1. PURPOSE

This Statement of Objectives (SOO) defines mission need, objectives, desired outcomes, and constraints to enable industry to propose commercially viable and credible solutions for the advancement of critical Vertical Solar Array Technology (VSAT) subsystems.

NASA will actively engage with selected Offerors through ongoing technical engagement, milestone reviews, and Government insight and oversight activities to support assessment of technical progress, and achievement of program objectives. Offerors are expected to apply independent scientific and engineering judgment in selecting technical approaches and proposed solutions that best satisfy the objectives and outcomes defined herein.

See Appendix A for additional solicitation details.

2. BACKGROUND/MISSION NEED

NASA requires resilient, scalable, and long-duration surface power architectures to support lunar exploration, including mobility systems, habitats, and landers. Vertical Solar Array Technology (VSAT) is a critical component of this infrastructure. However, current VSAT systems cannot progress to a flight program without further maturing key components, as the overall system Technology Readiness Level (TRL) is constrained by its lowest-TRL subsystems (currently at TRL 4).

Furthermore, to prevent the need to oversize VSAT systems, the arrays must be able to flexibly share energy with other lunar assets during eclipses or low-generation periods. This requires integration into a standardized lunar microgrid. This research and development effort focuses on critical risk reduction, specifically targeting electrical system integration, thermal rejection, and external power exchange, to mature these systems for future mission adoption.

3. OBJECTIVES

The overall objective of this effort is to advance critical VSAT subsystems from a starting Technology Readiness Level (TRL) of 4 to a target TRL 5-6 through the system-level demonstrations in relevant ground environments. The scope of work described herein applies to all Contract Line Item Numbers (CLINs) under this Topic (see Section 6, Contract Structure, of the Appendix A). Successful efforts shall address the following key objectives:

3.1 **Objective 1 -** Electrical System Maturation: Demonstrate end-to-end electrical system integration to resolve existing vulnerabilities regarding power quality, reliability, redundancy, and monitoring/control.

3.2 **Objective 2 –** Thermal Control Resiliency: Develop and validate thermal control and rejection strategies capable of maintaining core avionics and electronics within survival and operational temperature limits during periods of extreme solar heating and lunar darkness.

3.3 **Objective 3 –** External Power Interoperability: Implement standardized external power interfaces to ensure VSAT interoperability with external lunar surface assets, providing a basis for a flexible, scalable operational power architecture.

4. PERFORMANCE OUTCOMES

Successful efforts shall achieve the following outcomes:

4.1 Power Exchange Capability: Demonstrate a VSAT external power exchange capability (multiple interfaces) that operates reliably on a standardized 120 Vdc, 6-kW hardware-rated interface.

4.2 Electrical Performance: Demonstrate integrated electrical system performance, explicitly validating power quality, fault tolerance, and system-level monitoring and control.

4.3 Cable Stability: Validate that the external power exchange interface meets all power-quality and stability limits across a 100-meter interface cable.

5. CONSTRAINTS AND SCOPE

The following in-scope and out-of-scope constraints apply to all proposed technical approaches. Offerors shall ensure their proposed technical approach strictly adheres to these boundaries. See Section 8.2, Evaluation Criteria, of Appendix A for further information on how compliance with these boundaries affects proposal scoring.

5.1 In-Scope: The following elements shall be considered in scope and included in this effort:

5.1.1 All proposed hardware and interface designs must comply with Lunar Power Exchange Interface Requirements (EHP-10069) Electrical Power System (EPS) requirements.

6. DELIVERABLES AND REVIEWS

Offerors shall propose deliverables and reviews appropriate to the maturity, scope, and technical approach of their proposed efforts. Deliverables are expected to provide sufficient technical evidence to demonstrate progress toward the stated objectives and outcomes. The desired deliverables and reviews of a successfully awarded contract include:

6.1 Demonstrations and supporting documentation validating advancements in system design, technology maturation, operational readiness, and risk reduction for critical technology elements and key interfaces of the Vertical Solar Array Technology (VSAT) system.

6.2 Technical reports and briefings documenting system design, hardware fabrication, integration, testing activities, performance characterization (e.g., power quality, thermal control/dissipation/heating, fault tolerance), and technical progress throughout the period of performance.

6.3 System characterization, build, and performance data supporting the assessment of system reliability, thermal stability, and full compliance with the Lunar Surface External Power Exchange (LSEPE) limits (e.g., demonstrating 120 Vdc, 6-kW capability across a 100-meter interface cable).

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6.4 Test reports documenting the end-to-end electrical, thermal, operational, functional, or environmental performance of the VSAT components or subsystems under simulated lunar environmental conditions (e.g., extreme external heating during sunlight, extreme cold during darkness) and anticipated fault scenarios.

6.5 Documentation describing the proposed pathway for advancing the Technology Readiness Level (TRL) of the demonstrated technology to a flight-ready program, alongside integration strategies to ensure VSAT interoperability with mobility systems, habitats, and landers for future NASA space applications.

6.6 Government insight activities, including technical interchange meetings, progress reviews, demonstrations, and site visits, as appropriate and coordinated with the Government, to support technical assessment, collaborative risk reduction, and programmatic visibility.

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