NASA SBIR 2017 Phase I Solicitation

A1.09 Vehicle Safety- Internal Situational Awareness and Response

Lead Center: GRC

Participating Center(s): AFRC, ARC, LaRC

Technology Area: TA15 Aeronautics

Achieving a vision for a safer and more efficient National Airspace (NAS) with increasing traffic and the introduction of new vehicle types requires increasingly intelligent vehicle systems able to respond to complex and changing environments in a resilient and trustworthy manner. Future air vehicles, especially autonomous vehicles, must operate with a high degree of awareness of their own well-being, and possess the internal intelligence to provide warning and potentially take action in response to off-nominal states. A vehicle's capability to independently assure safety may be the only recourse in some situations, and addresses the recurring issue of inappropriate crew response. Further, early warning of impending maintenance conditions reduces maintenance cost and vehicle down-time through improved vehicle availability and throughput. Understanding the vehicle state also has impact on vehicle performance, efficiency, and environmental impact. This Subtopic seeks technologies to enable intelligent vehicle systems with an internal situational awareness and ability to respond to off-nominal conditions for piloted vehicles augmented with autonomous capabilities, as well as increasingly autonomous unmanned air systems (excluding vertical lift vehicles).

Areas of interest include:

- Networked sensors and algorithms to provide necessary vehicle full-field state information ranging from the component level to the subsystem and system level.
- On-board hardware and software systems that are modular, scalable, redundant, high reliability, and secure with minimal vehicle impact.
- Information fusion technologies to integrate information from multiple, disparate sources and evaluate that information to determine health and operational state.
- Diagnostic and prognostic technologies that inform decision making functions with critical markers trending to unsafe state.
- Decision-making algorithms and approaches to enable trustworthy real-time operations, take preventive actions as needed in complex uncertain environments, and appropriately communicate status to other components of the NAS.
- Develop integrated systems technologies that enable the mitigation of multiple hazards, while effectively dealing with uncertainties and unexpected conditions.
- Develop approaches that combine improved inflight vehicle state safety awareness with adaptive methods to achieve improved efficiency, performance, and reduced environmental impact.
- Significantly enhance the fidelity and relevance of information provided to ground systems by the vehicle in-flight for use in on-demand maintenance.