A1.03 Technologies for Improved Aviation Security

Lead Center: LaRC

Participating Center(s): ARC

Following the attacks on September 11, 2001, NASA recognized that it now shared the responsibility for improving homeland security. The NASA Strategic Plan includes requirements to enable a more secure air transportation system and to create a more secure world by investing in technologies and collaborating with other agencies, industry, and academia. NASA's role in civil aeronautics has always been to develop high-risk, high-payoff technologies to meet critical national aviation challenges, and ensuring the security of the nation from terrorist attacks is a high priority national challenge.

NASA aims to develop and advance technologies that will reduce the vulnerability of the Air Transportation System (ATS) to threats or hostile acts, and identify and inform users of potential vulnerabilities in a timely fashion. Specific technical focus areas include system-wide security risk assessment and incident precursor identification; enhanced flight procedures and onboard systems to protect critical infrastructures and key assets and enable the safe recovery of a seized aircraft; definition of directed energy threats to the aircraft and on/off-board systems that will provide surveillance and countermeasures of these threats; integrated adaptive control systems to detect and compensate for vehicle damage; hardened and security-enhanced aircraft networks and data links; remote monitoring of the aircraft environment and systems; new materials for composite fire and explosive resistant fuselage structures; advanced, airborne, \textit{in situ} detection of chemical and biological terror agents; and commercial aircraft fuel tank inerting. Technologies under development are intended for the next-generation ATS, however, issues such as retrofitting, certification, system implementation, and cost-benefit analysis must be considered during the technology development process.

NASA seeks highly innovative and commercially viable technologies that will improve aviation security by addressing threats to air vehicles, as well as the ATS. Specific areas of focus include: preventing aircraft from being used as a weapon of mass destruction (WMD); protection from man-portable air defense systems (ManPADS) and electromagnetic energy (EME) attacks; light-weight, fire- and explosive-resistant composite materials; explosive resistant fuel systems, ground-based decision support tools needed to monitor airspace security concerns; reporting systems to monitor security violations; secure encrypted data link systems, intrusion-tolerant communications networks and communications systems to support emerging aviation security applications; tools to support real-time management of security information; and chemical and biological sensor development. Technologies may take the form of tools, models, techniques, procedures, substantiated guidelines, prototypes, and devices:
• Intelligent systems monitoring and alerting technologies;
• Technologies that enable secure communications, navigation, and surveillance onboard the aircraft;
• Secure communications systems to support emerging aviation security applications;
• Onboard and ground surveillance and interception systems for aircraft immunity to electromagnetic interference and electromagnetic pulse intrusions;
• Technologies and methods to provide accurate information and guidance to enable pilot avoidance of protected airspace, maintain positive identity verification of aircraft operators, determine pilot intent, and deny flight control access to unauthorized persons;
• Flight control systems that accommodate vehicle damage relative to changes in aircraft stability, control, and structural load characteristics;
• Material systems, fuselage structural concepts, and fuel systems that are resistant to fire and explosions;
• Fuel system technologies that prevent or minimize in-flight vulnerability of civil transport aircraft due to small arms or man-portable defense systems type projectiles;
• Decision-support tools and methods to improve communication, collaborative, and distributive decision-making;
• Data fusion technologies for integrating disparate sources of flight-related information;
• Computational approaches to monitoring crew health, stress level, state of duress, and performance; and
• Validation methods and tools for advanced safety and security critical systems.