NASA SBIR 2009 Phase I Solicitation

A4 Aeronautics Test Technologies

NASA has implemented the Aeronautics Test Program (ATP) within its Aeronautics Research Mission Directorate (ARMD). The purpose of the ATP is to ensure the long term availability and health of NASA's major wind tunnels/ground test facilities and flight operations/test infrastructure that support NASA, DoD and U.S. industry research and development (R&D) and test and evaluation (T&E) needs. Furthermore, ATP provides rate stability to the aforementioned user community. The ATP facilities are located at the NASA Research Centers, including at Ames Research Center, Dryden Flight Research Center, Glenn Research Center and Langley Research Center. Classes of facilities within the ATP include low speed wind tunnels, transonic wind tunnels, supersonic wind tunnels, hypersonic wind tunnels, hypersonic propulsion integration test facilities, air-breathing engine test facilities, the Western Aeronautical Test Range (WATR), support aircraft, test bed aircraft, and the simulation and loads laboratories. A key component of ensuring a test facility's long term viability is to implement and continually improve on the efficiency and effectiveness of that facility's operations. To operate a facility in this manner requires the use of state-of-the-art test technologies and test techniques, creative facility performance capability enhancements, and novel means of acquiring test data. NASA is soliciting proposals in the areas of instrumentation, test measurement technology, test techniques and facility development that apply to the ATP facilities to help in achieving the ATP goals of sustaining and improving our test capabilities. Proposals that describe products or processes that are transportable across multiple facility classes are of special interest. The proposals will also be assessed for their ability to develop products that can be implemented across government-owned, industry and academic institution test facilities. Additional information: http://www.aeronautics.nasa.gov/atp/index.html.

Subtopics

A4.01 Ground Test Techniques and Measurement Technology

Lead Center: LaRC

Participating Center(s): ARC, GRC

NASA is strategically positioning its ground test facilities to meet the future testing needs for our nation. NASA's aeronautics and space research and development pushes the limits of technology, including the ground test facilities that are used to confirm theory and provide validation and verification of new technical concepts. By using state-of-the-art test measurement technologies, data acquisition, testing techniques and enhancing facility performance, NASA will be able to operate its facilities more efficiently and effectively and also be able to meet the challenges presented by NASA's cutting edge research and development programs. Therefore, NASA is seeking highly innovative and commercially viable test measurement technologies, test techniques, and facility performance technologies that would increase efficiency, capability, productivity for ground test facilities.

The emphasis for this subtopic is in the area of test measurement technology. Examples of the types of technology solutions sought, but not limited to, are: skin friction measurement techniques; improved flow transition and quality detection methodologies; non-intrusive measurement technologies for velocity, pressure, temperature, and strain measurements; force balance measurement technology development; and improvement of current cutting edge technologies, such as Partical Based Velocimetry (LDV, PIV), Pressure Sensitive Paint (PSP), and focusing acoustic measurements that can be used more reliably in a production wind tunnel environment. Instrumentation solutions used to characterize ground test facility performance are being sought in the area of aerodynamics performance characterization (flow quality, turbulence intensity, mach number measurement, etc.). Areas of interest are in the subsonic, transonic, supersonic, and hypersonic speed regimes. Specialized areas may include cryogenic conditions, icing conditions, and rotating turbo machinery.

Proposals that lead to products or processes that are applicable specifically to the ATP facilities (see http://www.aeronautics.nasa.gov/atp) and across multiple facility classes are especially important. The proposals will also be assessed for their ability to develop products that can be used in government-owned, industry and academic institution aerospace ground test facilities.

A4.02 Flight Test Techniques and Measurement Technology

Lead Center: AFRC

Participating Center(s): ARC, GRC

NASA's flight research is reliant on a combination of both ground and flight research facilities. By using state-of-the-art techniques, measurement and data acquisition technologies, NASA will be able to operate its flight research facilities more effectively and also meet the challenges presented by NASA's cutting edge research and development programs.

The scope of this subtopic is broad, with emphasis on emissions, noise, and performance. Research technologies applicable to this subtopic should address (but are not limited to) the following ground and flight facilities at Dryden: Western Aeronautical Test Range (WATR), Flight Loads Laboratory (FLL), Research Flight Simulation Hardware-in-the-Loop Simulation (HILS), Test bed and Support Aircraft (e.g. F-15, F-18, ER-2, Gulfstream-III, and Ikhana). In addition to the facilities, the following generic capabilities are desired that pertain to any of a variety of types of vehicles ranging from low-speed, to high-altitude long-endurance to supersonic, to hypersonic and access-to-space.

- Modeling, identification, simulation, and control of aerospace vehicles in flight research, flight sensors, sensor arrays and airborne instruments for flight research, and advanced aerospace flight concepts.
- Safer and more efficient design of advanced aerospace vehicles requires advancement in current predictive design and analysis tools. The goal is to develop more efficient software tools for predicting and understanding the response of an airframe under the simultaneous influences of structural dynamics, thermal dynamics, steady and unsteady aerodynamics, and the control system. The benefit of this effort will

ultimately be an increased understanding of the complex interactions between the vehicle dynamics subsystems with an emphasis on flight research validation methods for control-oriented applications.

- Proposals for novel multidisciplinary nonlinear dynamic systems modeling, identification, and simulation for control objectives are encouraged. Control objectives include feasible and realistic boundary layer and laminar flow control, aeroelastic maneuver performance and load control (including smart actuation and active aerostructural concepts), autonomous health monitoring for stability and performance, and drag minimization for high efficiency and range performance.

- Real-time measurement techniques are needed to acquire aerodynamic, structural, control, and propulsion system performance characteristics in-flight and to safely expand the flight envelope of aerospace vehicles. This subtopic encompasses the development of sensors, sensor systems, sensor arrays, or instrumentation systems for improving the state-of-the-art in aircraft ground or flight research. This includes the development of sensors to enhance aircraft safety by determining atmospheric conditions. The goals are to improve the effectiveness of flight research by simplifying and minimizing sensor installation, measuring new parameters, improving the quality of measurements, minimizing the disturbance to the measured parameter from the sensor presence, deriving new information from conventional techniques, or combining sensor suites with embedded processing to add value to output information. These sensors and systems are required to have fast response, low volume, minimal intrusion, and high accuracy and reliability.

- This subtopic further solicits innovative flight research experiments that demonstrate breakthrough vehicle or system concepts, methodologies, technologies, and operations in the real flight environment and that are particularly related to separation and flow quality characterization in subsonic flight, shockwave propagation in supersonic flight, and small scale technology development in hypersonic flight. It further seeks advanced flight techniques, operations, and experiments that promise significant leaps in vehicle performance, operation, safety, cost, and capability; and that require a demonstration in an actual-flight environment to fully characterize or validate advances.

NASA is seeking highly innovative and viable research technologies that would increase efficiency or overcome limitations for flight research. Other areas of interest include: Verification & Validation techniques for non-deterministic and complex redundant systems; Design Tools integrated into the simulation environment for early research and validation; Flight Measurements & Data Acquisition; Skin Friction; Flight Hardened Systems & Miniaturization; Signal Processing & Reconfigurable Systems; Wireless technologies.