NASA SBIR 2014 Phase I Solicitation

A1.03 Real-Time Safety Assurance under Unanticipated and Hazardous Conditions

Lead Center: LaRC

Assuring safety of flight under uncertain, unanticipated, and multiple hazards is a core requirement for aircraft loss of control prevention and for safety-assured autonomous aircraft operations. Sources of hazards include adverse onboard conditions (e.g., system failures, vehicle impairment or damage), external disturbances (e.g., turbulence, inclement weather, wake vortices), and abnormal flight conditions (e.g., abnormal attitudes/rates, unsafe/abnormal flight trajectories, stall/departure). Research is sought that supports real-time flight safety assurance in either of the following critical areas:

- *Real-time Flight Safety Management* - Assuring flight safety requires the real-time ability to assess impacts and risks of current or impending hazards, and to enforce minimum flight safety margins. Research in this area includes:
  - Definition of flight safety and its core components.
  - Development of methodologies and algorithms for predicting impacts and risks to flight safety (or one or more key components) of uncertain, unanticipated, and multiple hazards.
  - Development of a supervisory control system that ensures a minimum margin of flight safety under uncertain, unanticipated, and multiple hazards.
  - Evaluation of flight safety prediction and supervisory control algorithms using analysis, simulation, and/or experimental testing under a variety of hazardous conditions.
- *Real-time Sensor Integrity Management* - Assuring the integrity of information required for aircraft control is a core requirement in assuring flight safety. Research in this area focuses on assuring the integrity of flight dynamics and control parameters and includes:
  - Development of a methodology to utilize all available information from diverse physical and virtual sensors in order to rapidly detect, isolate, and mitigate erroneous behavior within a sensor or sensor suite in real time.
  - Utilization of information fusion across multiple sensors (physical and virtual) and algorithmic redundancy to estimate lost information from failed sensor(s).
  - Assurance of information integrity under turbulence, noise, and abnormal and highly nonlinear flight conditions associated with aircraft loss of control.
  - Evaluation of sensor integrity management algorithms and the integrated system using analysis, simulation, and/or experimental testing under a variety of hazardous conditions.