NASA SBIR 2014 Phase I Solicitation

A3.04 Aerodynamic Efficiency

Lead Center: ARC

Participating Center(s): AFRC, LaRC

NASA is conducting fundamental aeronautics research to develop innovative ideas that can lead to next generation aircraft design concepts with improved aerodynamic efficiency. Innovative vehicle concepts are being studied with emphasis on MDAO methods that can simultaneously address complex interactions among aerodynamics, aeroelasticity, propulsion, dynamics, and controls. Modern aircraft development is a tightly coupled multi-disciplinary process designed to achieve as much efficiency as possible. There is an increasing interest in flight control technologies that can improve aerodynamic efficiency. Concepts such as performance adaptive aeroelastic wing shape control for drag reduction and circulation control for lift augmentation are potential aviation technologies that can contribute to the goal of aerodynamic efficiency. To realize the full potential of these technologies, tight coupling with vehicle dynamics and control should be emphasized. The vehicle-centric flight control perspective will enable an integrated approach that ensures complex vehicle interactions with new technologies are addressed. Areas of interest are performance adaptive aeroelastic wing shape control concepts that can:

- Tailor the spanwise lift distribution for optimal L/D throughout the flight envelope.
- Enable high-aspect ratio wing design with relaxed stiffness to reduce weight and drag penalties of non-lifting structures.
- Improve aerodynamic performance by enabling more efficient designs.

Specific subjects to be considered include but are not limited to:

- Novel control systems that can potentially reduce size, weight, and drag relative to the existing state-of-the-art, including concepts that can improve aerodynamic performance by exploring design options with relaxed static stability.
- Control laws and associated architectures that blend wing shape control for optimal L/D with performance, command tracking, and suitable handling and ride quality in all flight phases, taking into account aeroelasticity and flow physics as necessary.
- Measurement and instrumentation required to enable the control laws and architectures.
- Measurement, instrumentation, and/or estimation techniques for real-time identification of vehicle drag or L/D.
- Techniques to ensure robustness relative to measurement, estimation, and control uncertainty.