

SF254-D1204: Secure Multi-Source Data Fusion Environment for pLEO Constellations

ADDITIONAL INFORMATION

N/A

TECHNOLOGY AREAS:

Information Systems

MODERNIZATION PRIORITIES:

Space Technology

KEYWORDS:

pLEO; data fusion; secure environment; AI/ML; vendor sandbox; SDA; distributed operations; multi-vendor constellations; data ecosystems

OBJECTIVE:

The United States Space Force (USSF) seeks innovative solutions to develop and demonstrate a secure, adaptable software environment capable of ingesting, integrating, and analyzing high-volume, low-latency data streams from diverse space-based sources. This effort supports the Secure Multi-Source Data Fusion Environment for proliferated Low Earth Orbit (pLEO) Constellations topic and aims to deliver an extensible fusion platform that enables real-time situational awareness, advanced analytics, and dynamic mission adaptability across the Department of Defense's Proliferated Warfighter Space Architecture (PWSA).

Proposed solutions must support the integration of heterogeneous data types, enable rapid onboarding of new sensors and analytics tools, and facilitate secure, sandboxed evaluation of AI/ML-driven capabilities. The environment should be designed to enforce zero-trust security principles, maintain strict access controls and data sovereignty, and operate seamlessly across both physical and cloud-based infrastructures.

The architecture should allow for continuous scaling to accommodate growing mission needs, multi-vendor participation, and potential expansion to multi-level security environments and coalition operations. Priority will be given to solutions that enhance latency-sensitive decision-making, promote tool reusability, and align with SDA's broader objectives for resilient and interoperable battle management.

Ultimately, this effort will empower USSF and SDA to accelerate technology evaluation, reduce stovepiped workflows, and improve operational responsiveness across the evolving space enterprise.

ITAR:

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with section 3.5 of the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

DESCRIPTION:

The United States Space Force (USSF), through the Space Development Agency (SDA), is leading the development and deployment of the Proliferated Warfighter Space Architecture (PWSA)—a threat-driven, resilient constellation of satellites in Low Earth Orbit (LEO) that delivers global sensing and secure data transport at operational scale. At the heart of the PWSA is the Battle Management, Command, Control, and Communications (BMC3) Layer, which is responsible for enabling real-time tasking, automated decision-making, and timely kill chain execution in support of joint warfighter operations.

While various data fusion tools exist, few are designed to meet the scale, velocity, and multi-vendor integration demands of PWSA. This topic seeks innovative solutions to develop and demonstrate a secure, modular, and

extensible data fusion environment tailored to pLEO constellations and their evolving operational contexts. Proposed capabilities may include, but are not limited to:

- Real-time ingestion and fusion of diverse live or simulated data streams from PWSA assets
- Hosting AI/ML-driven analytics for mission applications such as anomaly detection, threat identification, and predictive situational awareness
- Establishing a secure sandbox framework to evaluate third-party tools in isolated environments with integrity and traceability
- Implementing zero-trust security principles, robust access controls, and data sovereignty enforcement to maintain resilience and continuity of operations

Solutions should be deployable in both cloud-based and on-premise environments, with a focus on core fusion infrastructure and sandbox functionality. Proposed architectures must enable rapid integration of new data sources, support future scalability to multi-level security and coalition use cases, and preserve government control over mission-sensitive data and tool access. This topic directly supports SDA's goal to enhance data-to-decision agility, accelerate tool evaluation, and enable a responsive, vendor-agnostic space mission architecture.

PHASE I:

This topic is intended for technology proven ready to move directly into Phase II. Therefore, Phase I awards will not be made for this topic. The applicant is required to provide detail and documentation in the Direct-to-Phase-II (D2P2) proposal which demonstrates accomplishment of a "Phase I-type" effort, including a feasibility study. This includes determining, insofar as possible, the scientific and technical merit and feasibility of ideas appearing to have commercial potential. It must have validated the product-mission fit between the proposed solution and a potential U.S. Air Force (USAF) and/or USSF stakeholder. The applicant should have defined a clear, immediately actionable plan with the proposed solution and the U.S. Department of Air Force (DAF) customer and end-user. The feasibility study should have:

1. Clearly identified the potential stakeholders of the adapted solution for solving the USAF and/or USSF need(s).
2. Described the pathway to integrating with DAF operations, to include how the applicant plans to accomplish core technology development, navigate applicable regulatory processes, and integrate with other relevant systems and/or processes.
3. Describe if and how the solution can be used by other U.S. Department of Defense (DoD) or Governmental customers.

PHASE II:

Phase II will focus on developing and demonstrating a secure, extensible data fusion environment tailored for deployment within a multi-vendor proliferated Low Earth Orbit (pLEO) constellation. This environment must support real-time integration of diverse data streams, scalable analytics, and secure third-party tool evaluation within a modular framework that aligns with future SDA and PWSA mission needs. Key deliverables may include:

- A functioning data fusion environment capable of ingesting and integrating at least two live or representative data streams in real time
- AI/ML-driven analytics addressing at least two operationally relevant use cases (e.g., anomaly detection, threat correlation, or predictive awareness)
- Full documentation of system architecture, onboarding procedures, and implemented security controls
- A secure, vendor-isolated sandbox environment for onboarding and evaluating third-party analytic tools, including the successful demonstration of at least one tool under auditability and strong isolation constraints
- Demonstration of deployed infrastructure (virtualized and/or physical) supporting the fusion environment
- Established performance benchmarks, along with a transition and scalability plan outlining how the solution can expand to incorporate additional data feeds, new analytic capabilities, and integration with coalition partners and multi-level security domains

Additionally, the Phase II effort will include implementation of robust access control mechanisms and zero-trust policy enforcement to ensure operational continuity, data sovereignty, and mission assurance in support of SDA's broader strategic objectives.

PHASE III DUAL USE APPLICATIONS:

Phase III efforts will focus on operationalizing, scaling, and transitioning the secure multi-source data fusion environment for proliferated Low Earth Orbit (pLEO) constellations into both government and commercial use. This includes maturing the platform to:

- Integrate additional and more complex data streams from diverse sources
- Expand support for multi-vendor access controls and third-party tool onboarding
- Enhance zero-trust security frameworks and policy enforcement mechanisms based on Phase II operational feedback
- Strengthen resilience, auditability, and interoperability with existing government systems

Additionally, Phase III will explore the commercialization potential of the architecture, including the delivery of classified innovation environments as a service to other U.S. government agencies and trusted industry partners. These secure sandboxes would enable rapid onboarding and evaluation of analytics tools and mission applications while maintaining strict data sovereignty and security compliance. The overarching objective is to transition the prototype into a sustainable, widely adopted capability that supports dynamic mission needs, accelerates vendor innovation, and offers scalable value across the national security space enterprise and adjacent commercial markets.

REFERENCES:

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3. PWSA Ground Layer Factsheet, Space Development Agency, 2024. <https://www.sda.mil/home/work-with-us/resources/>.
4. PWSA BMC3 Layer Factsheet, Space Development Agency, 2024. <https://www.sda.mil/home/work-with-us/resources/>.
5. Spaceport Data Fusion Initiative (SFDI), SBIR Award Abstract, 2024. <https://www.sbir.gov/awards/214564>.
6. AI-Enabled Operations, Palantir, 2022. https://www.palantir.com/assets/xrfr7uokpv1b/3A0y10xksgXENvRMNaAsUu/ed8f7f1ed534c0101f64536a85f7297b/Gotham_AI-Enabled_Operations_White_Paper.pdf.

TECHNICAL POINT OF CONTACT (TPOC):

None