NASA SBIR 2008 Phase I Solicitation

O2 Space Transportation

Achieving space flight can be astonishing. It is an undertaking of great complexity, requiring numerous technological and engineering disciplines and a high level of organizational skill. Overcoming Earth's gravity to achieve orbit demands collections of quality data to maintain the security required of the range. The harsh environment of space puts tight constraints on the equipment needed to perform the necessary functions. Not only is there a concern for safety but the 2004 Space Transportation Policy directive that states that the U.S. maintains robust transportation capabilities to assure access to space. Given this backdrop, this topic is designed to address technologies to enable a safer and more reliable space transportation capability. Automated collection of range data, and instrumentation for space transportation system testing are all required. The following subtopics are required to secure technologies for these capabilities.Â

Subtopics

O2.01 Automated Collection and Transfer of Launch Range Surveillance/Intrusion Data

Lead Center: KSC

Participating Center(s): GSFC, MSFC

NASA is seeking innovative technologies for sensors and instrumentation technologies which expedite range clearance by providing real-time situational awareness for safe Range operations from processing to launch and recovery. These sensors and instruments are expected to operate, as a payload, on mobile or deployable Unmanned Aerial Systems (UAS), High Altitude Airships (HAA), buoys, etc.

Purpose: NASA is embarking on a new era of space exploration with new launch vehicles and demands for availability to support launch times within hours of one another to ensure mission success. This availability requirement is allocated across the entire launch operations which includes the Range that provides clear corridor of land, air and sea for the vehicles to transit through, as they ascent or return. The current Range infrastructure is aging, labor intensive and independent, and would benefit from new sensors and instrumentation that improve the situational awareness to those that are responsible for ensuring public safety, mission assurance and efficient operations.

To aid in this situational awareness the new sensors and instrumentation must be able to operate in the environment that takes advantage of mobile or deployable Unmanned Aerial Systems (UAS), High Altitude Airships (HAA), buoys, etc. Use of these vehicles as a platform is intended to increase the Ranges availability while reducing the cost of operations. Size, power, weight and stability of these systems, that operate on these platforms, will be a major constraint their use.

These sensors and instrumentation provide for the remote detection, recognition, and identification of persons and

objects that have intruded into areas of the range that must be cleared in order to conduct safe launch operations. This would include a wide spectrum of optical, infrared, Radio Frequency (RF), and millimeter wave sensors for this purpose. In order to achieve accurate identification, time and position of intruding entities multiple sensors and instruments may be used, or combined through the use of neural networks and data fusion techniques. This will require the use of standards for communications, so that, data from individual sensors or instruments can be combined on a platform and processed on-board, or communicated to central location where a fused solution is processed.

Research should be conducted to demonstrate technical feasibility during Phase 1 and show a path toward a Phase 2 hardware and software demonstration and delivering a demonstration unit or software package for NASA testing at the completion of the Phase 2 contract.

O2.02 Ground Test Facility Instrumentation

Lead Center: SSC

Participating Center(s): GRC, MSFC

Ground testing of propulsion systems continues to be critical in meeting NASA's strategic goals. Advanced ground testing technologies and capabilities are crucial to the development, qualification, and flight certification of rockets engines. The ability to quickly and efficiently perform ground system certification greatly impacts all space programs. Proposals are sought in the following areas:

Instrumentation and Smart Sensors

Innovative network enabled sensors/instruments capable of providing data, a measure of the quality of the data, and a measure of their health are needed. Sensors may be wired or wireless. Smart instruments/sensors that enable improved rocket test operations must provide many of the following characteristics: simplify and standardize the configuration and maintenance of sensor systems; reduce integration time and errors; expedite fault identification, isolation, assessment, and recovery; facilitate reuse; contribute to improved system integration, decrease cabling mass; decrease costs associated with cable/connector fabrication; distribute computing resources; improve reliability and availability; reduce mean-time to recovery after a failure.

Current challenges include: computational power within the sensor to extract features of interest; full implementation of IEEE 1451 family of Smart Sensors and Actuators Standards (plug & play functionality); miniaturization; ease of adding/modifying software for continued evolution of the â€œsmart/intelligentâ€ capabilities.

Integrated Failure Detection, Isolation, and Recovery (IFDIR)

Innovative technologies are needed to enable implementation of affordable, modular, and evolvable IFDIR, including architectures, taxonomies, and ontologies; standards for interoperability; integration software environments; algorithms, approaches, and strategies for anomaly detection, diagnosis, prognosis; user interfaces for integrated awareness of system health and readiness for operations. IFDR must be achieved in the context of comprehensive and continuous vigilance.

Major challenges include software environments for integration, adherence to standards for interoperability, and validated algorithms/approaches/strategies for anomaly detection.