NASA SBIR 2014 Phase I Solicitation

A4.01 Ground Test Techniques and Measurement Technologies

Lead Center: LaRC

Participating Center(s): AFRC, ARC, GRC

The Ground and Flight Test Techniques and Measurements topic supports the experimental modeling and simulation requirements of NASA's Aeronautics Research Mission Directorate from takeoff speeds to Mach 10, as well as the testing requirements of other government and commercial entities. The primary objective is to develop innovative tools and technologies that enhance measurement capabilities, improve ground and flight resource utilization, and provide capability sustainment. This year the primary emphasis is on ground testing requirements.

Wind tunnel vehicle design databases have traditionally included the foundational measurements of forces, discrete surface pressures, and discrete surface temperatures. However, designing and testing future vehicles with highly integrated and possibly distributed propulsion and flow control systems will require enhanced, remotely sensed global surface measurements to accurately define the vehicle performance and acoustic levels covering a wide range of operational conditions. Enhanced optical systems are required to visualize the flow interactions both on and off the surface. Non-intrusive measurement systems offering multi-component velocities, density, and pressure in the tunnel stream are required to routinely quantify and baseline the test environment and to establish boundary conditions for advanced computational simulations. Non-intrusive measurements of off-body and near-body flow parameters both at a point and globally (i.e., planar or volumetric) are necessary to examine fluid-fluid and fluid-structure interactions for computational solution validation. In all cases, significant measurement accuracy enhancements are required to achieve the revolutionary aircraft systems of the future. Measurement systems must be robust and user-friendly to achieve the level of utility required for practical and routine application. Clean seeding methods that do not contaminate anti-turbulence screens are required in the wind tunnel testing environment; seedless methods for velocity measurements are particularly desired. Compact measurement systems and analysis techniques with dual use capability in both ground and flight test environments are valuable, enabling smooth transition between each. Since wind tunnel test data must ultimately represent free-air conditions, techniques and/or analysis methods that can demonstrate and articulate novel ground to flight extrapolation methodologies are sought. In all cases, measurement methods that can significantly increase data capture per test point are desired, including the simultaneous measurement of multiple flow parameters. Accordingly, the topic solicits cutting-edge enhancements that significantly improve existing test and measurement capabilities, and enabling tools that provide new opportunities for aerodynamic and aerothermodynamic discovery for NextGen and high-speed transportation systems.

The contraction of the Nation's ground-based testing resources emphasizes the technological need to improve wind tunnel utilization. Advanced methods that aid pre-test planning, improve data collection, enhance visual display in a data rich environment, and provide rapid analysis are solicited.

With an aging and reduced workforce comes the challenge of capability sustainment. Tools and technologies are solicited that enable knowledge capture, offer ubiquitous training, and provide workforce agility.