NASA SBIR 2017 Phase I Solicitation

A2.01 Flight Test and Measurements Technologies

Lead Center: AFRC

Participating Center(s): GRC, LaRC

Technology Area: TA12 Materials, Structures, Mechanical Systems and Manufacturing

NASA continues to see flight research as a critical element in the maturation of technology. This includes developing test techniques that improve the control of in-flight test conditions, expanding measurement and analysis methodologies, and improving test data acquisition and management with sensors and systems that have fast response, low volume, minimal intrusion, and high accuracy and reliability. By using state-of-the-art flight test techniques along with novel measurement and data acquisition technologies, NASA and aerospace industry will be able to conduct flight research more effectively and also meet the challenges presented by NASA and industry's cutting edge research and development programs.

NASA's Flight Demonstrations and Capabilities Project supports a variety of flight regimes and vehicle types ranging from low speed, sub-sonic electric propulsion, transonic civil transport, supersonic civil transport and hypersonic speeds for trans-atmospheric flight or space access vehicles. Therefore, this solicitation can cover a wide range of flight conditions and vehicles. NASA also requires improved measurement and analysis techniques for acquisition of real-time, in-flight data used to determine aerodynamic, structural, flight control, and propulsion system performance characteristics. These data will also be used to provide information necessary to safely expand the flight and test envelopes of aerospace vehicles and components. This requirement includes the development of sensors for both in-situ and remote sensing to enhance the monitoring of test aircraft safety and atmospheric conditions during flight testing.

Flight test and measurement technologies proposals should significantly enhance the capabilities of major government and industry flight test facilities comparable to the following NASA aeronautical test facilities:

- Aeronautical Test Range.
- Aero-Structures Flight Loads Laboratory.
- Flight Research Simulation Laboratory.
- Research Test Bed Aircraft.

Proposals should address innovative methods and technologies to reduce costs and extend the health, maintainability, communication and test techniques of these types of flight research support facilities.

Areas of interest emphasizing flight test and measurement technologies include the following:

- High performance, real time reconfigurable software techniques for data acquisition and processing associated with IP based commands and/or IP based data input/output streams.

- High efficiency digital telemetry techniques and/or systems to enable high data rate, high volume IP based telemetry for flight test; this includes Air-to-Air and Air-to-Ground communication.
- Improve time-constrained situational awareness and decision support via integrated, secure, cloud-based web services for real-time decision making.
- Prognostic and intelligent health monitoring for hybrid and/or all electric distributed propulsion systems using an adaptive embedded control system.
- Methods for significantly extending the life of electric aircraft propulsion energy source (e.g., batteries, fuel cells, etc.).
- Test techniques, including optical-based measurement methods that capture data in various spectra, for conducting quantitative in-flight boundary layer flow visualization, Schlieren photography, near and far-field sonic boom determination, and atmospheric modeling as well as measurements of global surface pressure and shock wave propagation.
- Measurement technologies for in-flight steady and unsteady aerodynamics, juncture flow measurements, propulsion airframe integration, structural dynamics, stability & control, and propulsion system performance.
- Miniaturized fiber optic-fed measurement systems with low power requirements are desirable for migration to small business class jets or UAS platforms.
- Innovative techniques that enable safer operation of aircraft.
- Wireless sensor/sensing technologies and telecommunication that can be used for flight test instrumentation applications for manned and unmanned aircraft. This includes wireless (non-intrusion) power transferring techniques and/or wirelessly powering remote sensors.
- Innovative measurement methods that exploit autonomous remote sensing measurement technologies for supporting advanced flight testing.
- Fast imaging spectrometry that captures all dimensions (spatial/spectral/temporal) and can be used on UAS platforms.

The emphasis of this work is on flight test and flight test facility needs. Aspects of specific development of the above technologies is also addressed as appropriate elsewhere in the NASA SBIR call.