NASA SBIR 2005 Phase I Solicitation

A1.02 Aviation Safety and Security; Fire, Icing, Propulsion and Secure CNS Aircraft Systems

Lead Center: GRC

NASA is concerned with the prevention of hazardous in-flight conditions and the mitigation of their effects when they do occur. Aircraft fires represent a small number of actual accident causes, but the number of fatalities due to in-flight, post-crash, and on-ground fires is large. One particular emphasis is on early, false-alarm resistant detection of the location, spread, and suppression of in-flight fires in hidden, inaccessible areas of the aircraft. Examples of hidden areas are behind cabin panels, inside ductwork, and so on. Another area of interest is in-tank monitoring of fuel/air flammability factors to provide more efficient active control of fuel tank inerting systems.

A second emphasis for this subtopic is on propulsion system health management, in order to predict, prevent, or accommodate safety-significant malfunctions and damage. Past advances in this area have helped improve the reliability and safety of aircraft propulsion systems; however, propulsion system component failures are still a contributing factor in numerous aircraft accidents and incidents. Advances in technology are sought which help to further reduce the occurrence of and/or mitigate the effects of safety-significant propulsion system malfunctions and damage. Specifically the following are sought: propulsion health management technologies such as instrumentation, sensors, ground and on-wing nondestructive inspection, health monitoring algorithms, and fault accommodating logic, which will predict/prognose, diagnose, prevent, assess, and allow recovery from propulsion system malfunctions, degradation, or damage.

A third emphasis is to increase the level of safety for all aircraft flying in the atmospheric icing environment. To maximize the level of safety, aircraft must be capable of handling all possible icing conditions by either avoiding or tolerating the conditions. Proposals are invited that lead to innovative new approaches or significant improvements in existing technologies for in-flight icing conditions avoidance (icing weather information systems) or tolerance (airframe and engine ice protection systems and design tools). With these emphases in mind, products and technologies that can be made affordable and retrofittable within the current aviation system, as well as for use in the future, are sought:

- Ground and airborne radome technologies for microwave wavelength radar and radiometers that remain clear of liquid water and ice in all weather situations.
- *In situ* icing environment measurement systems that can provide practical, very low-cost validation data for emerging icing weather information systems and atmospheric modeling. Measured information must include location, altitude, cloud liquid water content, temperature, and ideally cloud particle sizing and phase
information. Solutions envisioned would use radiosonde-based systems.

- Ice protection and detection technology submittal must provide significant improvements over current systems or address new design needs. Areas of improvement can be considered to be: efficient thermal protection systems, including composite wing or structures applications, ice sensors that provide detection and accretion rate for all possible icing conditions, wide area ice detection, detection that serves both ground and in-flight applications, ice crystal detection probe (for non-research aircraft applications), engine icing probe (that can measure Liquid Water Content and Total Water Content inside engine passages), and de-icing systems that operate at near anti-icing performance. Any submittal must be cost competitive to current technologies.

A fourth emphasis for this subtopic is protection and hardening of the aircraft’s communication, navigation, and surveillance (CNS) systems, as well as enabling new aviation security applications through improved air-to-ground data link communications and secure onboard information processing, computing, and air/ground networking. Technology is needed to harden the CNS systems, both onboard and air-to-ground, against abnormalities and deliberate attacks towards also enabling the next-generation airborne, ground- and space-based surveillance systems. Other communications related needs can be found in other NASA SBIR subtopics areas.

The final emphasis for this subtopic is on propulsion damage adaptive controls technologies and systems for new aircraft security applications. This technology is needed to enable a propulsion system to mitigate aircraft damage from hostile attacks.