NASA SBIR 2007 Phase I Solicitation

A1.04  Adaptive Flight Control

Lead Center: ARC

Participating Center(s): AFRC, GRC, LaRC

Small Business Innovative Research in adaptive flight control should address stability and performance, maneuverability, and safe landing of aircraft in adverse conditions (e.g., faults and failures, damage, and environmental upsets). This includes analysis and design methods for adaptive/intelligent reconfigurable control by developing practical and theoretic metrics. The approach must be able to address the following:

- Unmodeled dynamics (e.g., aeroelastic modes);
- Parametric uncertainty (e.g., stability and control derivative variations due to aerodynamic changes);
- Time-scale separation inherent in different actuators (e.g., slow engines as actuators);
- Nonlinear dynamic nature of the actuator response including time lag (e.g., engine variable spool-up time and actuator rate limiting);
- Stability of adaptive control methods in the presence of unmodeled dynamics and exogenous disturbances (e.g., wind shear and atmospheric turbulence).

Effective adaptive control methods need to be developed to mitigate multiple faults, failures, and damage conditions under uncertain (and potentially deteriorating) conditions. These methods include but are not limited to the following:

- Multi-objective adaptive optimal control;
- Aeroservoelastic mode filtering adaptive control;
- Direct adaptive control;
- Indirect adaptive control;
- Hybrid (direct and indirect) adaptive control.

These methods must be capable of achieving good performance (e.g., rise time, gain and phase margins, and command tracking) under adverse conditions while obeying system constraints (e.g., load limits and actuator rate saturation).

Innovative proposals are sought which can address the areas above and provide substantial improvements, in capability and range of applicability, over existing commercial technology.