



NASA SBIR 2009 Phase I Solicitation

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.