A1.02 Integrated Resilient Aircraft Control

Lead Center: ARC
Participating Center(s): AFRC, GRC, LaRC

The overarching goals for the Aviation Safety topic are to develop technologies, tools, and methods to (1) improve the inherent safety attributes of new and legacy vehicles, and (2) overcome safety technology barriers that would otherwise constrain full realization of the Next Generation Air Transportation System.

The specific technologies, tools and methods emphasized in this subtopic are vehicle dynamics and hazards effects modeling and simulation methods for coupled hazard effects assessment; detection, identification and prediction methods for flight safety diagnostics and prognostics; control and guidance methods for hazard mitigation, control recovery, and vehicle autonomy under adverse and emergency conditions; robust design and risk analysis and mitigation methods; advanced control structures and materials for resilient control; instrumentation for intelligent sensing, monitoring, and control; validation methods for complex models and adaptive systems; and software safety assurance and formal verification methods for safety-critical systems, leading to multi-disciplinary analysis and optimization capabilities that enable the development and validation of system-level integrated resilient control technologies to provide graceful recovery from potentially catastrophic in-flight failures/damage, external disturbances, vehicle upsets, and system and control input errors; as well as effective vehicle-based flight/mission management under adverse, upset, and hazards conditions. Proposals are sought in the following areas:

Resilient Flight Control

- Fault tolerance and hazard effects protection
- Onboard hazard effects assessment, mitigation and control recovery

Resilient Propulsion Control

- Damage tolerance and design for extended envelope operation
- Onboard hazard effects assessment, mitigation and control recovery

Resilient Airframe Control

- Damage tolerance and structural damage avoidance
- Onboard damage detection and identification, mitigation and control recovery

Resilient Vehicle Mission Management
• Control and performance management
• Vehicle-based mission management and autonomous collision avoidance
• Interface and communication management

Safety-Critical Systems V&V

• Software safety assurance methods for complex avionics systems
• Integrated V&V methods, tools, and test techniques for adaptive control systems
• Predictive capability assessment methods and tools