevant digital-twin environment and defines the metrics and

measurement plan for a Phase II hardware-in-the-loop demonstration.

Duration: 6

Proposal Details

Proposal Number: EXPAND.3.S26B-0571
Subtopic Title: Autonomous Onboard Health Management for Small Spacecraft and Distributed Systems
Proposal Title: SideGuard: Sensor/Side-channel Augmented Graph-Evidence Health Model for Small Spacecraft and Distributed Systems

Small Business Concern

Firm: Opal AI Inc.
Address: 4676 Admiralty Way, Marina del Rey, CA, 90292-6601

Summary Details

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

Small spacecraft and distributed satellite systems operate under severe observability, compute, and intervention constraints. Under these conditions, early faults can remain latent until they propagate into subsystem degradation, safe-mode entry, or mission loss. OpalAI proposes SideGuard, a low-SWaP onboard health and fault-management system for detecting and explaining early spacecraft faults without modifying protected flight software. When the target avionics architecture supports it, SideGuard is deployed as a companion-monitor architecture using a separate FPGA/eFPGA block, low-overhead sensing IP, or representative embedded monitor that observes the protected flight processor without intrusive software changes. SideGuard uses four kinds of evidence: spacecraft telemetry, side-channel signals such as power-rail ripple or electromagnetic emissions, mission context such as operating phase, and compact peer-health summaries from nearby spacecraft. These signals are represented as Health Tokens, checked for deviations from nominal behavior, linked to abnormal channels, and projected onto a subsystem evidence graph. The graph estimates the root subsystem, cascade path, uncertainty, time-to-effect, and bounded mitigation or safe-response options. In the preferred path, the

companion monitor handles low-overhead feature extraction, Health Token formation, APOR state logic, and selected quantized inference kernels, leaving the protected flight processor mainly responsible for telemetry or counter exposure and compact packet exchange. Phase I defines the operational concept, sensing inputs, evaluation dataset, compact ML detector, root-subsystem reasoning, time-to-effect reasoning, and performance validation under power, compute, and bandwidth constraints. Non-FPGA-demonstrated components remain software prototypes for Phase II hardware integration.

Duration: 6

Proposal Details

Proposal Number: EXPAND.3.S26B-0583
Subtopic Title: Autonomous Onboard Health Management for Small Spacecraft and Distributed Systems
Proposal Title: SpaceDucks: Mesh-Native Edge AI/ML for Autonomous Health Management of Smallsat Swarms

Small Business Concern

Firm: OWL Integrations, Inc.
Address: 3634 Sturbridge Place, Allentown, PA, 18104-1770

Summary Details

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

Small-spacecraft swarms fail in ways no pre-launch fault library can anticipate, and ground-loop response does not scale across distributed constellations operating with intermittent contact and light-time delay. Over 40 percent of in-flight failure modes are not identified at design time. This Phase I matures OWL's SpaceDuck platform, a flight-proven distributed LoRa mesh on orbit since April 2026, into an autonomous onboard health-management capability for small-spacecraft swarms. The proposed architecture is organized around three integrated technical objectives: Sense, a multi-modal health telemetry architecture on flight-heritage hardware that captures the bus, thermal, power, and radio signals required for autonomous fault

inference; Think, onboard ML cognition for anomaly detection, fault diagnosis, and graduated response, including unsupervised detection of unknown faults; and Distribute, mesh-distributed health-state propagation over the OWL mesh and swarm-level coordination including safing, role reassignment, task hand-off, and graceful degradation. Together, these close the detect-diagnose-respond loop in orbit on commodity flight compute, with no ground intervention required. Phase I will deliver a swarm health-state schema and OWL mesh message extensions, a characterized edge-AI anomaly detection model, and a three-node hardware-in-the-loop demonstration under injected fault scenarios. Phase I exits at TRL 4 with the integrated architecture validated in a relevant laboratory environment and a Phase II development plan defining an on-orbit demonstration concept that leverages SpaceDuck ONE flight-heritage hardware and OWL mesh infrastructure. This effort directly addresses Civil Space Shortfall 1438 (Autonomy, Edge Computation, and Interoperable Networking for Small Spacecraft) and establishes a low-cost, low-SWaP path to autonomous swarm resilience for NASA distributed missions.

Duration: 6

Proposal Details

Proposal Number: EXPAND.3.S26B-0645
Subtopic Title: Autonomous Onboard Health Management for Small Spacecraft and Distributed Systems
Proposal Title: Fleet-Wide Resilience Through Federated Learning for Distributed Small Spacecraft Swarms

Small Business Concern

Firm: In Orbit Aerospace Inc.
Address: 215 Arena Street, El Segundo, CA, 90245-3806

Summary Details

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

In Orbit Aerospace proposes to advance INTELLACT, an edge-resident AI/ML framework for autonomous spacecraft health management, into a distributed

federated learning architecture enabling fleet-wide fault detection, diagnosis, and autonomous response across cislunar small spacecraft swarms. Current onboard fault management systems rely on static rule-based fault trees and ground-loop diagnostics that are fundamentally incompatible with the light-time delays, sparse contact windows, and severe environmental conditions of cislunar operations. Critically, as many as 40% of failure modes go unidentified through Key Decision Point E, meaning a substantial fraction of faults a spacecraft will encounter were never anticipated at design time. INTELLACT addresses this directly: each spacecraft in the formation runs inference locally and exchanges learned model parameters rather than raw telemetry with peers across inter-satellite links, enabling the swarm to collectively detect degradation patterns no individual spacecraft would recognize on its own. Phase I funding will be used to mature the distributed federated learning architecture from TRL 3 to TRL 4 through high-fidelity modeling and simulation, validate performance against known and out-of-distribution fault scenarios, and establish hardware feasibility on representative smallsat flight compute platforms. Target markets include NASA cislunar smallsat programs, the Space Development Agency's Proliferated Warfighter Space Architecture, and commercial constellation operators requiring autonomous health management at scales where manual operations are no longer economical.

Duration: 6

Proposal Details

Proposal Number: EXPAND.3.S26B-0874
Subtopic Title: Autonomous Onboard Health Management for Small Spacecraft and Distributed Systems
Proposal Title: A 15-Depth Formally Verified FDIR Reasoning Pipeline with Flight-Heritage Structural-Health Sensing for Autonomous Spacecraft

Small Business Concern

Firm: Affekta LLC
Address: 1 Hermann Museum Circle Drive, Houston, TX, 77004-7184

Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 3 - 5

Technical Abstract (Limit 2000 characters):

FORTRESS-Swarm is a federated six-tier autonomous health-management architecture for ESPA-class small-spacecraft constellations integrating dual-modality structural-health monitoring â€” piezoelectric wafer active sensor (PWAS) sensing via New Mexico Tech and fiber-optic FBG sensing via Luna Innovations â€” with formally verified onboard fault detection, diagnosis, prognosis, and recovery. The technology addresses EXPAND.3.S26B: autonomous health management of multi-spacecraft systems under constrained power, computing, and communication resources. Tiers 0â€“3 run locally on each spacecraft within 10 W (Jetson Orin Nano, 18.8 Hz): physics-prior validation, AESOP semantic-embedding anomaly detection (F1=0.889), CUSUM/conformal detection, and 22-hypothesis Bayesian diagnosis augmented with four PWAS structural fault classes. Tier 4 provides LLM causal reasoning on the swarm lead via ISL. Tier 5 ensures local safe-mode containment regardless of communication state. A Dirichlet-process mixture model discovers unknown faults outside the hypothesis bank, addressing NASA's 40% unidentified-failure-mode estimate. STREL extends monitoring across the constellation with per-location robust conformal bounds. The architecture is backed by 42,000+ machine-checked formal verification theorems, providing DO-178C/DO-333 certification evidence. Phase I advances from TRL 4 for a single system to TRL 4â€“5 for distributed FDIR: 10-node Starling-analogue simulator (F1=0.973 on 7 fault types), Jetson SWaP validation, DPMM unknown-fault discovery (â‰¥3/4 classes), STREL â‰¥90% coverage, and NMT 15-task PWAS specification with LEO radiation qualification. Primary market: NASA constellations (Starling, SDA T2, CLD). Secondary: defense proliferated LEO. Tertiary: nuclear, automotive, robotics via cross-domain transfer (grid F1=0.978, ECLSS=0.960, ADCS=1.000). Phase II targets on-orbit demonstration via NMT's ISS-heritage payload, GomSpace,

Duration: 6

Proposal Details

Proposal Number: EXPAND.3.S26B-1088
Subtopic Title: Autonomous Onboard Health Management for Small Spacecraft and Distributed Systems
Proposal Title: Distributed Health Management and Fault Attribution for Spacecraft Swarms via Bounded Reasoning and Peer Consensus

Small Business Concern

Firm: Zamna Space Inc.
Address: 2 Bank St, New York, NY, 10014-1909

Summary Details

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

Distributed lunar, Martian, and deep-space missions face severe operational constraints, as significant communication latency and high operator-to-spacecraft ratios prevent real-time ground intervention. Under these conditions, current spacecraft fault-management systems fall short; they rely on pre-programmed rules and isolated, per-vehicle diagnostics that limit their ability to identify unknown faults or distinguish local hardware failures from fleet-wide environmental disturbances like geomagnetic storms. These limitations become critical when autonomous constellations operate beyond continuous ground supervision. To solve this, Zamna Space Inc. proposes a distributed onboard health-management architecture for autonomous spacecraft constellations. Phase I will develop and evaluate a magnetometry-centric implementation of a three-tier onboard health-management architectureâ€”combining deterministic fault detection, telemetry-based anomaly analysis, and bounded onboard diagnostic reasoningâ€”to establish a managed, high-fidelity scope for validating the core framework. This system enables spacecraft to compare compact health summaries across the constellation to determine whether anomalous behavior reflects an isolated hardware issue or a shared environmental event. The effort will deliver a CONOPS, a multi-spacecraft simulation environment, a prototype deterministic detection layer, telemetry-analysis pipeline, bounded reasoning framework, and a constellation-level coordination protocol validated across representative fault scenarios. Phase I emphasizes SWaP-compatible architectures suitable for ESPA-class spacecraft and establishes quantitative Key Performance Parameters for Phase II hardware maturation. Target markets include NASA exploration missions, commercial satellite constellations, and defense operators managing distributed autonomous spacecraft systems.

Duration: 6

Proposal Details

Proposal Number: GO.2.S26B-0087
Subtopic Title: Development of cost-effective 3D printing of SOA Hall thruster

magnetic circuits
Proposal Title: Cost-Effective AM Fabrication of Hall Thruster Magnetic Circuits via AFX Beam-Shaping LPBF

Small Business Concern

Firm: Chiron Dynamics
Address: 1360 Larkwood Ct NE, Cullman, AL, 35055-2127

Summary Details

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

Hiperco 50 (Fe-49Co-2V) is the premier soft magnetic material for Hall thruster magnetic circuits, offering unmatched saturation flux density (~2.35 T) and low coercivity (~1.3 Oe) in wrought form. Laser powder bed fusion (LPBF) offers the geometric freedom needed for next-generation thruster circuits but has historically produced high coercivities even after annealing. Traditional Gaussian beam LPBF processes exceed the wrought benchmark due to the fine grain structures inherent to standard Gaussian beam processing. We would like to investigate the use of a ring-mode AFX-1000 fiber laser profile with repass heating within the LPBF process as a physically motivated strategy for closing this coercivity gap. By redistributing laser energy from a concentrated central spot to an annular perimeter, the ring beam reduces thermal gradients, slows solidification cooling rates, and promotes coarser grain growth with stronger crystallographic texture, directly attacking the root cause of elevated coercivity. In Fe-Si soft magnetic alloys, ring mode alone has already demonstrated a 16% reduction in coercivity and 53% increase in grain size relative to Gaussian beam LPBF. The inclusion of a repass cycle for each layer further slows the cooling and adds to the already proven benefits of the ring mode. Phase I funding will support a systematic design coupon study applying the AFX ring-beam profile to Hiperco 50 powder across a matrix of beam profiles, scan speeds, and power levels, followed by optimized post-build annealing and magnetic characterization. The objective is to identify at least one process-anneal combination achieving coercivity properties sufficient for functional Hall thruster magnetic circuit applications. Target markets include commercial and government Hall thruster manufacturers, Department of Defense spacecraft propulsion programs, and NASA in-space propulsion development efforts requiring geometrically complex, high-performance electromagnetic components.

Duration: 6

Proposal Details

Proposal Number: GO.2.S26B-0360
Subtopic Title: Development of cost-effective 3D printing of SOA Hall thruster magnetic circuits
Proposal Title: Preserving Magnetic Performance at Lower Cost: Multi-Material Cold Spray Additive Manufacturing of SOA Hall Thruster Magnetic Circuits

Small Business Concern

Firm: Triton Systems, Inc
Address: 330 Billerica Road, Chelmsford, MA, 01824-2440

Summary Details

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

Triton Systems, Inc. (Triton) and The University of Alabama (UA) propose a domestic Cold Spray Additive Manufacturing (CSAM) workflow for state-of-the-art Hall thruster magnetic circuits. NASA Hall-effect thrusters (HETs) are the primary mode of in-space electric propulsion for satellite station-keeping, deep-space missions, and the Lunar Gateway. HET magnetic circuits (backpole, inner core, outer core) require soft-magnetic Fe-Co-V alloys with high saturation (Bs â‰¥ 2.0 T), low coercivity, and high Curie temperature. State-of-the-art production machines these parts from wrought Hiperco strip, incurring 5:1-20:1 buy-to-fly ratios, 100â€“300 hours of machining per 5 kW circuit set, 16-28 week lead times, and a concentrated wrought-strip supply that cannot scale to the projected ~10Ã— decadal HET demand from AEPS, JPL H10, and commercial constellations. Tritonâ€™s industrial-scale Titomic TKF-1000S high-pressure cold spray system (1 m3 envelope, â‰¥1 kg/hr deposition rate) co-located with UAâ€™s Alabama Atomization Facility (PSI HERMIGA 75/5 VI atomizer) and CALPHAD-guided alloy design produces tailored Fe-Co-V chemistries deposited at â‰¥97% as-sprayed density with compressive residual stress, avoiding the tensile stress and columnar texture characteristic of laser DED and L-PBF Fe-Co-V incumbents. Phase I produces three CALPHAD-refined feedstocks (pure Fe, Hiperco 27, CALPHAD-Hiperco 50A), establishes the cold spray process window, executes ASTM A801 Type 1 vacuum annealing at UA, and delivers ASTM A773 ring samples and ASTM E8 tensile bars to the NASA Glenn Research Center Electric Propulsion Laboratory for independent verification. Phase I feasibility targets: post-anneal Bs â‰¥ 2.0 T (â‰¥83% of wrought), Hc â‰¤ 250 A/m, machining reduced to 30-80 h/set, and lead time to 6â€“10 weeks/set. Phase II delivers a hot-fire-

integrable 5 kW circuit to NASA GRC, supporting AEPS Tier-2 supply and the broader commercial HET market.

Duration: 6

Proposal Details

Proposal Number: GO.2.S26B-0901
Subtopic Title: Development of cost-effective 3D printing of SOA Hall thruster magnetic circuits
Proposal Title: Development of Electron Beam Additive Manufacturing for Hall Thruster Magnetic Circuites

Small Business Concern

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

Summary Details

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

RadiaBeam proposes development of an electron beam additive manufacturing (EBAM) approach for fabrication of soft magnetic circuits used in Hall thrusters. The effort will investigate EBAM processing of Fe-based soft magnetic alloys, including low-carbon magnetic iron and Fe-Co systems, for fabrication of representative backpole, inner core, and outer core components for 5 kW class Hall thrusters. Conventional Hall thruster magnetic circuits rely on laminated and machined soft magnetic components assembled from multiple parts, constraining geometry, increasing complexity, and introducing magnetic discontinuities. The proposed EBAM approach enables fabrication of integrated magnetic hardware with reduced part count, improved manufacturability, and increased design flexibility. Relative to laser-based additive manufacturing, EBAM offers advantages including vacuum processing, reduced oxidation, lower residual stress, and improved microstructural control. Phase I activities will establish feedstock specifications, develop process windows, fabricate representative hardware and coupons, and perform magnetic and microstructural characterization. The effort leverages

RadiaBeamâ€™s prior EBAM experience in copper, niobium, refractory metals, RF hardware, and electromagnetic systems together with NC State CAMALâ€™s expertise in powder-bed electron beam additive manufacturing and alloy development, establishing the technical basis for future Hall thruster magnetic circuit fabrication and integration.

Duration: 6

Proposal Details

Proposal Number: GO.3.S26B-0237
Subtopic Title: Advanced Momentum Management and Propellantless Control Technologies for Solar Sail Spacecraft
Proposal Title: Broadband high efficiency ultralight diffractive films for solar sail momentum management

Small Business Concern

Firm: Beam Engineering for Advanced Measurements Co.
Address: 1300 Lee Road, Orlando, FL, 32810-5851

Summary Details

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

While solar sailing technology has largely advanced the size of deployable solar sails, the controllability of these large thin structures continues to be an obstacle in the implementation of solar sail-craft for flight. Thin switchable liquid crystal diffractive films would be able to provide an efficient, propellant-less method to perform momentum management in the â€œrollâ€ axis. These switchable diffractive films could be imbedded onto the edge of the sail membrane and turned â€œonâ€ or â€œoffâ€ by sending current to the devices. Unlike RCDâ€™s which could only provide a torque in the pitch and yaw directions depending on which pairs of patches were activated, the diffractive switchable films can provide a radiation pressure force in the plane of the sail. The objective of the current proposal is to prove the feasibility of using thin diffractive films based on geometrical phase modulation for controlling solar sails and most effectively utilizing unique

opportunities provided by the technology such as the feasibility of obtaining near 100% efficiency in micrometer and even sub-micrometer thin films in broad bands of spectrum. Of particular importance is the opportunity of polarization-independent diffraction to fully use the available solar light power. The Phase 1 of the program would allow addressing: (1) technology development for high-contrast optical switching; (2) optimizing materials for low-voltage/low power control; (3) developing technology for fabrication of thin-switchable diffractive films using, for example, CP1; (4) technology of scaling to the sizes needed for NASA missions, and (5) adaptation to the space environment.

Duration: 6

Proposal Details

Proposal Number: GO.3.S26B-0313
Subtopic Title: Advanced Momentum Management and Propellantless Control Technologies for Solar Sail Spacecraft
Proposal Title: Dielectric Elastomer Fiber Technology (DEFT) for Propellantless Control

Small Business Concern

Firm: ATSP Innovations, Inc.
Address: 19111 FM 362, Waller, TX, 77484-5073

Summary Details

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

ATSP Innovations, Inc. is developing Dielectric Elastomer Fiber Technology (DEFT) to eliminate disturbance torques in solar sail propulsion without the use of consumable propellants or failure-prone mechanical stages. DEFT introduces a completely solid-state momentum management architecture integrated directly into deployable thin-ply composite booms. By co-axially extruding multi-layer silicone fibers with conductive carbon nanotube (CNT) ink electrodes, DEFT operates natively inside the booms as an electrostatic compliant capacitor. Applying a voltage induces localized fiber elongation, translating microscopic strain into

macroscopic structural deflection. This morphing shifts the sailâ€™s Center of Pressure (CoP), providing continuous, sub-second propellantless attitude steering authority. Phase I funding will transition this technology from a conceptual framework to a verified laboratory entry-level maturity (TRL 3). Milestones include: (1) formulating conductive silicone/CNT inks to achieve a target volume resistivity of <1 Î©Â·m; (2) establishing a multi-pass wire-extrusion technique to manufacture concentric DEFT fibers; (3) characterizing fiber actuation strain (1â€“5% longitudinal elongation) and mapping dielectric breakdown voltages; (4) fabricating an ultra-thin, low-ply carbon fiber composite ribbon using a low-temperature, low-viscosity aromatic polyester epoxy matrix; and (5) validating the dynamic control loop by documenting macro-scale structural deflection and sub-second actuation cycles. The primary market is NASA and defense aerospace, specifically supporting deployable configurations like the Advanced Composite Solar Sail System (ACS3) to enable high-reliability SmallSat constellations, space-weather platforms, and communications relays in non-Keplerian lunar/cislunar orbits. Secondary commercial markets include satellite operators seeking to extend orbital longevity, deep-space exploration probes, wearables, and adaptive optics.

Duration: 6

Proposal Details

Proposal Number: GO.3.S26B-0671
Subtopic Title: Advanced Momentum Management and Propellantless Control Technologies for Solar Sail Spacecraft
Proposal Title: Boom-Actuated Morphing Sail System

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):

Opterus Research & Development proposes the Boom Actuated Morphing Sail

System (BAMSS)â€”a propellant less momentum management technology that enables precise, long duration attitude control for large solar sail spacecraft. BAMSS uses individually deployable and retractable High Strain Composite (HSC) booms to dynamically reshape the sail in real time, achieving torque minimizing geometries predicted through advanced finite element modeling and analytical SRP response tools. By trimming disturbance torques at their source, the system reduces or eliminates reliance on mass translators, reaction wheels, and propellant based desaturation, addressing a critical challenge for future NASA solar sail missions that must maintain stable pointing under continuous solar radiation pressure. Phase I funds will be used to develop high fidelity FEM based sail shape prediction models; evaluate control authority through analyses of SRP induced deformations, thermal effects, and manufacturing imperfections; and perform benchtop proof of concept demonstrations correlating analytical predictions with physical behavior. These efforts will establish feasibility, validate controllability, and define requirements for a flight like prototype in Phase II. Target markets include NASA missions requiring propellant less propulsion and long duration attitude control, such as heliophysics observatories, solar weather sentinels, deep space precursor missions, and non Keplerian orbits. Additional applications include national security spacecraft, reflective membrane systems, drag sail platforms, and commercial or academic small satellite solar sails. BAMSS offers a scalable, high authority, consumable free control architecture that enhances mission longevity and expands the operational envelope of future sailcraft.

Duration: 6

Proposal Details

Proposal Number: INSITU.1.S26B-0003
Subtopic Title: Fault Management Technologies for Autonomous Systems
Proposal Title: DISCERNS-FM: Distinguishing Internal, Sensor, Control, Environmental, and Runtime Nonconformances for Spacecraft Fault Management

Small Business Concern

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

Summary Details

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

Robust spacecraft fault management (FM) must address more than hardware failures. It must also account for failed sensors or corrupted sensor-data flow, harmful or unexpected interactions with the environment, software faults, incorrect control inputs, and failure of autonomy components themselves. QSI proposes DISCERNS-FM, a focused enhancement to QSIâ€™s TEAMSÂ® fault modeling, analysis, and runtime diagnostics toolset where the proposed innovation is a model-based fault-discrimination framework that distinguishes between the different causes of degraded component performance and distinguishes between internal component failure and degradation with the external causes as mentioned. The Phase I effort will define novel causal modeling constructs, diagnostic logic, AI evidence interfaces, and proof-of-concept scenarios showing how DISCERNS-FM distinguishes internal failures from sensor faults, bad inputs, and environment-driven effects. The target customers that include NASA and commercial space industry benefits directly with the adoption of the proposed technology through increasing spacecraft resilience, increasing onboard fault estimation and response capability, reducing science interruptions, improving FM design completeness, decreasing FM model and test development effort, improving visualization of FM across hardware/software/operations, and clarifying residual risk from incomplete coverage.

Duration: 6

Proposal Details

Proposal Number: INSITU.1.S26B-0607
Subtopic Title: Fault Management Technologies for Autonomous Systems
Proposal Title: Software for Anomaly and Failure In-The-Loop Reasoning and Evaluation

Small Business Concern

Firm: Stottler Henke Associates, Inc.
Address: 1650 South Amphlett Blvd., San Mateo, CA, 94402-2516

Summary Details

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

FM is vital for space missions, given the high exposure to difficult environments (e.g., corrosive dust, extreme temperature, radiation) and very low tolerance for failure. A flexible, effective, time-efficient, and cost-effective FM system would save mission objectives; reduce costs, time taken, and uncertainty for NASA missions; and enable more robust FM and improve alignment of FM planning with mission risk profiles. We propose Software for Anomaly and Failure In-The-Loop Reasoning and Evaluation (SAFIRE), which leverages substantial previous NASA investment in mature technologies and weaves these technologies into a generalized customizable widely deployable FM framework. SAFIRE consists of an FM architecture; a software framework which implements the architecture; a components library which includes fundamental building blocks to be reused and built upon within the framework; and a tool suite to facilitate the development, modification, use, and reuse of existing and new SAFIRE components. SAFIRE is designed for engineers to â€œplugâ€ into software systems already in use by NASA and will significantly reduce the labor and time required to develop and test FM systems. To prove the generalizability of our approach, in Phase I we will demonstrate SAFIRE on simulated versions of our subcontractor Astroboticâ€™s LunaGrid (a lunar power grid) and CubeRover. Despite advancements in capabilities in fault management techniques, real-time and onboard implementation of the fault detection models remains an active area of research. SAFIRE will advance the state of the art in this area by providing a powerful low-SWaP AI/ML fault detection and diagnosis algorithm which hybridizes model-based and model-free approaches. In addition, cutting-edge research has yet to be unified into a reusable software framework that software developers can easily apply and customize to their own systems, a problem which SAFIRE addresses.

Duration: 6

Proposal Details

Proposal Number: INSITU.1.S26B-0921
Subtopic Title: Fault Management Technologies for Autonomous Systems
Proposal Title: Manifest: Compiled Probabilistic Fault Reasoning Across Spacecraft Subsystems

Small Business Concern

Firm: PiLogic, Inc.
Address: 531 Magellan Rd, Arcadia, CA, 91007-6439

Summary Details

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

Manifest is a compiled exact-AI inference engine for spacecraft fault management. The engineer describes the spacecraft as components, connections, sensors, and prior failure rates in a JSON specification, about a day of work. The PiLogic Manager builds a Bayesian network from that specification and compiles it offline into an Arithmetic Circuit. Onboard, two passes over the circuit (addition and multiplication only, on a fixed data structure) compute calibrated posteriors over every modeled component health state. The runtime uses no GPU, performs no dynamic memory allocation, executes in single-digit milliseconds on a single CPU core, occupies under 10 MB of RAM, and compiles to under 100 KB of code. Phase I funding exercises Manifest as a general-purpose FM capability across three subsystems: electrical power, attitude control, and thermal management. Each network carries a residual hypothesis class so posterior mass unassigned to any modeled fault triggers a calibrated unknown-fault alert. Two paired-subsystem propagation scenarios measure cross-subsystem localization accuracy. Funding also formalizes the JSON specification schema, an automated test-case generator, per-subsystem fault coverage reports, and the preliminary performance model governing Phase II prototype evaluation. Target markets include NASA smallsat constellations, Artemis CLPS payloads, and Mars Campaign Office Earth-Independent Operations missions; United States Space Force, SDA, and AFRL programs; and commercial Earth observation, satellite communications, and in-space servicing operators. Active commercial engagements include Starcloud (in-orbit on Starcloud-1 at about 0.1 ms per inference), Astranis (EPS and thermal runaway diagnostics testing), Novi Space (Lime in-orbit planned during Phase I), and Golden Dome awardees in conversation. Onboard-diagnostics aerospace TAM is about $5 billion per year.

Duration: 6

Proposal Details

Proposal Number: INSITU.2.S26B-0731
Subtopic Title: Sample Handling, Processing, and Control for In-Situ Lunar and

Planetary Science Instruments
Proposal Title: TRACE: Traceable Ruggedized Automated Chemistry Engine

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

The Traceable Ruggedized Automated Chemistry Engine (TRACE) serves as a programmable wet-chemistry front end for planetary science instruments, automating sample preparation and handling prior to analysis. Unlike current in-situ fluidics limited to single-step glass ampules or polymer manifolds incompatible with aggressive reagents, TRACE enables programmable, multi-step sample preparation. Utilizing a monolithic DMLS-printed metal manifold, with custom ruggedized rotary valves and syringe pumps, TRACE is elastomer-free, vacuum-rated, and autoclavable to +121Â°C to meet strict planetary protection and contamination control requirements. It performs complex sequences â€" extraction, sequential mixing, and derivatization â€" using harsh solvents, strong acids, and fluorinated reagents without degradation or vacuum permeation loss over multi-year transits. Phase I funding will de-risk critical mechanical and fluidic sub-assemblies. Objectives include: 1) Characterizing liquid-sealing performance of a space-rated thermoplastic-on-metal rotary valve interface across the survival thermal range (-40CÂ° to +121CÂ°); 2) Demonstrating He-leak-tight vacuum integrity on a simplified, HIP-densified DMLS manifold test article using metallic face-seal O-rings; 3) Developing a preliminary design and material selection for the syringe pump; and 4) Delivering a Phase II build-and-qualify plan, CONOPS, and architecture centered on EDC/NHS fatty-acid derivatization. Target markets span federal and commercial sectors. Near-term NASA infusion targets include Artemis surface payloads, CLPS instruments, and the Mars Life Explorer concept. Terrestrially, TRACE's primary commercial target is the $460M automated radiosynthesis module market (9.8% CAGR to 2035), where ionizing radiation and aggressive solvents degrade polymer fluidics in hot cells. A secondary OEM licensing track targets rugged analytical instruments for biodefense, semiconductor manufacturing, and other extreme-environments.

Duration: 6

Proposal Details

Proposal Number: INSITU.2.S26B-0822
Subtopic Title: Sample Handling, Processing, and Control for In-Situ Lunar and Planetary Science Instruments
Proposal Title: Non-Ejective Intake Bit (NIB): A Dual-Stage Sealed Architecture for Contamination-Controlled Lunar and Planetary Regolith Sample Handling

Small Business Concern

Firm: Torres Orbital Mining Inc
Address: 4200 San Jacinto St, Houston, TX, 77004-4853

Summary Details

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

The Non-Ejective Intake Bit (NIB) is a dual-stage sealed regolith acquisition and conveyance module designed to acquire and transfer lunar regolith to an analytical instrument interface within a continuously enclosed, contamination-controlled pathway. Conventional in-situ sample handling follows an open-path architecture in which acquisition, transfer, and delivery occur as separated operations, introducing potential contamination exposure at each transition. The NIB proposes an alternative: acquire, contain, and convey simultaneously within a sealed pathway beginning at the point of surface contact. Stage 1 employs rotating blades at a 4Â° attack angle and 8â€“12 RPM â€” parameters selected to minimize kinetic energy imparted to regolith particles and preferentially displace material inward rather than produce outward ejecta. Stage 2 conveys displaced material through a fully enclosed auger to a sealed storage chamber, maintaining sample integrity through instrument handoff. Phase I funding ($225,000, 6 months) will experimentally evaluate this architecture under lunar-relevant conditions using JSC-1A simulant. Five objectives address: (1) ejecta characterization under vacuum (â‰¤10â»Â´ torr); (2) sealed conveyance path integrity and sample condition at delivery; (3) passive grain-size stratification across fine/medium/coarse fractions; (4) thermal cycling seal integrity across lunar operational temperature range; and (5) instrument interface specification and Phase II development framework. Primary target market is NASA Artemis and CLPS surface science instrumentation requiring contamination-controlled sample acquisition. Secondary markets include terrestrial hazardous bulk-material handling environments where respirable particulate exposure reduction is operationally required. TOM is an ESRIC Space Resources Programme Cohort 6 company incubated at Greentown Labs, Houston, TX.

Duration: 6

Proposal Details

Proposal Number: INSITU.2.S26B-1087
Subtopic Title: Sample Handling, Processing, and Control for In-Situ Lunar and Planetary Science Instruments
Proposal Title: Iris Core Cutter and Retention Mechanism for Stratigraphy-Preservation

Small Business Concern

Firm: Unleashed Robotics, Inc.
Address: 4701 88th Ave NW, Gig Harbor, WA, 98335-6181

Summary Details

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

Unleashed Robotics is developing the iris core cutter, an actively actuated downhole core closure mechanism that recovers intact, depth-stratified cores from a planetary borehole. No existing sample handling system delivers this capability. Mars 2020 SCS acquires 13 mm cores from 7 cm depth (Moeller et al., 2021). DrACO delivers pneumatic cuttings from 2 cm, destroying stratigraphic order (Zacny et al., 2020). CryoSADS transports bulk particulate with no core integrity. Surface scoops provide no depth data. NASA OIG found SCS was the largest schedule risk and most complex new development component on Mars 2020 (IG-17-009, 2017). The iris cutter captures a core at the cutting face inside the borehole, retains it through ascent, and delivers it to the surface with depositional order intact. Closure uses the existing drill drivetrain through an electromagnetically braked planetary gear; a Hall sensor confirms closure state. Phase I funding supports four sequential activities at the Gig Harbor outdoor test setup with CSM low-density concrete simulant: (1) fabricate the Phase I EDU and measure closure torque, retention force, release kinematics, and 100-cycle endurance; (2) test stratigraphy preservation in layered simulant at five depths (25, 50, 100, 150, 200 cm) with colored sand markers; (3) ascent simulation under a 600-second load profile at nominal, 1.5x, and 2x amplitudes; (4) derive a Functional Requirements Document with quantitative SOA

comparison against SCS, DrACO, CryoSADS, and surface scoops. The proposal advances the iris cutter from TRL 2 to TRL 3 as a sample handling mechanism. Target markets span NASA Mars and lunar in-situ sampling, terrestrial mineral exploration coring where stratigraphic integrity drives assay accuracy, environmental site characterization, and polar ice coring for NSF Antarctic and Greenland operations.

Duration: 6

Proposal Details

Proposal Number: INSITU.3.S26B-0453
Subtopic Title: Robotic Mobility, Manipulation, and Sampling
Proposal Title: Heaterless Rotary Actuator for Deep Space Exploration

Small Business Concern

Firm: Apech Labs
Address: 1576 Sweet Home Rd, Buffalo, NY, 14228-2710

Summary Details

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

Apech Labs is offering NASA CryoARC (Cryogenic Actuator, Rotary Control), a cryogenic-ready, dust-tolerant, heaterless rotary actuator family that supports lunar and Martian surface mobility as well as deep space exploration. CryoARC builds off of Apech Labsâ€™ experience developing lunar surface ready linear actuation and other environmentally-hardened mechanisms. CryoARC extreme operating temperature range is enabled by a hybrid ceramic epicycloidal drive and dedicated design elements and tribological choices that enable low or lubrication-free operation. The full 360Âº rotation actuator design allows for convenient signal transfer through the rotary joint with a low-profile integral slip ring. Designed to be a family of actuators extensible to different use cases, CryoARC will offer a variety of motor, gear ratio, and output size options that can be optimized for torque, speed, or output resolution. The CryoARC family is radiation tolerant and will be designed with regolith hardening features such as labyrinth seals. Apech Labs is a small

business with extensive experience in complex aerospace product development, including a Technology Readiness Level (TRL) 7 Regolith Immune Linear Actuator Family that enables linear actuation throughout the lunar night. We will bring these capabilities to bear to provide the best possible offering to NASA on Phase I by maturing the design and breadboarding key elements, effectively raising the technology readiness to level 4. We have secured interest from a heritage aerospace manufacturer to provide additional insight and as a potential commercialization partner.

Duration: 6

Proposal Details

Proposal Number: INSITU.3.S26B-0488
Subtopic Title: Robotic Mobility, Manipulation, and Sampling
Proposal Title: REDIRTS (REgolith Direct Robotic Tube Sampling)

Small Business Concern

Firm: Jensen Dynamics LLC
Address: 1921 Adams Rd, Owingsville, KY, 40360-8071

Summary Details

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

In Response to the NASA SBIR_26P_P1 Solicitation for proposals on the topic INSITU.2.S26B (Sample Handling, Processing, and Control for In-Situ Lunar and Planetary Science Instruments), we propose to develop REDIRTS (REgolith DIrect Robotic Tube Sampling), a device that could be deployed robotically for direct collection of individual Moon or Mars soil samples into a core tube sampling device itself. No plumbing of any kind, where sticking or clogging could occur, would be necessary. The tube itself could be used not only as a means of delivery of a sample of controlled size and position to another location within reach of a robotic arm, but could also be sealed on the bottom and used as a controlled experimental chamber for in situ testing. The core tube device is based on the principle successfully applied in manual core tube regolith sampling (no drill involved) to shallow depths

by the Apollo astronauts.

Duration: 6

Proposal Details

Proposal Number: INSITU.3.S26B-1090
Subtopic Title: Robotic Mobility, Manipulation, and Sampling
Proposal Title: LunaNet - RoboLink 5G/NTN-Enabled Robotic Manipulation and Autonomous Surface Operations for Lunar and Planetary Exploration

Small Business Concern

Firm: Albatross LLC
Address: 616 Owens Street, Blacksburg, VA, 24060-7223

Summary Details

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

Future NASA Artemis and Moon-to-Mars missions will require autonomous robotic systems capable of operating reliably in harsh lunar and planetary environments with minimal human intervention. Existing robotic exploration architectures rely on point-to-point communications, limited mobility coordination, and operator-supervised control frameworks that are fundamentally insufficient for the scalable, persistent multi-agent operations these missions demand. This proposal introduces LunaNet-RoboLink, a 5G/NTN-enabled robotic communications and manipulation framework designed to support autonomous robotic operations, distributed robotic coordination, teleoperation, edge-assisted autonomy, and intelligent mobility management for lunar and planetary exploration. The system integrates: â€¢ Private 5G cellular networking adapted for lunar surface deployment â€¢ Software-defined radio (SDR) infrastructure providing reconfigurable wireless interfaces â€¢ NTN-compatible communications per 3GPP Release 17/18/19/20 â€¢ Robotic teleoperation with sub-100 ms closed-loop latency â€¢ Intelligent multi-access edge computing for autonomous robotic coordination â€¢ Mission-aware adaptive QoS management and AI-assisted scheduling The proposed Phase I effort directly addresses NASA SBIR subtopic INSITU.3.S26B: Robotic Mobility, Manipulation,

and Sampling, and the critical capability gaps identified in the Planetary Science Decadal Survey 2023â€“2032 and the 2026 Civil Space Shortfalls. Phase I will deliver a private 5G cellular system architecture, a functional 5G robotic networking testbed, a wireless robotic teleoperation demonstration, lunar propagation models, and a detailed Phase II roadmap targeting TRL 4.

Duration: 6

Proposal Details

Proposal Number: INSITU.4.S26B-0197
Subtopic Title: Variable Gravity Sample Preparation and Analysis
Proposal Title: In-Situ Compositional Analysis of Space-Grown Plant Tissue Using Autonomous Mid-Infrared Chemometrics

Small Business Concern

Firm: Realize Ascent Labs LLC
Address: 645 Meeting St, Charleston, SC, 29403-4279

Summary Details

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

Realize Ascent Labs proposes to demonstrate feasibility of deploying an autonomous FT-MIR chemometric analytical pipeline on embedded, space-appropriate compute hardware for in-situ compositional analysis of space-grown plant tissue. Phase I funding will be used to: (1) develop and validate an autonomous chemometric pipeline on low-power embedded hardware with a crew-facing graphical user interface, validated equivalent to the desktop reference system; (2) complete a full size, weight, and power characterization with a compliant duty-cycle protocol; (3) develop a validated leafy green FT-MIR calibration dataset for three to four priority nutritional traits with ATR vs. DialPath sample interface evaluation; and (4) produce a Phase II hardware integration roadmap. The target market is NASA biological and physical sciences research programs requiring in-situ crop compositional analysis capability for ISS, Commercial LEO Destinations, and future lunar habitat plant production systems.

Secondary markets include commercial controlled environment agriculture operators requiring rapid, reagent-free nutritional verification for QA/QC and labeling substantiation. These results establish the foundation for a Phase II instrument enabling iterative in-situ space biology research on how variable gravity and exploration atmospheres affect plant tissue composition, directly supporting the BLiSS campaign recommended by the 2023 BPS Decadal Survey.

Duration: 6

Proposal Details

Proposal Number: INSITU.4.S26B-0328
Subtopic Title: Variable Gravity Sample Preparation and Analysis
Proposal Title: Gravity-Independent Single-Molecule Multi-Omic Sequencing

Small Business Concern

Firm: XGenomes Corp
Address: 750 Main St, Cambridge, MA, 02139-3544

Summary Details

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

XGenomes Corp. is developing a gravity-independent, single-molecule multi-omic sequencing platform for use in space-based biological research. The technology leverages Sequencing by Hybridization (SbH) via the transient, repetitive binding of fluorescently labeled 5-mer oligonucleotide probes to immobilized single-stranded DNA, imaged by super-resolution TIRF microscopy. This approach achieves >Q50 base-call accuracy, surpassing the space state-of-the-art, while enabling detection of sequence variants at <0.1% variant allele fraction in cell-free DNA (cfDNA). Phase I funding will be used to: (1) replace existing vacuum-pull fluidics with a gravity-independent positive-displacement system that eliminates the bubble formation vulnerabilities documented during ISS operations of competing technologies; and (2) design and validate a TP53 cfDNA mutation probe panel targeting the six hotspot mutations most frequently induced by space radiation in astronauts, demonstrating end-to-end sequencing at â‰¤0.1% VAF. The platform addresses

two target markets. The near-term market is NASA and commercial spaceflight operators requiring on-orbit nucleic acid sequencing for astronaut health monitoring, microbial surveillance, and space biology research. The larger long-term market is terrestrial clinical oncology liquid biopsy diagnostics, where the platform's single-molecule accuracy and compact form factor address unmet needs in point-of-care cfDNA testing.

Duration: 6

Proposal Details

Proposal Number: INSITU.4.S26B-0586
Subtopic Title: Variable Gravity Sample Preparation and Analysis
Proposal Title: Air-film cassette for gravity-independent life science sample preparation and analysis

Small Business Concern

Firm: Aloft Biotechnologies
Address: 12085 Research Dr., Alachua, FL, 32615-6837

Summary Details

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

Aloft Biotechnologies proposes Float-Layer, a gravity-independent biological sample processing and fluid stabilization technology designed to enable modular, autonomous-compatible life sciences experimentation in variable gravity environments. The proposed Phase I effort directly addresses NASA SBIR topic INSITU.4.S26B by developing a compact biological processing architecture capable of stable gas exchange, low-shear culture maintenance, and integrated analytical compatibility under simulated microgravity conditions. Current space biology systems are limited by unstable fluid behavior, bubble formation, and gravity-dependent fluid handling, which constrain reproducibility and hinder future crew-independent experimentation. Float-Layer addresses these limitations through a passive air-film fluid management architecture that stabilizes multiphase biological fluids and enables oxygen transfer without active sparging or mechanical agitation.

Prior studies demonstrated enhanced oxygen transfer, bubble stripping capability, compatibility with standard laboratory analytics, and significantly improved Vibrio fischeri growth under simulated microgravity compared to conventional FEP culture bags. Phase I funding will support validation of Float-Layer at the Microgravity Simulation Support Facility (MSSF) at NASA Kennedy Space Center. Planned activities include oxygen transfer characterization, biological sample processing validation using V. fischeri suspension culture, planning of a modular autonomous-compatible payload architecture, and ISS-aligned containment validation with low size, weight, and power requirements. The technology is intended for future deployment on Commercial Low Earth Orbit Destinations, satellites, and lunar biological research platforms. Target markets include in-space pharmaceutical and biotechnology research, orbital biomanufacturing services, academic space biology research, and commercial space station infrastructure providers.

Duration: 6

Proposal Details

Proposal Number: INSITU.5.S26B-0301
Subtopic Title: Contamination Control and Planetary Protection
Proposal Title: Plume Contamination Module for Autonomous Proximity Operations

Small Business Concern

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

Summary Details

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

Spacecraft thrusters generate plumes that can deposit contaminants and erode sensitive surfaces, including solar arrays, instruments, and scientific payloads. These contaminants can degrade external surfaces, reduce instrument performance, and introduce operational risks during spacecraft proximity operations. Current plume contamination assessments rely on computationally intensive pre-flight

analysis cycles that require months of iterative design and cannot support real-time operations or autonomous decision making. As missions become increasingly complex and autonomous, there is a growing need for integrated real-time contamination assessment capabilities. To address this gap, Rarefied Studios has proposed a real-time plume contamination module for proximity operations designed for integration with flight software. This capability will extend the existing Spacecraft Plume Impingement in Rarefied Environments (SPIRE) platform with physics-based contamination modeling optimized for dynamic operational environments. Phase I funding will support the development of contamination models, performance optimization, and demonstration of real-time contamination analysis during proximity operations. Target applications include space station design and operation, satellite servicing, autonomous flight, and deep space exploration missions.

Duration: 6

Proposal Details

Proposal Number: INSITU.5.S26B-0497
Subtopic Title: Contamination Control and Planetary Protection
Proposal Title: Automated Sample Containment and Enrichment for Nanopore sequencing using TRAPs (ASCENT)

Small Business Concern

Firm: ChromoLogic LLC
Address: 1225 S Shamrock Ave, Monrovia, CA, 91016-4244

Summary Details

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

NASA planetary protection and contamination-control missions require rapid, reproducible detection of low-biomass microbial DNA from spacecraft, cleanroom, habitat, and returned-sample environments. Although nanopore sequencing has been demonstrated aboard the ISS, upstream sample preparation and library preparation remain manual, contamination-sensitive, operator-dependent, and poorly suited for

microgravity or spacecraft-relevant workflows. ChromoLogic proposes ASCENT (Automated Sample Containment and Enrichment for Nanopore sequencing using TRAPs): a closed, automated, cassette-based sample-to-library preparation system for low-biomass metagenomic analysis. As a core technology, ASCENT employs thermally responsive alkane partitions (TRAPs), pseudo-valves that allow for automation of sample and reagent manipulation through heat actuation. By integrating TRAPs with magnetic bead-based nucleic acid capture, isothermal DNA amplification, and MinION-compatible library preparation in a sealed disposable cassette, this architecture eliminates pumps, valves, centrifugation, and repeated manual pipetting, thereby reducing crew time, workflow variability, and contamination risk. Phase I will establish feasibility by designing and fabricating multi-TRAP cassettes, demonstrating low-input DNA extraction and cleanup, generating MinION-compatible libraries from ASCENT-processed DNA, quantifying reagent background, carryover, cross-contamination, workflow reproducibility, and evaluating microgravity-relevant risks. Once completed, ASCENT will provide NASA with a compact front-end automation module for nanopore sequencing that can support spacecraft biological cleanliness monitoring, ISS and future habitat microbial surveillance, sample return containment verification, and planetary protection assessments. The same platform could also support commercial applications in pharmaceutical cleanroom monitoring, bioburden investigations, field-forward bio-surveillance, and decentralize

Duration: 6

Proposal Details

Proposal Number: INSITU.5.S26B-0827
Subtopic Title: Contamination Control and Planetary Protection
Proposal Title: Hydrogel-Based Bioaerosol Collection Cartridge for In-Space Environmental Monitoring

Small Business Concern

Firm: AI Biosciences, Inc.
Address: 1902 Pinon Dr, College Station, TX, 77845-7458

Summary Details

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

Studying bioaerosols aboard the International Space Station is important because airborne microorganisms can affect astronaut health, spacecraft systems, and the success of long-duration space missions. In the microgravity environment of the ISS, airborne particles do not settle normally as they do on Earth. Environmental Control and Life Support Systems (ECLSS), and other flight hardware are at risk without having the capability of monitoring the abundance and richness associated with microbial assemblages. In this Phase I proposal, we aim to develop a novel and effective bioaerosol sampling method using super-absorbent polymer (SAP) beads. We leverage the â€œstickyâ€ property of SAPs to capture bioaerosols for downstream analysis. We believe the gelâ€™s moist surface will effectively collect bioaerosols on the hydrogelâ€™s outer surface. The hydrogel can function like a sponge, removing and collecting materials from the air. Different bead sizes provide varied surface areas and spaces for bioaerosol capture. The hydrogelâ€™s high water content allows extended use of the HBCC for sampling over days. These beads enable efficient capture of airborne pathogens, and collected samples can be readily eluted as liquid for downstream analysis using traditional culture methods, PCR, or sequencing. When paired with a portable PCR or LAMP-based real-time detector, this system enables specific, targeted on-site pathogen detection. Furthermore, integration with sequencing and microbiome profiling approaches transforms the platform into a powerful tool for airborne pathogen exposure assessment and transmission monitoring. Phase I Team. Space Fluidics expert Mark Weislogel (IRPI, LLC) will assist us in developing the HBCC for space use. Professor Chris E. Mason, who helped with the NASA Twin Studies, will evaluate the HBCC and assist with sequencing analysis. Professor Hannah Barbian, a genomic epidemiologist, will serve as our consultant.

Duration: 6

Proposal Details

Proposal Number: INSITU.6.S26B-0309
Subtopic Title: Plant Research Technologies for Space
Proposal Title: Directed-Energy Seed Priming for Uniform Germination and Enhanced Early Seedling Vigor in Space Controlled-Environment Agriculture

Small Business Concern

Firm: Global Neighbor Inc
Address: 1091 Star Valley Ct, Dayton, OH, 45458-9281

Summary Details

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

Global Neighbor Inc. (GNI) proposes to adapt Directed Energy Seed Priming (DESP) into a compact, non-chemical seed preconditioning and early crop-stand assessment approach for space controlled-environment agriculture. The Phase I effort will evaluate the ability of DESP to improve lettuce germination reliability, reduce emergence variability, and support vigorous early seedling establishment during a 21-day growth window in a controlled plant-habitat testbed. This work addresses NASAâ€™s need for reliable crop stands in future lunar and Martian plant production systems, where limited crew time, constrained volume, finite water and nutrient resources, and restricted replanting opportunities make early establishment a mission-relevant reliability challenge. GNI will design a habitat-compatible benchtop DESP treatment architecture, test DESP-treated lettuce under controlled plant-habitat conditions, and define a Phase II path for exploration-atmosphere and plant-habitat integration. If successful, the technology has the potential reduce crop-establishment risk for NASA space crop production while also supporting terrestrial controlled-environment agriculture, seed testing, propagation, and seed enhancement markets.

Duration: 6

Proposal Details

Proposal Number: INSITU.6.S26B-0535
Subtopic Title: Plant Research Technologies for Space
Proposal Title: Crop Habitat Automation and Robotic Monitoring System (CHARMS)

Small Business Concern

Firm: Space Kentucky LLC

Address: 9711 Secretariat Drive, Louisville, KY, 40214-6527

Summary Details

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

The Crop Habitat Automation and Robotic Monitoring System (CHARMS) is a self-contained, automated subsystem designed for small space plant habitats to optimize crop stand establishment. Traditional space agriculture relies on crew-intensive "plant pillows" that lack physical flexibility and are prone to seed placement errors. These risks are compounded under NASA's Exploration Atmosphere (56.5 kPa hypobaria, 34% O2), where rapid evaporation and altered fluid capillary action can cause root hypoxia or desiccation. To address this, CHARMS replaces static media with an active mechatronic and sensing architecture. To mitigate schedule risk during the 6-month Phase I program, Space Kentucky LLC will isolate engineering uncertainties into three independent Proof-of-Concept breadboards managed by the PI and a Space Agronomy Consultant. Prototype 1 evaluates a surface-mount technology (SMT) inspired pneumatic toolhead and mechanical punch that indexes a Hybrid Seeding Tape reel to cleanly shear and embed plugs within a +/-1.0 mm depth tolerance while protecting the fragile radicle. Prototype 2 operates inside a laboratory vacuum chamber at 56.5 kPa to validate an enclosed fan-sponge loop capable of adding moisture while deploying an air shroud to keep adjacent optics free of condensation. Prototype 3 establishes a smart crop bed utilizing multi-spectral grow lights and automated capillary irrigation to support 21-day baseline trials of salad crops, tracking canopy health via top-down visible and thermal cameras. Feasibility will be verified via a comprehensive data package and a comprehensive Virtual Demonstration delivered to NASA technical monitors. CHARMS directly aligns with NASA goals for Artemis and ISS habitats, while providing terrestrial value for vertical farming automation.

Duration: 6

Proposal Details

Proposal Number: INSTALG.3.S26B-0430
Subtopic Title: Large-Scale Computing and Computational AI
Proposal Title: SALT Agent: A Local, Sandboxed Environment for Application Porting and Tuning

Small Business Concern

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

Summary Details

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

SALT Agent is a secure, self-hosted AI agent harness for semi-automated porting and refactoring of HPC applications to new parallel runtimes, languages, and accelerators. It is designed to run entirely inside restricted environments such as the NASA High-End Computing enclave, with no source code, prompts, or runtime data leaving the customer network. Its key innovation is the combination of an in-enclave coding agent with an HPC-domain context layer that grounds suggestions in SALT-FM/TAU profiling and curated system documentation. Phase I funding will support a proof-of-concept implementation and feasibility testing on network-isolated HPC systems. The work will evaluate local open-weights models and open-source agent harnesses, integrate source-level instrumentation and performance profiling, prototype retrieval-augmented access to HPC runtime and tuning knowledge, and exercise the integrated workflow on a representative porting task. Deliverables include a feasibility report, reproducible deployment artifacts, and a Phase II path toward a hardened prototype. SALT Agent is intended to reduce the time and cost of modernizing large scientific codes while preserving security and data sovereignty. It is especially relevant for organizations that cannot use cloud-based AI tools because of proprietary, export-controlled, or otherwise sensitive source code. Target markets include NASA mission teams and HEC centers, Department of Energy laboratories, national security laboratories, university HPC centers, and industrial R&D groups that maintain complex mixed-language applications and require secure AI-assisted software modernization.

Duration: 6

Proposal Details

Proposal Number: INSTALG.3.S26B-0928
Subtopic Title: Large-Scale Computing and Computational AI
Proposal Title: Local HPC Code Refactoring using Secure Small Language Models

(LOCUS-SLM)

Small Business Concern

Firm: Phase III Physics LLC
Address: 1839 S MAIN ST, LOS ANGELES, CA, 90015-3637

Summary Details

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

Phase III Physics (P3P) proposes LOCUS-SLM (Local HPC Code Refactoring using Secure Small Language Models), a secure, locally deployable Small Language Model workbench for verified parallelization of NASA scientific HPC codes. The system combines a locally hosted code SLM with classical program analysis and a multi-stage verification harness that automatically checks every generated patch for correctness and performance before acceptance. This neuro-symbolic, verification-gated architecture enables AI-assisted code modernization behind the firewall, where cloud-hosted assistants (Copilot, hosted GPT) cannot be used. A preliminary prototype on a curated set of NASA-relevant kernels has demonstrated end-to-end feasibility, recovering verified parallel code with multi-thread speedups approaching expert-written references. Phase-I funding will be used to expand the kernel benchmark across multiple scientific-computing domains in both C/C++ and Fortran, mature the LOCUS-SLM pipeline components, and benchmark the full workflow against published HPC code models and classical autoparallelizer baselines. Target markets are NASA HECC, CISTO, and CCMC, DOE national laboratories, DoD HPC environments, and industrial CAE/CFD users whose proprietary or sensitive source code must remain inside the enterprise boundary.

Duration: 6

Proposal Details

Proposal Number: INSTALG.4.S26B-0532
Subtopic Title: Detectors and Integrated Electronics
Proposal Title: Quantum Rydberg-Atom Field Transducer

Small Business Concern

Firm: Opto-Atomics Corp.
Address: 1891 N Gaffey St, San Pedro, CA, 90731-1270

Summary Details

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

Opto-Atomics Corp. proposes to develop the Quantum Rydberg-Atom Field Transducer (QRAFT), a room-temperature atomic receiver concept for terahertz (THz) detection in NASA Earth science applications. QRAFT addresses the need for compact, scalable receivers with competitive noise performance in the 500â€“1,200 GHz range, where molecular transitions and atmospheric windows support measurements of atmospheric composition, hydrology, cloud ice, upper-atmospheric chemistry, and climate-related radiometry. Existing receiver approaches often rely on cryogenic detectors or mixers, complex local-oscillator chains, or narrowband room-temperature Schottky front ends that constrain size, weight, power, cost, spectral agility, and array scalability. QRAFT uses a room-temperature alkali vapor cell as an optically read atomic field transducer. Incident THz radiation couples to selected Rydberg atomic transitions, producing a measurable optical response that can encode the amplitude, frequency, phase, or modulation of the incoming field. By selecting atomic species, optical excitation pathways, and Rydberg-state manifolds, QRAFT can be engineered for targeted spectral coverage while preserving an atomically referenced receiver response. Phase I will establish feasibility by identifying optimized spectral operating regions, modeling sensitivity and receiver noise, and demonstrating representative in-band atomic response and optical readout. The effort will define a path toward compact, room-temperature, frequency-agile receiver pixels for future NASA THz instruments and array architectures.

Duration: 6

Proposal Details

Proposal Number: INSTALG.4.S26B-0798
Subtopic Title: Detectors and Integrated Electronics
Proposal Title: Cryogenic Material Characterization Testbed for Very Large Format Infrared Detector Arrays

Small Business Concern

Firm: 8D Photonics, LLC
Address: 4901 Taurus Rd. NE, Rio Rancho, NM, 87144-6815

Summary Details

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

8D Photonics proposes to develop and validate a cryogenic material characterization testbed for very large format infrared detector arrays. The Phase I effort will extend 8Dâ€™s time-resolved microwave reflectance (TMR) technology beyond minority carrier lifetime screening toward calibrated wavelength-dependent absorption-coefficient measurement of infrared detector materials. With proper calibration and known material thickness, the method is intended to quantify absorption onset, provide wavelength-dependent absorption-coefficient information, and establish an upper bound on absorber-limited quantum efficiency before device fabrication. NASA Phase I funding will support measurement R&D, calibration-method development, signal-to-noise and mapping-feasibility assessment, representative infrared material characterization, and modification of an 8D IR Pioneer mini system for NASA evaluation. The modified mini testbed will support 2-inch wafers, coupons, piece parts, and partially processed detector structures, with grease-free sample mounting, surface-temperature validation, and Class 4-compatible laser access. The target markets include NASA detector-development laboratories, NASA-supported detector-material suppliers, infrared focal plane array developers, defense and commercial infrared foundries, government laboratories, and university research groups requiring earlier cryogenic feedback on material quality, uniformity, absorption behavior, and detector-relevant performance.

Duration: 6

Proposal Details

Proposal Number: INSTALG.4.S26B-0864
Subtopic Title: Detectors and Integrated Electronics
Proposal Title: VERY LONGWAVE INFRARED SENSOR FOR FINDING AND TRACKING ASTEROIDS

Small Business Concern

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

Summary Details

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

Planet Earth lives in a dangerous neighborhood filled with asteroids some of which could collide with our planet and wreak havoc (like the one that wiped out the dinosaurs). So it's important to detect and track them, especially the small ones that are more common AND difficult to see because they are dark (they don't reflect sunlight like the moon does). These asteroids are ~ 200K or colder and therefore "glow/shine" at infrared wavelengths of 16 microns or longer by virtue of their intrinsic blackbody radiation. A sensor that can see this emission is one of the best ways to find and track these asteroids. A new infrared detector, called strained layer superlattices (SLS), has been developed by QmagiQ (via SBIRs) and others over the last decade, and is now commercially available in wavelengths upto ~ 13 microns. Extending this to 16 microns and beyond is challenging because of the extreme control of material parameters required, and due to the drop in quantum efficiency (QE) with increasing cutoff wavelength inherent in the physics of the SLS. Higher QE is needed for greater detection range. In Phase I, we will theoretically design detector material with cutoff greater than 16 microns, model its sensitivity to various material parameters, and investigate design aspects to boost quantum efficiency. The results will be applied in Phase II to fabricate the very longwave infrared (VLWIR) imaging focal plane arrays (FPAs), and to develop and deliver a compact camera to NASA for evaluation for this critical NASA mission.

Duration: 6

Proposal Details

Proposal Number: INSTALG.5.S26B-0461
Subtopic Title: Remote-Sensing Technologies
Proposal Title: Schottky Diode Switches for Radiometer Internal Calibration

Small Business Concern

Firm: Virginia Diodes, Inc
Address: 979 Second Street SE, Charlottesville, VA, 22902-5049

Summary Details

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

This proposal is responsive to NASA SBIR subtopic INSTALG.5.S26B: Remote-Sensing Technologies (SBIR) under the section Technologies for Passive Microwave Remote Sensing (SBIR) - 1/f Noise and Long-Term Stability Mitigation. The crux of the effort is the development of Schottky diode switching technology to enable internal calibration of radiometer systems in the frequency ranges of interest to NASA. The innovation pursued is the development of suitable waveguide switches to enable internal calibration at frequencies exceeding 100 GHz. This Phase 1 (P1) effort will focus on the development, demonstration, and evaluation of an innovative Dicke switch that incorporates two SPST Schottky diode switches and a hybrid coupler in a novel configuration. The initial P1 prototype will use discrete components and an existing diode design. The goal is to prove the feasibility of the novel switching concept to achieve performance suitable for internal calibration above 100 GHz. In P2 the designs for the diode and its embedding circuit will be fully optimized and the switch will be integrated into a single waveguide housing (see image). Also, given the availability of high-quality noise diodes and precision waveguide loads, the entire receiver system can be fully integrated into a compact waveguide module; ideal for SmallSat and CubeSat platforms. At the completion of the P2 program VDI envisions the development of reliable and highly integrated radiometer frontends with internal calibration that are suitable for NASA missions in atmospheric science, heliophysics, and weather monitoring. These systems will also be suitable for commercial weather monitoring using CubeSats and SmallSats.

Duration: 6

Proposal Details

Proposal Number: INSTALG.5.S26B-0886
Subtopic Title: Remote-Sensing Technologies
Proposal Title: 28 GHz Instantaneous-Bandwidth Spectrometer

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):

Pacific Microchip Corp. (PMCC) proposes to develop a 28 GHz instantaneous-bandwidth (IBW) spectrometer ASIC for compact NASA remote-sensing instruments. The Phase I effort will implement and validate an FPGA-based demonstration using PMCC's existing P26600A 8-bit, 56 GS/s ADC ASIC, developed under NASA Award No. 80NSSC25C0043, coupled to a Xilinx VCU118 Virtex UltraScale+ FPGA board through a new VITA 57.4 FMC+ evaluation card. The ADC digitizes the up to 28 GHz signal and outputs data through 20 silicon-proven PMCC high-speed JESD204B+ serial lanes at 28 Gb/s per lane. The FPGA will deserialize and align the lanes, implement a two-stage PFB/FFT spectrometer backend, and demonstrate 16,384 spectral channels, corresponding to approximately 1.71 MHz channel spacing across the full 28 GHz IBW. Phase I will quantify ADC bandwidth, jitter sensitivity, gain flatness, bandwidth mismatch, spectral leakage, channel isolation, amplitude flatness, spurious response, accumulation stability, FPGA power, and interface integrity using clean-tone and multi-tone tests. The results will define a Phase II monolithic ASIC that integrates the ADC, PFB/FFT processing, accumulation, clock synthesis, readout, calibration/control CPU, and radiation-aware control logic on one chip. The Phase II ASIC will eliminate the need to export the raw ADC payload data off chip, target <8 W total power (<0.3 W/GHz), use mature CMOS technology, target at least 1 Mrad(Si) TID tolerance with SEE mitigation, and reuse PMCC's spaceflight-proven HiTCE LTCC BGA package.

Duration: 6

Proposal Details

Proposal Number: INSTALG.5.S26B-0893
Subtopic Title: Remote-Sensing Technologies
Proposal Title: Rapidly-tunable Advanced Photonic Integrated Device LAser for Space Exploration Remote Sensing (RAPID-LASERS)

Small Business Concern

Firm: Analog Photonics, LLC
Address: 1 Marina Park Drive, Boston, MA, 02210-1873

Summary Details

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

Analog Photonics proposes the Rapidly-tunable Advanced Photonic Integrated Device LAser for Space Exploration Remote Sensing (RAPID-LASERS), a photonic integrated circuit tunable laser subsystem designed to meet the demanding requirements of next-generation NASA remote sensing instruments. Combining high-speed tuning with <1 Âµs random-access times, wavelength agility across 100 nm, â‰¥20 GHz mode-hop-free tuning, â‰¥2 mW optical output, and drawing on APâ€™s <50 kHz fundamental linewidth ITLA experience, RAPID-LASERS integrates high-speed modulation and a library of photonic components to provide a unified single tunable laser subsystem for remote sensing missions. Directly applicable to multiple NASA-relevant applications, this laser will be packaged as a standardized nano-ITLA package, optionally lightly-customized for specific missions. This compact and standardizable design provides revolutionary SWaP-C savings, enabling a solution that is a full compact remote-sensing subsystem in order to truly supports mission goals. In Phase I of RAPID-LASERS, the laser cavity will be fully modeled at all remaining edge conditions, and the PIC will be fully laid out with mission-useful photonic circuits included, ready for tapeout. The nano-ITLA package will be mechanically designed around this PIC. Target markets include NASA remote-sensing payload developers, Government defense markets in remote sensing, and commercial customers in the LiDAR market. AP will also offer the basic laser as a component in the AIM Photonics PDK, which AP maintains and develops.

Duration: 6

Proposal Details

Proposal Number: INSTALG.5.S26B-0895
Subtopic Title: Remote-Sensing Technologies
Proposal Title: Optical Phased-array Targeting with Integrated Coherent Apertures (OPTICA)

Small Business Concern

Firm: Analog Photonics, LLC
Address: 1 Marina Park Drive, Boston, MA, 02210-1873

Summary Details

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

The OPTICA module is a fully solid-state, coherent Optical Phased Array (OPA) LiDAR with high performance (300 meter ranging at 1.8 Mpt/s) in a low-volume-production-cost and compact form-factor (sub-1U), a wide field-of-view (100â° Ã— 25â° long-range or 150â° Ã— 90â° short-range), with excellent sunlight interference rejection and environmental resilience, ultimately leading to the lowest-weight and lowest-cost LiDAR option. The Phase I funding performs a system architecture study on how OPA LiDAR can be used for NASA's SmallSat, CubeSat, and UAV missions, and the module design is completed through the design of an FPGA System-on-Module for full software reconfigurability. Phase I concludes with a Phase II plan. During Phase II, the module is constructed and characterized for NASA's missions. Analog Photonicsâ€™ OPA LiDAR can underpin autonomous vehicles, robotics, aerospace, and industrial automation. Developing fabrication-ready, scalable OPA LiDAR is a critical sensing technology for future technology. In short, OPA LiDAR is how AI systems will sense the real world.

Duration: 6

Proposal Details

Proposal Number: INSTALG.5.S26B-0919
Subtopic Title: Remote-Sensing Technologies
Proposal Title: Bias-Insensitive Type II MUTC Photodiodes for 300 GHz Remote Sensing

Small Business Concern

Firm: Phase Sensitive Innovations Inc
Address: 116 Sandy Dr, Newark, DE, 19713-1187

Summary Details

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

The lack of commercial sub-THz photomixers continues to hinder the maturation of promising photonic technologies, including high data rate 6G analog/digital links, sub-THz imaging and spectroscopy, and integrated optical frequency combs. Available uni-traveling carrier (UTC) modules lack the reduced form factors and inline optical and RF connectors needed for dense systems integration, while their high- power performance falls significantly short of the 1 mW at 300 GHz benchmark set by NASA. To address this commercial development opportunity, Phase Sensitive Innovations (PSI), in collaboration with the University of Virginia (UVA), proposes the design, optimization, and demonstration of new bias-insensitive type-II GaAsSb/InP modified uni-traveling carrier (MUTC) photodiodes for remote sensing up to 300 GHz. The die-level innovation exploits a staggered type-II band alignment at the GaAsSb/InP heterojunction interface to provide a smooth conduction band, which eliminates localized carrier trapping and enables high-power, low-bias operation deep into the sub-THz spectrum. New ultra-wideband and banded photomixer modules will be developed based on the design, fabrication, and manufacturing resources provided by PSIâ€™s existing high-power DC-40 GHz MUTC production line and 110 GHz fast uni-traveling carrier (FUTC) prototype units. This program will provide an immediate pathway to the power, bandwidth, and size, weight, and power (SWaP) targets defined for a next-generation sub-THz photomixer for commercial and NASA applications.

Duration: 6

Proposal Details

Proposal Number: LAND.1.S26B-0492
Subtopic Title: Real-time Characterization of Regolith Stability during Planetary Descent & Landing
Proposal Title: Three-dimensional time-resolved characterization of ejecta particles and terrain mapping in Plume-Surface Interaction (PSI) events using advanced high-speed infrared imaging methods

Small Business Concern

Firm: MetroLaser, Inc.
Address: 22941 Mill Creek Drive, Laguna Hills, CA, 92653-1215

Summary Details

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

The physics of plume surface interactions (PSI) when a spacecraft performs an extraterrestrial surface landing involves producing soil erosion/cratering and high-speed ejecta which are fundamentally coupled. Relevant mitigation techniques require understanding the physics of PSI. More specifically, accurate 3D characterization of the crater profile, terrain topography and high-speed ejecta particles in terms of particle size distributions, trajectories and velocities is needed by NASA to assess mitigation measures and for benchmark validation of modeling and simulation (M&S) tools. The current state of experimental findings on PSI is scarce and in-situ diagnostics used to obtain data only provide two-dimensional information that are dependent on ambient light and visibility conditions making measurements difficult close to touchdown. Therefore, we propose to examine the feasibility of high-speed, infrared-based stereoscopic, indirect time-of-flight and digital holography (DH) systems in providing high resolution, time-resolved, three-dimensional (3D) terrain mapping, and ejecta particle trajectories, velocities and size distributions generated by PSI events during landing. Infrared imaging enhances this capability by penetrating dense ejecta plumes that otherwise cause obscuration in conventional visible-light imaging. Because these wavelengths are less susceptible to scattering by fine dust particles, the underlying 3D crater shape and terrain surface deformation that will be imaged by high-speed infrared stereoscopic and time-of-flight systems will also remain observable much longer than conventional visible light imaging methods, allowing continuous monitoring of crater growth and morphology during the PSI for extended timescales. This effort will provide a prototype instrument for ground testing and a preliminary design for

a compact stereoscopic or time-of-flight terrain mapping system coupled with a DH flight instrument for NASAâ€™s future mission needs.

Duration: 6

Proposal Details

Proposal Number: LAND.1.S26B-0509
Subtopic Title: Real-time Characterization of Regolith Stability during Planetary Descent & Landing
Proposal Title: SeismoFuse: Structure-Borne Seismic-Augmented Multi-Modal Fusion for Real-Time Regolith Stability and Subsurface Hazard Detection under PSI Obscuration (Lunar/Mars EDL)

Small Business Concern

Firm: Space ER
Address: 841 DOROTHEA ROAD, La Habra Hts, CA, 90631-8109

Summary Details

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

Space ER LLC, in partnership with Texas A&M Engineering Experiment Station (TEES), proposes SeismoFuse, a real-time regolith stability characterization system for planetary Entry, Descent, and Landing (EDL). Human-scale landers (40-ton class) required by the NASA Artemis program present severe risks from unpredictable surface mechanical properties, such as catastrophic pad sinkage, asymmetric settling, and damage from Plume-Surface Interaction lofted debris. Current orbital data and surface imaging fail to assess subsurface hazards or mechanical properties through dense PSI dust obscuration. SeismoFuse addresses this critical gap through a novel, integrated solid-state architecture. The system utilizes a 350g piezoelectric transducer array embedded natively in lander footpads to capture structural vibration signatures generated passively by descent engine dynamics and initial touchdown ground contact. Utilizing advanced physics-informed Bayesian inference and sensor fusion with onboard non-optical streams (Doppler LIDAR and IMU data), SeismoFuse converts these robust acoustic

signatures into real-time categorical bearing-capacity classifications and sinkage-risk estimations with calibrated uncertainty quantification at a 2 Hz update rate. Operating reliably throughout terminal descent (60s to 0s) and the first 500ms of touchdown settling, the system is immune to visibility failure and provides immediate, actionable geotechnical intelligence to the lander GN&C system for closed-loop engine throttling, load redistribution, and stabilization. Funding will support laboratory validation and computation of the software engine on flight-representative FPGA hardware, targeting TRL 3/4. The primary target market is NASA (Artemis Human Landing Systems and Commercial Lunar Payload Services), with follow-on markets including international and commercial planetary landing missions.

Duration: 6

Proposal Details

Proposal Number: LAND.1.S26B-0585
Subtopic Title: Real-time Characterization of Regolith Stability during Planetary Descent & Landing
Proposal Title: Radar Sensing and Spectral Wavefield Analysis for Real-Time Regolith Stability Assessment During Planetary Landing

Small Business Concern

Firm: Omega Sensing Technologies
Address: 4310 Boulder Pond Dr, Ann Arbor, MI, 48108-7600

Summary Details

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

This proposal develops a real-time electromagnetic (EM) velocity estimation and subsurface characterization framework for ground-penetrating radar (GPR) to support planetary descent and landing operations. Future Artemis-class missions require improved understanding of regolith geotechnical properties that directly influence landing stability including bearing capacity and subsurface hazard structure. Existing GPR processing approaches rely on manual hyperbola extraction

or computationally intensive inversion methods that are not suitable for autonomous, time-constrained operations. The proposed technology reformulates EM velocity estimation as a multiscale statistical inference problem in the frequency-wavenumber domain. It exploits stationary-phase spectral structure of hyperbolic radar scattering, where propagation velocity is encoded in the orientation of coherent spectral energy distributions. Rather than relying on explicit reflector localization, the framework estimates velocity directly from second-order spectral statistics using covariance-weighted structure tensor analysis. To improve robustness under noisy and heterogeneous regolith conditions, the approach incorporates wavelet-domain coherence enhancement prior to spectral analysis. Analytic wavelet transforms and scale-adaptive statistical thresholding suppress incoherent noise while preserving coherent diffraction structure associated with subsurface scattering. Funding will support development and validation using synthetic lunar regolith simulations and planetary radar datasets, including measurements from the RIMFAX instrument aboard the Mars Perseverance rover. The effort will also demonstrate computational feasibility for real-time operations. The target application is NASA planetary landing systems requiring autonomous subsurface situational awareness during powered descent. Additional dual-use markets include geotechnical site characterization and infrastructure inspection.

Duration: 6

Proposal Details

Proposal Number: LAND.2.S26B-0191
Subtopic Title: Development and Modeling of Waterproofing Coatings or Surface Treatments for Reusable Thermal Protection Systems (TPS)
Proposal Title: Durable Hydrophobic TPS Coatings

Small Business Concern

Firm: Advanced Ceramics Manufacturing
Address: 7800 S. Nogales Highway, Tucson, AZ, 85756-9645

Summary Details

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

Thermal protection systems (TPS) for atmospheric entry vehicles rely on highly porous ceramic insulation tiles, such as Alumina Enhanced Thermal Barrier (AETB), to provide vital thermal stability. However, their inherent open porosity renders them highly susceptible to environmental moisture absorption during ground handling, storage, and pre-flight processing. Moisture ingress leads to increased dead weight, reduced thermal efficiency during ascent, and risks of internal vaporization or structural cracking during rapid thermal transients. State-of-the-art waterproofing relies on alkoxysilane treatments like methyltrimethoxysilane (MTMS) and dimethyldimethoxysilane (DMS). These baseline systems are heavily constrained by long, humidity-sensitive in-situ hydrolysis timescales, toxic methanol generation, and performance degradation above 300â€“500Â°C. Advanced Ceramics Manufacturing (ACM) will utilize Phase I funding to develop a dual-phase siliconeâ€“silica infiltration system that establishes combined chemical and structural moisture resistance within porous ceramic networks. The formulation combines a 100% active, solventless methyl methoxy-functional siloxane resin binder (DOWSIL 2405) with hydrophobically modified fumed silica nano-fillers dispersed in VOC-exempt volatile methylsiloxanes (DOWSIL OS-20) or high-purity isoparaffins. Applied via bench-scale injection or spray , the fluid achieves water-like viscosity (1.0â€“3.5 cP) to deposit a sub-micron, covalent pore-lining along internal fiber walls. This locks in hydrophobicity and increases transport tortuosity while keeping the macroscopic network breathable and free of mass penalties. Target markets include NASA exploration platforms (Artemis/Orion) and commercial reusable launch vehicles (SpaceX, Blue Origin) undergoing high-cadence turnaround processing.

Duration: 6

Proposal Details

Proposal Number: LAND.2.S26B-0416
Subtopic Title: Development and Modeling of Waterproofing Coatings or Surface Treatments for Reusable Thermal Protection Systems (TPS)
Proposal Title: Polysilazane-based waterproofing coating for reusable thermal protection systems

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

Reusable thermal protection system tiles used in modern commercial spacecraft utilize Alumina Enhanced Thermal Barrier (AETB) materials. AETB is a low-density highly porous ceramic with exceptionally low thermal conductivity. However, the high porosity also allows for significant water absorption (upwards of 300% of the tilesâ€™ dry weight), which can lead to structural failure of the tiles and unexpected increases in launch weight. Currently, water absorption is prevented by a surface coating made from silane waterproofing agents. These silanes are toxic, highly volatile, must be injected into the tiles in a time consuming process, and require extended curing periods of several days. TDA Research proposes to develop a novel waterproofing coating for AETB tiles which offers excellent water repellency (<50% of the water uptake of currently used waterproofing agents) and is compatible with the reentry conditions experienced by spacecraft exteriors. The coating utilizes a polysilazane resin that can be applied to the tiles through typical spray or brush techniques. The resin will then be rapidly cured using high intensity ultraviolet (UV) light to form a robust Si(O,N,C) coating with hydrophobic properties. This coating will be stable to temperatures over 1600Â°C and will thus be able to withstand the 1260-1536Â°C temperatures experienced during re-entry. Use of this novel coating will make AETB tiles truly reusable and eliminate concerns related to mechanical failures due to water absorption within the tiles.

Duration: 6

Proposal Details

Proposal Number: LAND.2.S26B-0451
Subtopic Title: Development and Modeling of Waterproofing Coatings or Surface Treatments for Reusable Thermal Protection Systems (TPS)
Proposal Title: Easily-Applied Hydrophobic Coating for Reusable Thermal Protection Systems

Small Business Concern

Firm: Luna Labs USA, LLC
Address: 706 Forest Street, Charlottesville, VA, 22903-5231

Summary Details

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

NASA is prioritizing reusable spacecraft with rapid launch cadences to support the needs of the growing space industry. Due to the harsh conditions associated with reentry, spacecraft typically require reconditioning between successive launches. For spacecraft equipped with Alumina Enhanced Thermal Barrier (AETB) tiles, moisture uptake prior to launch can cause a variety of mechanical issues during launch, orbit, and reentry. Current waterproofing on these tiles is a slow, labor-intensive process, resulting in downtime between launches associated with the waterproofing cure time. Therefore, NASA requires an improved waterproofing solution for AETB tiles that decreases turnaround times for spacecraft. Luna Labs will utilize extensive experience with high temperature and hydrophobic coatings to produce an easily-applied, thermally stable, hydrophobic coating that will reduce the time needed for application and curing, while improving the durability of the coating through multiple reentry cycles. This easily-applied hydrophobic coating will decrease the amount of turnaround time between launches.

Duration: 6

Proposal Details

Proposal Number: LAND.2.S26B-0809
Subtopic Title: Development and Modeling of Waterproofing Coatings or Surface Treatments for Reusable Thermal Protection Systems (TPS)
Proposal Title: Stable hydrophobic inorganic enhancement for low-mass durable TPS (SHIELD)

Small Business Concern

Firm: SenSanna Incorporated
Address: 7468 Candlewood Rd., Hanover, MD, 21076-3216

Summary Details

Estimated Technology Readiness Level(TRL Begin - TRL End): 1 - 4
Technical Abstract (Limit 2000 characters):

Reusable spacecraft thermal protection system (TPS) tiles based on Alumina Enhanced Thermal Barrier (AETB) materials are susceptible to moisture uptake due to their low-density porous silica/alumina fiber structure. Absorbed water can increase launch mass, promote freeze damage, and generate internal pressure during rapid thermal transitions. Current waterproofing methods rely on labor-intensive processes that utilize hazardous silanes and volatile reagents, require extended cure and purge times, and degrade during high-temperature exposure, necessitating frequent retreatment for reuse. This project will develop a durable, low-mass, inorganic alternative to organic waterproofing treatments for AETB and similar porous ceramic TPS materials, based on lanthanum phosphate (LaPOâ,,,), a refractory ceramic material that can exhibit stable non-wetting behavior. Unlike silane treatments, the proposed approach does not rely on thermally labile organic hydrophobic groups. The technical objective is to determine whether a very dilute liquid-phase process can nucleate directly on internal AETB fiber surfaces, reduce bulk water uptake, and retain performance after thermal exposure without pore blockage or unacceptable mass gain. Phase I will develop sequential lanthanum/ phosphate infiltration and surface-precipitation processes on uncoated AETB coupons. Formulation variables will include precursor chemistry, concentration, pH, La:P ratio, deposition cycles, drying conditions, and heat-treatment temperature. Treated coupons will be characterized for water uptake, mass gain, penetration uniformity, pore blockage, and thermal-aging behavior. The best process will then be applied to larger glass-coated AETB tile samples through edge or back-face access paths and evaluated under torch-stand thermal exposure. The project will determine whether inorganic LaPOâ,,, surface treatment can provide a lower-hazard, thermally durable alternative to conventional organic TPS waterproofing methods.

Duration: 6

Proposal Details

Proposal Number: LAND.2.S26B-1085

Subtopic Title: Development and Modeling of Waterproofing Coatings or Surface Treatments for Reusable Thermal Protection Systems (TPS)
Proposal Title: GradWet-TPS: Gradient Wettability Waterproofing for Reusable Thermal Protection Systems

Small Business Concern

Firm: Vuronyx Technologies
Address: 5 WALNUT HILL PARK, Woburn, MA, 01803-1750

Summary Details

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

GradWet-TPS is a novel in-situ waterproofing treatment for reusable thermal protection system (TPS) tiles, specifically AETB and FRCI silica-alumina fiber tiles, that engineers a deliberate gradient of wettability through the tile thickness using a single injection of organosilazane (OPSZ) solution through existing tile ports. The outer zone achieves Î¸ â‰ˆ 130Â° (strongly hydrophobic, LEP â‰ˆ 6.2 kPa), transitioning to Î¸ â‰ˆ 95Â° at the inner zone (mildly hydrophobic, open vapor transport). No new hardware, no oven cure, and no vacuum equipment are required. Prior TPS waterproofing art, including DMS, MTMS, and all alternatives, addresses only one failure mode: liquid water ingress. GradWet-TPS simultaneously addresses three documented AETB failure modes: (A) freeze-expansion cracking, by reducing pore saturation from ~18% to <5%, cutting freeze-expansion pressure 3.6Ã—; (B) ascent vapor pressurization, by preserving open vapor diffusion pathways through the mildly hydrophobic inner zone to the uncoated SIP base, preventing the ~57,800Ã— volume expansion of trapped water from generating catastrophic internal pressure; and (C) cryogenic pad condensation, by confining any liquid intrusion to the outer zone only. Phase I funding will support: (1) a 1D Fickian diffusion + chemisorption model predicting the Î¸(depth) gradient profile; (2) experimental gradient deposition on JSC-1A-derived and porous silica coupons at 3 OPSZ concentrations with contact angle verification by depth sectioning; (3) liquid entry pressure and gravimetric moisture uptake comparison vs. DMS/MTMS baseline; and (4) direct experimental demonstration of freeze-thaw and ascent depressurization failure mode mitigation. Target markets include NASA Ames TPS maintenance operations, commercial reusable launch vehicle operators (SpaceX Dragon, Sierra Space Dream Chaser), and jet engine nacelle ceramic insulation â€” any application requiring moisture management in porous ceramic fiber systems.

Duration: 6

Proposal Details

Proposal Number: LAND.3.S26B-0410
Subtopic Title: Low Cost Domestic Source for Blended Carbon and Phenolic Felt Batting or Yarn
Proposal Title: Domestic Source for Blended Carbon Yarns

Small Business Concern

Firm: Applied Technology Solutions, Inc.
Address: 4910 University Square, Suite 7, Huntsville, AL, 35816-1846

Summary Details

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

Applied Technology Solutions Inc., (ATS) proposes the demonstration of a domestic process for the creation of customer carbon fiber - phenolic fiber blend yarns. The proposed effort utilizes a series of mature yarn processing technologies to produce a final multiple ply blended yarn with tailorable properties. The ATS approach builds on prior experience developing custom carbon and ceramic yarn blends for high temperature applications. Through the execution of the proposed effort the team will demonstrate the ability to blend and successfully spin a 4-ply carbon fiber â€“ phenolic fiber (or surrogate fiber) yarn in a repeatable fashion with technologies that are scalable. Additionally, the team will demonstrate the ability to process >95% carbon content fiber under the proposed work. Once complete, the ATS team will perform initial characterization of the prototype yarn and make note of any gaps that exist between the measured properties and the targeted properties outlined in the topic documentation. The processing parameters identified during the Phase 1 effort, along with their corresponding impact on yarn properties, will be documented and utilized as a point of departure for achieving the stated yarn characteristics highlighted in the call during a follow-on Phase 2 effort. The data collected during the Phase 1 effort will be documented in a final report and will be leveraged for Phase 2 planning. All funding awarded under this effort will be utilized to cover the labor and consumable materials necessary to demonstrate the proposed yarn prototype. Successful execution of this work will result in a domestic option for blended carbon fiber â€“ phenolic fiber yarns for spacecraft thermal protection system (TPS) applications with utility for both government and commercial space customers.

Duration: 6

Proposal Details

Proposal Number: LAND.3.S26B-0599
Subtopic Title: Low Cost Domestic Source for Blended Carbon and Phenolic Felt Batting or Yarn
Proposal Title: Proprietary High-Carbon and Phenolic Fiber Felt: A Dedicated Manufacturing Line for Aerospace Applications

Small Business Concern

Firm: American Felt & Filter Company Inc.

Address: 361 Walsh Ave, New Windsor, NY, 12553-6727

Summary Details

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

American Felt & Filter Company, Inc. (AFFCO) proposes the development of a dedicated manufacturing line for a proprietary blend of high-carbon and phenolic fiber battings and felt billets for aerospace thermal protection applications. This material â€" engineered to deliver exceptional thermal resistance, structural flexibility, and customizable density â€" has no known commercial or industrial equivalent. No manufacturer currently produces this specific blend, and no dedicated production line for it has previously been established. The requested funding of $224,996 supports a six-month performance period encompassing production line commissioning, iterative lab-scale R&D production runs, and development of complete commercial readiness infrastructure: standard operating procedures, formal product specifications, a proprietary industry product code, quality yield reporting, and a final material property report documenting through-thickness density, char yield, and in-plane and through-thickness shrinkage. AFFCO brings more than 125 years of specialized felt and fiber manufacturing experience to this initiative, including active PICA material production partnerships with Space, NASA, Blue Origin, Lux Aeterna and Varda â€" directly establishing the phenolic-carbon material science expertise underpinning this development. The innovation addresses NASA STMD Entry, Descent and Landing technology shortfalls (including #1569, #1567, #1572, and #1563) and supports NASA Strategic Plan Objective 3.1. Beyond NASA applications, the material targets the expanding commercial aerospace economy, including launch vehicle developers, re-entry system manufacturers, and emerging small businesses entering the space sector.

Duration: 6

Proposal Details

Proposal Number: LIVEI.1.S26B-0379
Subtopic Title: Surface Sustainability and Logistics: Dust Mitigation
Proposal Title: Cryogenic Umbilicalâ€™s Cord (CRUMS)

Small Business Concern

Firm: Hedgefog Research Inc.
Address: 1891 N Gaffey St Ste 224, San Pedro, CA, 90731-1270

Summary Details

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

Hedgefog Research Inc. (HFR) proposes to develop a new, advanced Cryogenic Umbilicalâ€™s Cord (CRUMS) for Lunar and Martian surface operations that maintains reliable fluid and electrical transfer in highly abrasive dusty, and cryogenic conditions. The CRUMS will align with the NASA Dust Mitigation Roadmap and support Artemis and Moon-to-Mars objectives by reducing operational risk and enabling sustainable exploration. Our concept of design is to use known, space proven cryogenic materials such as polyimides, with and without metal coatings, for Multi-Layer Insulation (MLI) blanketing, Electro-Dynamic Dust Shields (EDS), and white optical coatings. The benefits of the proposed CRUMS are as follows: â€¢ Cryogenic compatibility using a new, â€œsolid stateâ€ MLI design â€¢ The ability to remove dust from the outer umbilical surface per NASA-STD-1008 â€¢ Embedded detection of dust build-up for automated cleaning cycles â€¢ High electric field anti-arcing circuits to prevent any electrical breakdown or sparking â€¢ Zero power consumption, unless EDS is activated â€¢ Highly reflective white optical outer coatings to reduce heat absorption from the sun â€¢ Micro-meteorite protection using multilayer â€œWhipple Shieldsâ€ â€¢ Use of radiation proven materials throughout the construction

Duration: 6

Proposal Details

Proposal Number: LIVEI.1.S26B-0776
Subtopic Title: Surface Sustainability and Logistics: Dust Mitigation
Proposal Title: Durable Methyl-Terminated Polysilazane Ceramic Coating for Lunar Dust Adhesion Mitigation on Surface Operations Hardware

Small Business Concern

Firm: ELEMENT 119 LLC
Address: 296 REYNOLDS BRIDGE ROAD, THOMASTON, CT, 06787-1996

Summary Details

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

Element 119 LLC proposes to develop and validate a methyl-terminated polysilazane (Me-PSZ) ceramic coating for passive lunar dust adhesion mitigation on Artemis surface operations hardware. Lunar regolith particles, angular, electrostatically charged, and averaging 70 micrometers in diameter â€” adhere to uncoated hardware at forces 10â€“50 times higher than terrestrial dust, degrading solar array output by 20â€–40% and radiator emissivity by up to 30% at contamination levels as thin as 100 micrometers. No current passive coating survives the lunar environment: vacuum UV radiation at 121 nm destroys low-surface-energy silicone chemistry within months, and thermal cycling between â^'173Â°C and +127Â°C cracks most organic-inorganic hybrid systems. Element 119's Me-PSZ system addresses both failure modes through three innovations: methyl-functional ceramization producing a surface energy below 25 mN/m in a thermally stable SiCN ceramic matrix; TiOâ,, nanoparticle dispersion at 1â€“5 wt% to absorb VUV photons before they cleave Siâ€“C bonds; and graphene nanoplatelet doping at 0.5â€–2 wt% for controlled triboelectric charge dissipation. Phase I funding will be used to synthesize and screen a 16-variant formulation library, characterize anti-adhesion performance against JSC-1A simulant on aluminum, titanium, and Kapton substrates, and subject the top formulations to simulated lunar environmental exposure (VUV fluence equivalent to 6 months south pole exposure; 50 thermal cycles â^'150Â°C to +130Â°C). A physics-based particle adhesion model will be calibrated against test data. Technology advances from TRL 2 to TRL 4. Target markets: CLPS lander contractors, NASA Artemis EVA and surface systems, ESA lunar programs.

Duration: 6

Proposal Details

Proposal Number: LIVEI.1.S26B-0816
Subtopic Title: Surface Sustainability and Logistics: Dust Mitigation
Proposal Title: Modular Wireless Power System for Umbilical Applications

Small Business Concern

Firm: Yank Technologies
Address: -

Summary Details

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

For lunar and Mars missions, there are significant challenges in developing a reliable surface powering system for robotic manufacturing due to harsh environmental conditions. Regolith and dust storms often create reliability challenges over time for physical-mechanical connections, such as power connections due to strong insulating and electrostatic properties. According to this LIVEI.1.S26B subtopic, NASA requires advanced umbilical systems for the Moon and Mars that maintain â€œelectrical transfer in highly abrasive, cryogenic, and dusty conditions.â€ Therefore, solutions are sought to improve electrical power interfacing with reconfigurable designs to unlock scalable robotic manufacturing in harsh environments. Wireless power transfer (WPT) can help mitigate these challenges, but existing state-of-the-art (SOA) solutions are low power, highly customized, and must be completely redesigned for each umbilical product. Furthermore, they currently require near-physical contact and precise alignment, which presents a significant risk towards NASA missions. The proposed Modular Wireless Power System for Umbilical Applications is a reconfigurable and modular system to support a variety of high power commercial and government products for unpredictable and significant misalignment. The system includes high intrinsically efficient coils with the ability to operate for a wide range of load conditions. Furthermore, it also incorporates a modular architecture and programmable output voltages to readily scale and adapt for variety of different NASA robots. By the completion of the Phase I development, the system will be tested, verified, and optimized with regolith simulants to be more representative of lunar and Mars surface environments.

Duration: 6

Proposal Details

Proposal Number: LWS.2.S26B-0407

Subtopic Title: Softgoods Habitats Employing Layered or Trapped Unrefined Regolith Shielding (SHELTURS)
Proposal Title: Lunar Shelter Wide Regolith Ancillary Protection (WRAP)

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):

Studies have shown that lunar habitats will benefit from the addition of a 2-3m thick layer of regolith covering the habitat to enhance micrometeoroid, thermal and radiation protection. Insitu generation of this protection eliminates the need to bring the shielding mass to the lunar surface from earth, making large inflatable habitats very mass and volumetrically efficient. Current architectures rely on extensive heavy equipment to construct the regolith cover including bulldozers, cranes, and large gantry 3D printers, that all require significant mass delivered to the lunar surface and power to operate that will not be available for early missions or for multiple landing sites. Moonprint Solutions will develop the Lunar Shelter Wide Regolith Ancillary Protection (WRAP) to facilitate simplified construction of a shaped layer of unrefined lunar regolith around the habitat in any geometry required. The WRAP consists of a softgoods regolith holder that is self-erecting and a conveying system that fills the holder. The conveying system will be integral to the holder so the system is simple, lightweight and does not require much power to operate. The holder is made from robust materials and establishes a minimal regolith fill volume such that the burden on the regolith collecting rover is minimized and the timescales are compressed. The finished structure will be freestanding and will provide outstanding protection to the habitat, and is extensible to numerous other applications such as rover garages.

Duration: 6

Proposal Details

Proposal Number: LWS.2.S26B-0472
Subtopic Title: Softgoods Habitats Employing Layered or Trapped Unrefined Regolith Shielding (SHELTURS)
Proposal Title: Cellularly Supported Regolith Shielding (CSRS) for Inflatable Lunar Habitats

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):

Sustained human presence on the Moon and Mars will require habitats that can mitigate long-term hazards of extraterrestrial living, including exposure to ionizing radiation and solar particles, as well as potential impacts from micrometeoroids or ejecta. We propose a conceptual design for in situ resource utilization (ISRU) to use cellularly supported regolith shielding (CSRS) on inflatable habitats. The proposed design uses a tessellated pattern of hexagonal bags/cells filled with bulk regolith to cover the surface of the habitat to attenuate radiation. Our company has developed a number of textiles for spacesuit applications that are resistant to penetration or abrasion by regolith, and these materials will be used to fabricate the bags to ensure that underlying habitat layers are protected. These textiles are compatible with anticipated Lunar temperature conditions, are non-flammable, and are resistant to UV degradation. Synergistic design of the optimal habitat geometry and cell dimensions will take advantage of natural granular mechanics to stabilize the regolith. Additional anchoring effects derive from from the walls of the bags/cells oriented perpendicular to the inflated surface. Under the 1.625 m/s2 gravity on the Moon, a 3m thick layer of regolith exerts approximately 9.8 kPa, which is well below the 56.5 kPa exploration atmosphere pressure anticipated in an inflatable habitat. Inflation of the habitat will be used to raise the cellularly supported regolith into position. Here we propose multi-cell filling methods and simple filling equipment to ensure efficient utilization of surface excavation equipment assets. The modular bag design and filling strategy is potentially applicable to other Lunar infrastructure component needs such as berms, blast shields, roads, or other temporary or reconfigurable structures.

Duration: 6

Proposal Details

Proposal Number: LWS.2.S26B-0712
Subtopic Title: Softgoods Habitats Employing Layered or Trapped Unrefined Regolith Shielding (SHELTURS)
Proposal Title: In-Situ Regolith Shielding for Inflatable Lunar Habitats

Small Business Concern

Firm: SpaceFactory Inc.
Address: -

Summary Details

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

Inflatable habitats offer significant mass and volumetric packaging advantages for long-duration space missions; however, as these systems transition from LEO applications to the lunar surface, they must be made resilient to radiation exposure, meteoroid impacts, extreme thermal cycling, and abrasive lunar dust. We propose an in-situ regolith shielding architecture utilizing a softgoods confinement layer integrated onto the habitat surface. This layer, comprised of individual confinement cells, is filled with bulk regolith while positioned near the lunar surface and accessible to robotic excavation systems. The primary mechanism for elevating and retaining the regolith in place is the staged inflation itself. Once a row of cells is filled and compacted, the habitat expands vertically to expose the next row, enabling progressive deployment of the regolith shielding layer. Phase I will assess feasibility through: (1) preliminary engineering of the confinement layer; (2) preliminary structural analysis under representative lunar loading conditions; (3) a low-fidelity demonstration utilizing an IPEx-like robotic bucket drum to fill 1/4-scale confinement cells during staged lifting operations; and (4) development of preliminary operational concepts assessing construction sequencing and timelines using representative near-term robotic capabilities. The proposed effort directly addresses NASAâ€™s interest in low-upmass shielding approaches for inflatable habitats while reducing reliance on heavy equipment, binders, and sintering processes. The effort builds upon SpaceFactoryâ€™s prior NASA-funded research in robotic construction systems, regolith shielding architectures, and lunar structural analysis methodologies developed under the REACT ACO, STTR programs, and NASA Centennial Challenge robotic habitat construction efforts.

Duration: 6

Proposal Details

Proposal Number: SPWX.2.S26B-0058
Subtopic Title: Sensors and Instrumentation for Space Environment Measurement
Proposal Title: Low Noise Core Material for Fluxgate Magnetometers

Small Business Concern

Firm: SkyVision Sciences, LLC
Address: 25557 Bella Vista Circle, Steamboat Springs, CO, 80487-0000

Summary Details

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

SkyVision Sciences proposes to develop a new technique for producing wire-type magnetic core materials for use in miniaturized advanced magnetometers. Improvements to the magnetic noise level in the core are sought to improve upon sensitivity of the magnetic field sensor. In addition, improvements to the mechanical stability of these components is sought as handling these cores during assembly can induce stress and thereby degrade sensor quality. SkyVision's design is projected to exhibit properties comparable to that of Mo-Permalloy 6-81.3 with reduced Barkhausen noise and with improved handleability. The Phase I effort will examine the processing effects upon the properties of the core material; measuring their magnetic properties and Barkhausen noise in order to optimize its functionality. The Phase II effort is envisioned to further improve and characterize the materials properties, scale the fabrication process, and provide material to NASA or its partners for fabricating a magnetometer with this new core material.

Duration: 6

Proposal Details

Proposal Number: SPWX.2.S26B-0554
Subtopic Title: Sensors and Instrumentation for Space Environment Measurement
Proposal Title: Perovskite Photon-Counting Detectors for Solar Flare Hard X-ray Imaging

Small Business Concern

Firm: Perotech Inc
Address: 112 Celtic Cir, Chapel Hill, NC, 27516-4661

Summary Details

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

Perotech, Inc. proposes a perovskite single-crystal photon-counting hard X-ray (HXR) sensor system for solar flare imaging spectroscopy, responsive to NASA SBIR subtopic SPWX.2.S26B. The innovation integrates Perotech's formamidinium lead bromide (FAPbBr3) single-crystal detector, built on foundational IP from the Huang group at UNC-Chapel Hill, with an established photon-counting readout architecture to deliver polarization-resilient, self-powered HXR imaging spectroscopy across 0.1 to hundreds of keV. Compared with the incumbent CdTe state of the art (FOXSI-4), FAPbBr3 exhibits shallow point defects, bipolar charge transport with comparable electron and hole mobility-lifetime products, self-powered (0 V) operation, temperature stability, and radiation hardness exceeding 10 Mrad of Co-60 dose with 1.2% retained energy resolution. Phase I funding will be used to (1) derive a quantitative, mission-driven Sensor Performance Specification; (2) fabricate two FAPbBr3 coupon variants (standard biased and self-powered); (3) execute a tiered bench characterization campaign covering static spectroscopy, polarization stability under flare-class flux ramps (10^3-10^6 cps/mm^2), vacuum and thermal cycling (-20 to +60 C), and extended X-ray dose accumulation at the UNC-CH higher-flux facility; and (4) deliver a hybrid-pixel readout integration plan around a Timepix3-class ASIC. The program exits Phase I at TRL 5 with test coupons, a test report, and a prototype roadmap. Target markets span NASA heliophysics, astrophysics, planetary science, and space-environment monitoring missions, plus four commercial verticals: photon-counting medical CT, security and cargo inspection, industrial NDT (EV battery, semiconductor packaging), and synchrotron beamline detectors. Cross-market amortization anchors a durable Phase III commercialization pathway.

Duration: 6

Proposal Details

Proposal Number: SPWX.2.S26B-0665
Subtopic Title: Sensors and Instrumentation for Space Environment Measurement
Proposal Title: Receiver for Space Weather Atomic Oxygen Measurement

Small Business Concern

Firm: LongWave Photonics LLC
Address: 958 San Leandro Avenue , Mountain View, CA, 94043-1996

Summary Details

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

LongWave Photonics proposes to develop a compact 4.744 THz heterodyne receiver for atomic oxygen measurements supporting NASA heliophysics and space-weather missions. The receiver uses a solid-state THz quantum cascade laser local oscillator to pump a waveguide-integrated THz quantum-well infrared photodetector operated as a photoconductive mixer. The purpose is to enable a low SWaP receiver architecture for SmallSat atomic-oxygen radiometry, where ultimate mixer sensitivity must be balanced against LO power, cryogenic lift, front-end power, packaging, and receiver maturity. Phase I funding will be used to produce a quantitative, internally consistent receiver design package. The work will optimize a reduced-well THz-QWP mixer for absorption, RF-to-IF responsivity, low dark current, and at least 300-MHz of IF bandwidth; evaluate resonant or guided-wave coupling structures that efficiently couple both the OI signal and QCL LO into the QWP active region; and combine the mixer design with QCL power, IF-chain, and cryocooler constraints to select a Phase II receiver operating point. The Phase I endpoint will be a Phase II-ready design package with noise, bandwidth, LO-power, and thermal budgets traced to the receiver requirements.

Duration: 6

Proposal Details

Proposal Number: SPWX.2.S26B-0948
Subtopic Title: Sensors and Instrumentation for Space Environment Measurement
Proposal Title: QUASAR: Quantum Atomic Hybrid Scalar-Vector Magnetometer for Space Applications

Small Business Concern

Firm: FieldLine Industries Inc
Address: 371 Centennial Parkway STE 100, Louisville, CO, 80027-1323

Summary Details

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

Technical Abstract (Limit 2000 characters):

FieldLine Industries (FLI) proposes QUASAR, a compact hybrid quantum magnetometer capable of simultaneous scalar and vector magnetic field measurements across environments spanning near-zero field through geomagnetic field strengths. QUASAR combines high sensitivity, broad dynamic range, omnidirectional operation, and low size, weight, and power (SWaP) in a compact architecture designed for resource-constrained spacecraft, including CubeSats and small satellite platforms. Phase I funding will support development and demonstration of key enabling technologies including scalar/vector operation, near-zero-field operation, omnidirectional sensing, low-noise magnetic field control electronics, and in-situ calibration methodologies. The proposed system builds upon FLI's existing commercial quantum magnetometer technologies and deployed sensing systems, including compact scalar and zero-field atomic magnetometers currently operating in space-relevant and operational environments. QUASAR addresses growing demand for compact, high performance magnetic sensing systems across heliophysics, planetary science, Earth science, space weather monitoring, and distributed spacecraft architectures. Beyond NASA missions, target markets include commercial space systems, geomagnetic observatories, space weather infrastructure monitoring, magnetic navigation and assured PNT, geophysical sensing, and autonomous systems operating in GPS-degraded or denied environments. FLI is at the forefront of scalable quantum sensing technologies, developing compact atomic magnetometers and enabling architectures for next-generation scientific, aerospace, and defense applications.

Duration: 6

Proposal Details

Proposal Number: SURFMOB.1.S26B-0651
Subtopic Title: Advanced Human Lunar Surface Mobility Technologies
Proposal Title: Lighting-Robust Visual SLAM and Risk-Aware Navigation for GPS-Denied Lunar Surface Mobility

Small Business Concern

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

Summary Details

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

Artemis missions require Lunar Terrain Vehicles (LTVs) and Pressurized Rovers (PRs) capable of long-range autonomous traverses in a GPS-denied lunar south-pole environment characterized by persistent shadows, low-angle illumination, high-contrast lighting, and visually repetitive regolith. Existing navigation systems based on wheel odometry, inertial sensing, and geometry-only terrain costmaps are insufficient under these conditions due to accumulated localization drift and degraded perception reliability. To address these challenges, PickNik Robotics proposes a solution for autonomous navigation on the lunar surface using two tightly coupled capabilities: LUMOS, a lighting-robust SLAM framework, and a semantic risk costmap for uncertainty-aware lunar surface navigation. The first proposed capability is the Lunar Uncertainty-aware Mapping and Odometry System (LUMOS), a newly developed Simultaneous Localization and Mapping (SLAM) framework that extends learning-based uncertainty-aware visual odometry into a persistent mapping and localization system for sustained lunar surface operations. The second capability is a semantic risk costmap that estimates terrain traversability using localization confidence, terrain slope, and lighting conditions. Unlike conventional geometry-only costmaps, the proposed approach explicitly represents perception degradation and navigation uncertainty, enabling safer autonomous mobility and future risk-aware path planning. During Phase I, PickNik will develop, integrate, and evaluate LUMOS and the semantic risk costmap within the MoveIt Pro platform and lunar simulation environment, directly addressing requirements for hazard detection and autonomous navigation under lunar south pole environmental conditions. Beyond NASA lunar mobility applications, the resulting autonomy capabilities have commercial relevance for mining, construction, agriculture, defense, and other robotic operations in GPS-degraded environments.

Duration: 6

Proposal Details

Proposal Number: SURFMOB.1.S26B-0692
Subtopic Title: Advanced Human Lunar Surface Mobility Technologies
Proposal Title: Flash LiDAR Mobility Products for Safe Autonomous and Supervised Lunar Surface Operations

Small Business Concern

Firm: Advanced Scientific Concepts, LLC
Address: 125 Cremona Drive, Goleta, CA, 93117-3083

Summary Details

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

Advanced Scientific Concepts (ASC) proposes Global Shutter Flash LiDAR Lunar Mobility (GSFL-LM) products for safe autonomous and supervised lunar surface operations. The technology converts organized point-cloud data, captured with a single laser pulse, into compact rover-local products: elevation, slope, roughness, obstacle, crater, step, keep-out, traversability, hazard-confidence, and safe-corridor layers. This is not a generic LiDAR autonomy stack; the proposed simulators, datasets, DEM-generation methods, radiometric models, hazard-confidence maps, and embedded mobility products are tailored to Flash LiDAR data and verifiable hardware characteristics. GSFL-LM addresses Artemis mobility needs in GPS-denied, bandwidth-limited, intermittently connected, low-compute, harsh-lighting lunar environments, including south-pole shadow and low-texture terrain. Phase I will define product formats/interfaces, prototype classical embedded terrain-processing and hazard algorithms, evaluate AI/hybrid enhancements, develop compressed hazard memory and selective data recording, extend ASCâ€™s physics-based GSFL Digital Twin simulation/replay workflow, and assess feasibility using simulation and live/analog data where available. The intended use is to support rover autonomy, supervised driving, hazard detection/avoidance, local planning and localization-support interfaces, human oversight under communication delays, mission verification, anomaly review, and Digital Twin-based algorithm improvement. The system is a sensor-informed perception, confidence, and verification layer for downstream autonomy, not a complete rover autonomy stack. Initial NASA markets include LTV, PR, LUV, commercial lunar rovers, robotic cargo movers, landers, and surface logistics systems. Broader markets include planetary mobility, defense autonomy, mining, construction, infrastructure inspection, off-road autonomy, and robotics in degraded visual environments.

Duration: 6

Proposal Details

Proposal Number: SURFMOB.1.S26B-1083
Subtopic Title: Advanced Human Lunar Surface Mobility Technologies

Proposal Title: Lunar Autonomy and Mobility Simulation

Small Business Concern

Firm: MacLean Engineering and Applied Technologies, LLC dba METECS
Address: 1030 Hercules, Houston, TX, 77058-2722

Summary Details

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

Lunar autonomy development has been held back by fragmented simulation tooling: terrestrial simulators don't transfer directly to lunar use, and existing lunar-capable simulations (Trick-based rovers, JPL DARTS, VIPER RSIM, Chrono) each impose a high integration burden forcing payload vendors to build custom terrain, sensor, and terramechanics stacks and forcing NASA integrators to bridge disparate vendor interfaces. LAMS (Lunar Autonomy and Mobility Simulation) addresses this gap with a high-fidelity, performant lunar simulation toolset compatible with the popular open MuJoCo engine and interoperable with NASA simulation environments through a SpaceFOM HLA interface. Real-time and faster-than-real-time performance is emphasized to support integrated large-scale moonbase simulations, human-in-the-loop testing, autonomous ML training, and Monte Carlo analysis. A modular upgrade path lets users trade fidelity for speed across the autonomy development lifecycle from early kinematic prototyping to high-fidelity terramechanics validation. Phase I delivers three integrated modules: Terrain (lunar terrain mapping and terramechanics models), Perception (south-pole lighting, IMU, and odometry), and HLA integration. Target markets include NASA's Lunar Surface Programs and commercial lunar payload providers, academic autonomy research, and terrestrial off-road autonomy applications.

Duration: 6