NASA SBIR 2018 Phase I Solicitation

S5.06 Space Weather R2O/O2R Technology Development

Lead Center: GSFC

Technology Area: TA11 Modeling, Simulation, Information Technology and Processing

NASAâ€™s role under the NSWAP is to provide increased understanding of the fundamental physics of the Sun-Earth system through space-based observations and modeling, develop new space-based technologies and missions, and monitor space weather for NASA's space missions.Â This SBIR subtopic is intended to solicit new enabling technologies as part of NASAâ€™s response to this national objective. While this subtopic will consider all concepts demonstrably related to NASAâ€™s Research-to-Operations/Operations-to-Research (R2O/O2R) responsibilities outlined in the NSWAP, four broad areas have been identified for priority development:Â

- NASA supports the Community Coordinated Modeling Center (CCMC), located at GSFC, as a centralized government-run facility that hosts, maintains, and validates heliophysics models, some of which will become suitable for use by the space weather operations and forecasting community. Innovations solicited include modernization of the CCMC core infrastructure, the preparation and validation of existing science models in preparation for transition to operations, and ideas for future models tied to space weather forecasting needs. Proposals directly tied to NASA's NSWAP activities may be given priority. Â Infrastructure improvement proposals should be coordinated with NASA CCMC requirements and needs, and outline the process for implementation, mitigations to ensure continued community access to CCMC resources throughout the transition process, and flexibilities that allow for future integration of additional modeling tools, archives, or repositories. For example, the CCMC is interested in technologies that enable utilization of high-end computing architectures to optimize system performance for tasks such as â€œruns on request (RoR).
- The Heliophysics System Observatory (HSO) data archives include a vast array of spacecraft observations suitable for the development of space weather benchmarks, which are the set of characteristics against which space weather events are measured. Baseline benchmarks have been established or are nearing completion.Â Innovations to further refine these benchmarks are solicited, as are concepts for future creative approaches utilizing new data types or models that could become available. Proposals should address the feasibility and utility of establishing any newly proposed functional benchmarks, preferably in coordination with one or more of the participating NSWAP agencies.
- A particular challenge is to combine the sparse, vastly distributed data sources with realistic models of the near-Earth space environment. Â Innovations across the broad range of data assimilation techniques are solicited, with the long-term goal of enabling future tools and protocols for the operations community. Proposals should address requirements that:
    - Develop space weather applications or technologies desired by operational organizations that augment existing and future needs.
    - Include the ability to integrate data from assets which typically do not share similar time series, utilize different measurement techniques (e.g., imaging vs in-situ particles and fields), and are

distributed throughout the heliosphere.
    - Specify that new forecasting tools which can be straightforwardly validated by the CCMC or other equally robust validation methodology.
    - Examine the potential for integrating additional resources, such as ground based instrumentation e.g., USGS ground conductivity measurements which can be used to calculate geomagnetically induced currents.
- Heliophysics science relies on a wide variety of instrumentation for its research and often makes its data available in near-real-time for space weather forecasting purposes. Concepts are solicited for instrumentation concepts, flight architectures, and reporting systems that may be suitable for data assimilation into space weather monitoring and forecasting systems. This includes the miniaturization of existing systems and/or technologies deployable as an array of CubeSats. In order to be considered for investment, SBIR technologies should demonstrate comparable, or better, precision and accuracy when compared to the current state-of-the art.Â Further, SBIR instrument designs should avoid duplicating current NASA research spacecraft arrays or detector systems including those currently in formulation (e.g., SDO, Van Allen Probes, MMS, IMAP).Â

Proposals should demonstrate an understanding of the current state-of-the-art, describe how the proposed innovation is superior, and provide a feasible plan to develop the technology and infuse into a specific NSWAP activity.