



## **NASA SBIR 2011 Phase I Solicitation**

### **A1.13 Advanced Upset Protection System**

**Lead Center:** AFRC

**Participating Center(s):** ARC, GRC, LaRC

One of the common causes for Loss of control (LOC) is the crew's lack of awareness of the current energy state relative to the current mission phase and inappropriate response to a low or high-energy state. Technologies to prevent the development of an inappropriate energy state via manual aids and automatic approaches are crucial for the prevention of loss of control.

In large airplanes, energy management refers to the ability to know and control the complex combination of the aircraft's airspeed and speed trend, altitude and vertical speed, configuration, and thrust. For example, near-terminal operations (takeoff and landing) require precise control of airspeed to achieve optimum performance while maintaining safe stall margin, and altitude management is critical for approaches. The penalty for improper energy management can be de-stabilized approaches, excessive pilot workload leading to distraction, and ultimately inadequate altitude or airspeed to recover from a loss-of-control event (e.g., stall). Many loss-of-control incidents/accidents can be attributed to improper management of airspeed, especially those leading to aerodynamic stall or departure from controlled flight.

Under this research subtopic, an envelope protection system would be developed to prevent low and high energy states based on the aircraft's current mission phase objectives. The envelope protection system should investigate the automatic use of the propulsion system, landing gear and secondary flight controls to maintain energy state. Methods to display information on system status to the pilot should also be considered to prevent adverse pilot interaction with the envelope protection system. Use on both current and NextGen aircraft should also be considered.