NASA SBIR 2017 Phase I Solicitation

A1.04 Aerodynamic Efficiency-Active Flow Control Actuators and Design Tools

Lead Center: LaRC

Participating Center(s): AFRC

Technology Area: TA15 Aeronautics

NASA's Aeronautical Research Mission Directorate (ARMD) has developed the Strategic Implementation Plan (SIP) that describes its research plan for advancing aeronautics research to meet the aviation industry's demands over the next 25 years and beyond. One element of the plan focuses on developing ultra-efficient commercial vehicles. Improved vehicle efficiency will be achieved by reducing fuel burn and emissions. Active flow control (AFC) is a technology that has the potential to aid in achieving the efficiency goals of the next two generations of commercial vehicles. Active flow control is the on-demand addition of energy into a boundary layer for maintaining, recovering, or improving vehicle performance. AFC actuation methods have included steady mass transfer via suction or blowing, and unsteady perturbations created by zero net mass flux actuators, pulsed jets, and fluidic oscillators. Previous wind tunnel and flight tests demonstrated that this technology is capable of improving vehicle performance by reducing and/or eliminating separation and increasing circulation. When integrated into a transport aircraft, therefore, AFC would result in smaller control surfaces creating less drag and thereby less fuel consumption during flight. Widespread application of the technology on commercial transports, however, requires that AFC actuation systems be energy-efficient, reliant, and robust. Another challenging aspect of the design of the actuation system involves understanding how and where to integrate the actuator into the vehicle. Computational tool development is needed, in parallel with actuator development, to enable a more synergistic approach to active flow control system design thus maximizing the potential benefits of an AFC system.

This solicitation is for innovative AFC actuator concepts and design tools, applicable to subsonic transports and/or civil aircraft that incorporate vertical lift capability, that take advantage of reduced order models to develop AFC actuators and AFC actuation systems that will aid in advancing AFC technology.

Areas of specific interest where research is solicited include but are not limited to the following:

- Development of simple, low-cost, and efficient tools for modeling AFC actuator performance.
- Development of design tools for optimizing AFC actuator system integration.
- Development of actuator concepts capable of controlling separation due to large adverse pressure gradients or shock/boundary layer interactions.
- Development of novel, energy-efficient, and robust actuation systems.
- Development of closed-loop active flow control systems with demonstrated improvements in AFC efficiency measured by the energy consumed by the AFC actuator.
- Experimental or computational studies that demonstrate the efficiency of a proposed actuation system.