NASA SBIR 2018 Phase I Solicitation

A1.08 Aeronautics Ground Test and Measurement Technologies

Lead Center: LaRC

Participating Center(s): ARC, GRC

Technology Area: TA15 Aeronautics

NASA's aeroscience ground test facilities include wind tunnels, air-breathing engine test facilities, and simulation and loads laboratories. They play an integral role in the design, development, evaluation, and analysis of advanced aerospace technologies and vehicles. These facilities provide critical data and fundamental insight required to understand complex phenomena and support the advancement of computational tools for modeling and simulation. The primary objective of the Aeronautics Ground Test and Measurements Technologies subtopic is to develop innovative tools and technologies that can be applied in NASA's aeroscience ground test facilities to revolutionize testing and measurement capabilities and improve utilization and efficiency. Of primary interest are technologies which can be applied to NASA's portfolio of large-scale ground test facilities [1]. For this solicitation, NASA seeks proposals for innovative research and development in the following areas:

- *Wind Tunnel Calibration and Characterization* - Capabilities for wind tunnel calibration and characterization are critical for overall enhancement of facilities and will play a critical role in achieving the CFD 2030 Vision [2]. Systems that can provide planar or volumetric measurements of flow quantities such as velocity, density, temperature, and pressure in the airflow upstream, around, and downstream of test articles are required to quantify tunnel inflow and outflow conditions and specify boundary conditions for numerical simulations.
- *Model Attitude, Position and/or Shape Sensing* - Measurements of test article attitude and position (e.g., roll, pitch, and yaw angles and spatial coordinates X, Y, Z of a wind tunnel model or other structure under test) are critical but are often difficult to make due to packaging constraints and model orientations where gravity based sensors are not applicable. To address some of these limitations, optical and non-optical techniques are needed to provide real-time or near real-time measurements of model attitude at data rates of up to 100 Hz and with sufficient accuracy (0.005± 0.0025 degrees in pitch 0.025±0.025 degrees in roll and yaw). For some applications, dynamic surface shape measurement techniques are needed at rates exceeding 10 kHz.
- *Technologies for Engine Simulators* - The need to assess aerodynamic performance at higher system levels with respect to fuel-burn and noise has created a great demand for propulsion-airframe integration (PAI) testing. Such tests use engine simulators which generate properly-scaled flows in the model. Currently, PAI tests can be quite expensive due to issues related to the integration of the simulator into the model, reliability, complexity of the calibration, and the high-pressure air and/or power which must cross the force and moment balance. NASA seeks innovative propulsion simulators that are more compact and capable of recreating the speed and volume of actual propulsion systems, including approach and landing conditions for the assessment of airframe noise. Hydraulic, pneumatic, electric, or hybrid approaches are solicited. NASA also seeks innovative measurement systems and techniques for monitoring and evaluating the performance of these simulators. Of interest are systems that can measure loads on individual blades

for studies involving boundary layer ingestion, and balances capable of transferring high pressure air and/or power across the balance and operating at high temperatures (up to 350° F).

In addition to the areas listed above, proposals for especially innovative measurement systems and techniques which are broadly applicable to common problems in aerodynamic ground testing will also be considered.

[1] https://www.nasa.gov/aeroresearch/programs/aavp/aetc/ground-facilities.

[2] https://ntrs.nasa.gov/search.jsp?R=20140003093.