NASA STTR 2024-II Solicitation

Proposal Details

Proposal Number: T1.15-1037
Subtopic Title: Alternative Design Approaches for High Heat Flux Detonation Engines
Proposal Title: Multi-parameter measurements for thermal shock and thermo-mechanical loading in RDREs

Small Business Concern

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

Summary Details

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

Rotating Detonation Rocket Engines (RDREs) promise higher thermodynamic efficiency and reduced system complexity compared to traditional rocket combustors but present severe challenges in thermal management. Detonation-driven pressure and temperature spikes, strong axial variations, and unsteady boundary-layer disruption render standard tools such as the Bartz correlation unreliable for predicting wall heat flux under RDRE conditions. This effort develops a new and modified Bartz correlation derived from first principles, incorporating RDRE-specific parameters such as channel geometry and detonation-driven flow features. Extensive experimental work will be conducted at relevant rocket operating conditions, using calorimetry, multipoint probes, and fast-response sensors to capture steady and unsteady wall heat loads. These datasets will be leveraged to validate CFD simulations with conjugate heat transfer and to support reduced-order modeling approaches. The integrated experimental, analytical, and computational framework will establish a physics-based reduced order model for RDRE wall heat flux and provide practical tools for rapid thermal assessment. The results are directly aligned with ongoing NASA efforts in RDE thermal management model development and will enable robust cooling strategies and combustor design for future NASA missions.

Duration: 24

Proposal Details

Proposal Number: T3.04-1015
Subtopic Title: Advanced Low-Temperature Secondary Batteries
Proposal Title: Advanced Low-Temperature Capable Polymer Composite Electrolyte, Semi Solid-State Battery

Small Business Concern

Firm: SOLID ENERGIES INC
Address: 985 E. ORANGEFAIR LANE, ANAHEIM, CA, 92801-1104

Summary Details

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

In Phase I, SEI developed a breakthrough semi-solid-state lithium-ion battery (SSLiB) technology addressing critical limitations of conventional energy storage for aerospace/defense applications. Our advanced polymer composite electrolyte combines local high concentration electrolyte (LHCE) and high-entropy electrolyte design principles, enabling operational temperature ranging from -60Â°C to 70Â°C versus typical -20Â°C to 55Â°C for standard Li-ion batteries. In Phase II, SEI will focus on optimization/scaling up to full-scale prototypes of cells and system that can meet the requirements of targeted NASA applications. A scalable pilot-scale production will be established, and characterization along with potential transition into targeted NASA missions, setting a solid basis for technical commercialization; Technology Purpose: The innovation is projected to eliminate safety risks of flammable liquid electrolytes with exceptional performance; Funding Use: Based on Phase II, SEI will advance the technology from TRL 3-4 to TRL 6-7 through four objectives: (1) Further optimization on materials (e.g., electrolyte/electrodes) and SSLiB cells (>350 Wh/kg, >1000 cycles, temperature -70Â°C to +90Â°C); (2) Cell processing optimization and scaling-up (4.7V, 10-20 Ah); (3) Prototyping/evaluation of SSLiBs-based battery systems (28V, 20-40 Ah); and (4) Procedures for manufacturing. Target Markets: Addresses $1.6 billion market, with NASA applications representing compelling segment given extreme space mission operating conditions. Technology enables new mission profiles from extended Mars rover polar winter survival to maintenance-free lunar installations. Commercialization targets defense/aerospace initially, with automotive OEM

qualification beginning 2027. Deliverables: Complete battery systems (28V/20-40 Ah) with SSLiB pouch cells in fully functional configurations with integrated battery management and thermal control systems, ready for NASA testing in rover or other applications.

Duration: 24

Proposal Details

Proposal Number: T6.09-1003
Subtopic Title: Human-Autonomous System Integration for Deep Space Tactical Anomaly Response in Smart Habitats
Proposal Title: Cognitive Systems Engineering (CSE) Methods to Support Adaptive, Integrated Anomaly Response

Small Business Concern

Firm: Applied Decision Science, LLC
Address: 1776 Mentor Avenue, Cincinnati, OH, 45212-3596

Summary Details

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

In this Phase II project, we propose to develop systems engineering tools to aid decision makers in considering the tradeoffs associated with design decisions in the context of future deep space smart habitats. We highlight two innovations. The first innovation is the collaborative tradespace tool (CTT), designed to aid multidisciplinary decision-making teams in examining tradeoffs in the conceptual and preliminary design phases before CONOPs are well-defined and high-fidelity prototypes are built. The CTT builds on the systems engineering tradeoff study process framework, emphasizing dimensions critical to the introduction of autonomy and smart automation. These include system resilience, human performance, team coordination, and cognitive support. The second innovation is the adaptation of Work Models that Compute (WMC). WMC is a computational modeling and simulation framework; for this project it will be adapted for use as a discovery tool for envisioning the impact of different HMT configurations on coordination challenges and cognitive work. Our approach is based on the Integrated Cognitive Analysis (ICA) methodology; the CTT will streamline the ICA process to make it more practical and support integration into NASAs mission planning and decision-making processes. Phase II funds will be

used to iteratively develop and evaluate the CTT, and to adapt WMC to allow non-programmers to use simulations for envisioning anomaly response operations. These products align with NASAs need for systems engineering tools that support designing for FDIR events in the context of future smart habitats. Commercialization efforts will focus on integration into NASA planning and design for the Moon to Mars mission and other government agencies designing for the integration of autonomy and smart autonomation.

Duration: 24

Proposal Details

Proposal Number: T7.04-1011
Subtopic Title: Lunar Surface Site Preparation
Proposal Title: Optimization of Lunar Materials for Launch and Landing Pads

Small Business Concern

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

Summary Details

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

Outward Technologies, in partnership with the Colorado School of Mines, proposes the continued optimization and analysis of regolith berm structures on the Moon for preventing hazardous ejecta from escaping landing pad areas and damaging nearby surface assets. The project's primary goal is to deliver civil engineered designs of protective berms, constructed from bulk regolith, whose performance and construction feasibility are rigorously verified through advanced simulation, modeling, and physical experiments. These efforts will be achieved by maturing the Lunar Landing Pad Design Tool (LLPDT), a comprehensive, multi-scale simulation framework integrating high-fidelity coupled CFD-DEM models with computationally efficient pure DEM models for analyzing far-field ejecta transport and berm impact dynamics. Phase II funding will be used to validate these models against physical experiments conducted in near-vacuum environments using Particle Image Velocimetry and ejecta particle capture methods to generate requisite data on ejecta kinematics and berm erosion. The practicality of the optimized berm designs will further be confirmed through a robust robotic ConOps established and refined using advanced robotics simulations within a

high-fidelity digital twin to analyze and optimize the construction process to ensure that the proposed berms can be built efficiently by autonomous rovers. The final deliverable is an open-source, validated design tool (TRL 6) and a set of optimized landing site plans that are confirmed to be constructible. This directly enables NASA mission planners and Commercial Lunar Payload Services (CLPS) providers to design, evaluate, and implement safe, cost-effective lunar infrastructure to support the Artemis program and a permanent presence on the Moon.

Duration: 24

Proposal Details

Proposal Number: T7.05-1006
Subtopic Title: Climate Enhancing Resource Utilization
Proposal Title: Efficient, High Performance Solid Oxide Electrolysis Cell for Hydrogen Production

Small Business Concern

Firm: OxEon Energy, LLC
Address: 257 River Bend Way, North Salt Lake, UT, 84054-2986

Summary Details

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

The team of OxEon Energy, a small business concern (SBC) and the University of Dayton Research Institute (UDRI), the research institution (RI), proposed a Phase I project, under the STTR program, a pathway to increase the specific power and power density of a solid oxide electrolysis stack to deliver lighter and more compact electrolyzer systems for terrestrial and aerospace applications at a commercially competitive price. The proposed concept included new cell design options using advanced electrode compositions, and a flexible prototyping process of electrode deposition for rapidly screening optimal electrode structures. In essence, implementation of the proposed path would increase the current density of an operating stack at a given voltage, thereby providing NASA with compact and lightweight electrolysis stacks for production of power and propellant consumables from lunar and Martian resources; and provide lower cost electrolysis devices for terrestrial applications to combat environmental concerns through production of hydrogen for industrial use, and re-use and upgrading of captured carbon dioxide (CO2). The stack

technology inorporating high performance cells from the Phase II project will be based on the successful electrolysis stack that the team delivered for the Mars OXygen In-situ Resource Utilization Experiment (MOXIE).

Duration: 24

Proposal Details

Proposal Number: T8.06-1005
Subtopic Title: Quantum Sensing/Measurement and Communication
Proposal Title: Microchip laser-integrated 2D entangled photon sources

Small Business Concern

Firm: Nanohmics, Inc.
Address: 6201 E. Oltorf St., Austin, Texas, 78741-0000

Summary Details

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

Low size, weight, power, and cost (SWaP-C) and scalable quantum light sources are crucial for developing a variety of next-generation NASA quantum measurement and communication applications. Integrated quantum photonics, which miniaturizes optical quantum systems onto microchips, addresses these challenges by leveraging semiconductor manufacturing techniques and novel advanced materials. Nanohmics, Inc. and Professor Anton Malko at the University of Texas at Dallas are to develop a microchip integrated 2D entangled photon source based on a novel van der Waals (vdW) ultrathin nonlinear optical (NLO) materials. By combining the novel vdW ultrathin crystal with electrically pumped, microchip laser photonics, our quantum light source technology will potentially enable next-generation control of entangled photon pair generation on a microchip, with significant expansion potential for photonic quantum technologies due to the advantages of miniaturization and scalability. During Phase I, we demonstrated synthesis of large-area high-quality vdW NLO crystals and their photon pair generation around 810 nm. During Phase II, we will integrate the vdW NLO crystals with commercial-off-the-shelf microchip lasers to construct a prototype device and demonstrate high-brightness, entangled photon pair generation in an ultracompact microchip device format (~10x smaller than conventional spontaneous parametric down-conversion light source) with significantly low SWaP-C.

Duration: 23

Proposal Details

Proposal Number: T8.07-1002
Subtopic Title: Photonic Integrated Circuits
Proposal Title: Waveguide Integrated SNSPDs on Foundry Silicon PICs

Small Business Concern

Firm: memQ Inc
Address: 5235 S Harper Ct. 9th Floor, Chicago, IL, 60615-4241

Summary Details

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

memQ proposes to develop superconducting nanowire single photon detectors (SNSPDs) through back-end-of-line (BEOL) fabrication on the 300 mm silicon photonics platform at AIM Photonics. This addresses NASA's need for integrated photonic single photon detectors. Waveguide-integrated SNSPDs offer unparalleled performance in efficiency and timing precision, benefiting PIC-based technologies such as LiDAR, communications, quantum systems, and sensing. In Phase I, we successfully demonstrated process feasibility by fabricating an SNSPD on a foundry-produced photonic chip. Phase II will involve fabricating SNSPDs with a 3-inch wafer-scale BEOL process. A dedicated Multi-Project Wafer (MPW) tapeout from AIM's platform will focus on specific functional photonic devices with on-chip integrated SNSPDs. By the end of Phase II, this technology is expected to be ready for development as a component on AIM's platform, utilizing a BEOL process for SNSPD in another commercial foundry (SEEQC) specializing in superconducting thin-film deposition and devices. Using this technology, we will fabricate large-scale arrays of SNSPDs coupled to single-mode SiN waveguides operating in the telecom C-band and paired with on-chip photonic circuitry relevant for both classical and quantum optical communications. memQ's first targeted use of the developed SNSPD arrays is for integration with on-chip beam splitter for multiplexed Bell state analyzers needed in quantum networking.

Duration: 24

Proposal Details

Proposal Number: T8.07-1034
Subtopic Title: Photonic Integrated Circuits
Proposal Title: QPICS: Quantum Dot Photonic Integrated Circuits on Silicon

Small Business Concern

Firm: Aeluma, Inc.
Address: 27 CASTILIAN DR., SANTA BARBARA, CA, 93117-3026

Summary Details

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

Aeluma, in collaboration with the University of Delaware, proposes to advance Quantum Dot Photonic Integrated Circuits on Silicon Photonics (QPICS) by developing scalable, high-performance quantum dot (QD) lasers and semiconductor optical amplifiers (SOAs) directly compatible with foundry-level silicon photonics platforms. Building on successful Phase I results, Phase II will leverage Aelumas proprietary 12-inch MOCVD growth technology to achieve robust epitaxy of QD materials enabling high-throughput and cost-effective manufacturing. The program will integrate these QD gain elements into silicon photonics designed by the University of Delaware and establish the first active QD-based photonic process design kits (PDKs) for foundry offerings. NASA applications include space-qualified optical communications, astronomy, docking, ranging, and sensing, where QD devices reduce size, weight, power, and cost (SWaP-C) while delivering superior performance in harsh and extreme environments. Broader dual-use markets include defense LiDAR and secure free-space optical links to satisfy NASA's urgent needs in PIC deployment, and commercial sectors such as LiDAR for autonomous vehicles, datacom transceivers, AI/high-performance computing (HPC) optical interconnects, and future quantum communication systems. Phase II funding will support QD laser and SOA growth optimization, device fabrication and iterations, testing and packaging, silicon photonic integration, and prototype demonstrations, while engaging foundries to enable scalable manufacturing. By combining domestic 12-inch MOCVD capability at Aeluma, extensive IP, and proven Phase I feasibility, this effort will deliver NASA-relevant

prototypes and position the U.S. as a leader in advanced photonic integration for space, defense, and commercial markets.

Duration: 24

Proposal Details

Proposal Number: T9.03-1004
Subtopic Title: Low SWaP-C Terrain Mapping Sensor for Onboard Hazard Detection
Proposal Title: RASTR Ultra-Fast Smart LiDAR Sensor for Terrain Mapping

Small Business Concern

Firm: Astrobotic Technology
Address: 1016 N Lincoln Ave, Pittsburgh, PA 15233-2132

Summary Details

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

Astrobotics RApid Scanning Terrain Resolver (RASTR) sensor solution addresses the need for a low-SWaP active sensor capable of accurately scanning a target landing region to a resolution of 10cm or better in just 2 seconds. This enables lower cost planetary landers while providing hazard detection (HD) capabilities that enhance landing safety and mission assurance, including payload deployment onto the surface. Astrobotic is developing RASTR to reduce the amount of time and power needed generate accurate terrain maps in during lunar descent. Building a system to better optimize around an increased scanning speed and lower SWaP and cost is critical to reducing the barriers to entry for integrating this sensor type into commercial landers. Reducing this sampling time is critical because as the required scan resolution increases, the scan time increases by time squared. Existing space-grade HD sensor system components do not take advantage of economies of scale (e.g., the autonomous vehicle and drone markets), resulting in cost and lead times that limit adoption by commercial providers, such as those participating in NASAs Commercial Lunar Payload Services (CLPS) initiative. Astrobotic brings over a decade of direct experience with LiDAR sensor systems for the companys lunar landers, including an in-house hazard detection and avoidance sensor system. The company is providing its mature high-performance space-grade computing, flight-ready LiDAR processing algorithms, validated physics-based simulation and terrain modeling tools, and experience flight testing LiDAR systems. An on-chip ultra-fast frequency modulated

continuous wave (FMCW) LiDAR commercial product provides the basis for the developed sensor hardware. This hardware will be matured toward a path-to-flight and software for dynamic motion compensation and learning-based point cloud densification will be developed. RASTR hardware and software will be integrated and demonstrated over lunar analog terrain.

Duration: 24

Proposal Details

Proposal Number: T10.01-1001
Subtopic Title: Autonomous Target Identification and Sensor Optimization
Proposal Title: Autonomous Storm Detection and Tracking Using Random Finite Sets

Small Business Concern

Firm: ASTER Labs, Inc.
Address: 155 East Owasso Lane, Shoreview, MN, 55126-3034

Summary Details

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

Lightning storm observations are used in advanced weather models to predict and provide warning of severe weather. Current lightning observations gathered from geostationary orbit are static and not well resolved. Observations made from Low Earth Orbit (LEO) offer improved resolution and could take advantage of decreasing LEO assembly, launch, and operational costs. However, challenges are introduced in these lower orbits due to rapidly changing observing locations during transit and typically smaller field of view of sensors on smaller spacecraft. Thus, to achieve autonomous extended storm target tracking from LEO, ASTER Labs will develop innovative Random Finite Set (RFS)-theory-based software using measurement filtering methods that include the Gamma-Gaussian-Inverse Wishart with either Cardinalized Probability Hypothesis Density or Generalized Labeled Multi-Bernoulli filters, and newer Trajectory Set Theory-RFS filters. In Phase I, ASTER Labs team developed prototypical RFS-based algorithms to identify storms, quantify and narrow a Region of Interest (ROI), and output the global location of each ROI. The developed STORM Module software tool provides storm tracking on-orbit with RFS filtering for Complementary Metal-Oxide-Semiconductor imaging sensors. Predictive estimation of the storm dynamics is provided via a Neural Ordinary Differential

Equations model. The Phase II effort will focus on further enhancing the STORM Module and its RFS-based algorithms, while performing software simulations and hardware demos to assess the algorithms performance. Key STORM software components will be implemented in highly optimized, near-real-time form. In the integrated hardware demos, the STORM Module will be implemented onto a Field Programmable Gate Array to detect simulated lighting events using a camera controllable by a gimballed platform during simulated transit. The target market for the STORM Module is weather satellites operated by government or private entities.

Duration: 24

Proposal Details

Proposal Number: T10.05-1007
Subtopic Title: Integrated Data Uncertainty Management and Representation for Trustworthy and Trusted Autonomy in Space
Proposal Title: Cislune Integrated Trust in Autonomy (CITA)

Small Business Concern

Firm: Cislune Inc.
Address: 301 N Almansor St, Alhambra, CA 91801-2644

Summary Details

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

Cislune will deliver CITACislune Integrated Trust in Autonomy, an integrated, uncertainty aware decision support and trust calibration toolkit for Artemis tempo operations. We convert raw, multisource telemetry into decision ready guidance by performing Uncertainty Quantification (UQ), fusing single and multiple sources, and presenting adaptive explanations in Open Mission Control Technologies (OpenMCT) panels and SimMoon virtual reality (VR) scenarios. In Phase II we extend our Phase I prototype by fielding a Hardware in the Loop (HIL) Digital Twin (DT) of the RERASSOR lunar rover in a regolith test bin, adding lightweight physiological sensing, and demonstrating fusedUQ during a lunar traverse where an astronaut in a Lunar Terrain Vehicle (LTV) departs the Human Landing System (HLS) and must respond to a rising methane overpressure alert while return to base margins tighten. Use of funds: finalize the HIL digital twin and terrain ingestion pipeline; develop fusedUQ and sensitivity analysis (a

One tap Risk Preview that shows how route/speed affect safe return under uncertainty); implement provenance tags (source, last calibration, model version) and stream health anomaly monitors; build Open MCT widgets (Return by Time timeline with confidence bands, risk bars, and concise rationales); run human in the loop evaluations with the University of Central Florida; and deliver code, datasets, and a performance and gaps report targeting Technology Readiness Level (TRL) 5. Target markets: primary NASA Artemis, Gateway, and Commercial Lunar Payload Services (CLPS) surface and orbital ops (flight and ground). Secondary prime contractors and mission ops teams that need trusted autonomy for crewed EVAs, robotic caretakers, and uncrewed maintenance.
Tertiary other high consequence domains that supervise autonomous systems (defense robotics, advanced air mobility, critical infrastructure control rooms).

Duration: 24

Proposal Details

Proposal Number: T11.06-1016
Subtopic Title: Extended Reality (Augmented Reality, Virtual Reality, Mixed Reality, and Hybrid Reality)
Proposal Title: Operationally Modulating Neurophysiological Interface for Extended Reality (OMNI Cog XR)

Small Business Concern

Firm: Tietronix Software, Inc.
Address: 1331 Gemini Avenue, Suite 300, Houston, TX, 77058-2794

Summary Details

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

During long duration spaceflight, astronauts encounter cognitive and physiological challenges due to microgravity, confinement, isolation, and exposure to cosmic radiation. Expected cognitive challenges include altered sensory perceptions, disrupted circadian rhythms, and increased cognitive workload due to the demands of operating in a confined spacecraft environment and managing complex mission tasks. Additionally, prolonged exposure to microgravity can lead to muscle atrophy, bone density loss, cardiovascular deconditioning, and fluid shift-related issues, affecting astronauts' physical health and overall well-being. Artificial Intelligent Agents,

monitoring these crewmember conditions and tailoring human computer interfaces, including XR platforms, might be utilized to better monitor crewmember health and preserve mission performance where operator decrements are detected. To achieve this, Tietronix has partnered with Drs Benge and Chang at UT Austin Dell School of Medicine, bringing extensive clinical, neuropsychological, and real-world research experience needed to develop OMNI Cog XR for NASA. This UT lab has developed NIH funded passive monitoring smartphone applications that can identify digital markers of cognitive states and deploy therapeutic countermeasures as needed. Additionally, in Phase II Dr Brian Russell, a scientist/entrepreneur (inventor of the Zephyr) with experience in cognitive/fatigue monitoring for NASA, Space X and DoD clients, has joined the project team to lead spaceflight-relevant operational testing of our system in phase II. By combining UTs passive monitoring expertise, Tietronixs proprietary real-time biometric assessment platform, and spaceflight cognitive/fatigue monitoring expertise, we will achieve the first autonomously modulating XR human-machine interface that can drive optimized crewmember performance throughout the rigors of long duration spaceflight.

Duration: 24

Proposal Details

Proposal Number: T12.01-1005
Subtopic Title: Additively Manufactured Electronics for Severe Volume Constrained Applications
Proposal Title: Volume-constrained Additive Manufactured Polymers for Integrated Robust Electronics (VAMPIRE)

Small Business Concern

Firm: Nanohmics, Inc.
Address: 6201 E. Oltorf St., Austin, Texas, 78741-0000

Summary Details

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

This Phase II STTR project advances Nanohmics development of compact, printed piezoelectric force-torque sensors (FTS) for cryogenic environments, specifically designed for NASA applications. These multilayer sensors, fabricated using aerosol jet printing (AJP) of PVDF and PVDF-HFP nanofibers, integrate both

dâ,ƒâ,ƒ and dâ,ƒâ,7 piezoelectric modes to achieve high-sensitivity, multi-axis load detection in extreme temperature conditions down to 77. Phase I successfully demonstrated proof-of-concept devices with survivability through liquid nitrogen cycling and measurable electromechanical response during benchtop testing. Phase II will focus on refining the sensor architecture to improve sensitivity, dynamic range (1100), and time constant control through tunable thickness and layer configuration. A robust cryo-compatible sensor housing will be developed to ensure thermal isolation and mechanical durability, while low-noise, multiplexed signal acquisition electronics will be designed to support multi-sensor arrays. The project also includes full system integration into NASAs SPARTA testbed to validate TRL advancement under mission-relevant conditions. The technology targets both government and commercial markets. Immediate applications include force and torque sensing for robotic manipulation, sample handling, and mobility in NASA missions.
Broader commercial uses span the aerospace, robotics, and cryogenics industries, where compact, durable, and highly sensitive FTS solutions are critical. Phase II funding will support sensor maturation, packaging, electronics development, and validation testing, preparing the technology for commercialization and Phase III transition.

Duration: 24

Proposal Details

Proposal Number: T12.09-1000
Subtopic Title: Thermoplastic Composites for Repurposable Aerospace Applications
Proposal Title: In-Space Disassembly and Assembly of Thermoplastic Composite Structures with Embedded Carbon Nano-Heaters

Small Business Concern

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

Summary Details

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

Long-duration missions to the Moon, Mars and beyond require infrastructure to be constructed sustainably. There are significant logistical challenges in delivering heavy and large payloads to space due to limited launch capabilities. Mission-enabling

technologies such as communication antennas, solar arrays, thermal radiators, and telescope mirrors, require large-area support structures. The fundamental principle of electromagnetic waves dictates that the performance of these devices scales with their aperture. While the size demand for these satellite structures easily goes beyond tens of meters, current launch fairing diameter is limited to about 5 meters. Structures for sustained planetary presence are expected to be even larger. The mass constraint on launch vehicles is equally restrictive, with the cost of space launch to low Earth orbit ranging from $2,000/kg to $20,000/kg. Delivering materials and structures to space for building infrastructure presents a critical barrier to sustainable human presence. The proposed innovation is a robotic thermoplastic composites welding technology. The purpose is to enable disassembly and reassembly of large truss structures by unwelding and welding of composite joints in space. This capability allows repurposing of spacecraft components for other missions, achieving multi-use structures, and construction of large structures without the limit of launch fairing dimensions. The team will develop composite joints that are embedded with a resistance heater made of the same thermoplastic matrix as the adherend composite struts and a thin-film resistor. The embedded heater provides in-situ heating to bring the thermoplastic matrix to the processing temperature for bonding and debonding the joint-strut interface by mechanical forces. Intelligent robotic systems with capabilities of object manipulation, power delivery, and mechanical actuation will perform welding and structural reassembly to achieve reconfiguration of a truss.

Duration: 24

Proposal Details

Proposal Number: T12.09-1015
Subtopic Title: Thermoplastic Composites for Repurposable Aerospace Applications
Proposal Title: Thermoplastic based carbon fiber structural batteries for space technologies

Small Business Concern

Firm: Energized Composite Technologies, LLC.
Address: 3251 Progress Drive, Orlando, FL, 32826-3230

Summary Details

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

EzCT proposes to advance multifunctional energized carbon fiber reinforced thermoplastic structural battery panels that uniquely combine load bearing strength high energy storage and thermal reshaping capability for in mission repurposing. The purpose of this technology is to eliminate the longstanding separation between structural components and battery systems in aerospace platforms by creating a single integrated material solution. In Phase I EzCT demonstrated proof of concept panels at TRL 3 with 200 Wh/kg energy density tensile strengths exceeding 250 MPa more than 3000 charge discharge cycles, and the ability to retain over 90 percent of capacity after reshaping. These results establish a strong foundation for scaling aerospace grade prototypes. The requested Phase II funding will be used to scale the technology to 1 m Ã— 1 m structural panels and advance to TRL 5 through comprehensive qualification testing in NASA relevant conditions. Technical objectives include demonstrating consistent reshaping without performance loss validating electrolyte stability and thermal management and developing a blueprint for pilot scale manufacturing and cost model that support Phase III transition and commercialization. Target markets include NASA spacecraft lunar habitats Gateway and Artemis infrastructure, and Mars forward exploration systems where mass volume and adaptability constraints are critical. Beyond NASA the technology is positioned for commercial aerospace electric aviation, electric vehicles and defense platforms where structural batteries can considerably reduce mass in subsystems that traditionally combine separate structural elements and batteries. By providing cradle to grave utility from launch through surface operations EzCTs innovation directly supports sustainable exploration architecture while unlocking significant economic and performance advantages across multiple industries.

Duration: 24

Proposal Details

Proposal Number: T13.01-1005
Subtopic Title: Intelligent Sensor Systems
Proposal Title: Multimodal Wireless Piezoelectric Microsensors For Harsh Environments

Small Business Concern

Firm: INTEGSENSE INC
Address: 1421 S CULPEPPER DR, STILLWATER, OK, 74074-1856

Summary Details

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

IntegSense will create a prototype for its passive wireless miniaturized sensor tag technology, the feasibility of which was validated during Phase I. The prototype is based on piezoelectric MEMS technology and is ruggedized for operation in harsh environments. The proposed system provides temperature and pressure readings from hard to access locations via wirelessly communicating with a nearby (>20 ft. away) transceiver module at ISM 915 MHz band. The combination of the stress-free low-loss substrate and excellent energy confinement in the MEMS device enables reliable and accurate readings in cryogenic to high temperatures (beyond 800 C), under radiation, vibration/shock, Technology Purpose: This technology enables competitively long-distance measurement of physical parameters (temperature and pressure in this effort) in sub-GHz to few GHz range, which represents an optimal balance between antenna size and communication distance. The change in the frequency of the MEMS resonator responsive to the physical parameter provides a simple, battery-less digital readout. Intended Use of Funding: Device optimization for extending the maximum operation temperature and lifetime along with prototype development and implementation are the main objectives of the proposed effort. This funding would allow for design, fabrication, and comprehensive performance characterization of prototypes to reach toward a refined prototype for test and evaluation in relevant environment. Target Markets: Battery-less and wireless sensor solutions enjoy a vast market opportunity and are needed across many industries. While the compact, resilient, and modular nature of the proposed sensor technology makes its application range broad, the proposed effort aims to support NASAs rocket propulsion testing applications.

Duration: 24

Proposal Details

Proposal Number: T15.04-1009
Subtopic Title: Full-Scale (Passenger/Cargo) Electric Vertical Takeoff and Landing (eVTOL) Scaling, Propulsion, Aerodynamics, and Acoustics Investigations
Proposal Title: eVTOL Aircraft Subscale Disturbance Response Testing for Full-sized Vehicle Qualification

Small Business Concern

Firm: Continuum Dynamics, Inc.
Address: 34 Lexington Avenue, Ewing, NJ, 08618-2302

Summary Details

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

Advanced air mobility (AAM) seeks to develop a large-scale transportation system to revolutionize how people live and work in this century. Electric vertical take-off and landing (eVTOL) aircraft will form a central part of the AAM infrastructure due to reduced emissions and noise impact. An important aspect for eVTOL aircraft certification is safe urban operations, which requires understanding of the response due to aerodynamic disturbances. Experimental data are required to support eVTOL aircraft development with respect to flight dynamics and controllability, as well as design specification development. In Phase I, Continuum Dynamics, Inc. with teaming partners Pennsylvania State University and Alakai Technologies performed initial development of a generic subscale flight testing methodology for eVTOL aircraft including identification of aero-propulsion-control scaling relationships, comprehensive simulation of eVTOL flight dynamics and disturbance response characteristics, and development and testing of an 11% subscale AAM multicopter aircraft. These initial developments form a foundation for further development and refinement of the generic subscale testing methodology. Phase II developments will include establishing a custom subscale rotor design and fabrication workflow to tailor stability and control characteristics in lower Reynolds number environments; developing a flexible limited degree of freedom testing capability to permit investigation of hover, low-speed/transition flight, and non-standard conditions including emergency recovery and edge-of-envelope conditions; and evaluation of flight control/mixing methods to reduce aircraft gust sensitivity. Tests will be performed for an alternate AAM aircraft configuration (lift+cruise) although the methodology is intended to be flexible and can adapt to other aircraft configurations of interest.

Duration: 24