A3 Airspace Systems

NASA’s Airspace Systems (AS) program is investing in development of revolutionary improvements and modernization for the air traffic management (ATM) system. The AS Program will enable new aircraft, new aircraft technologies, and air traffic technology to safely maximize operational efficiency, flexibility, predictability, and access into airspace systems. The major challenges are to accommodate projected growth in air traffic while preserving and enhancing safety; provide all airspace system users more flexibility and efficiency in the use of airports, airspace and aircraft; reduce system delays; enable new modes of operation that support the FAA commitment to "Free Flight" and maintain pace with a continually evolving technical environment, and provide for doorstep to destination transportation developments. AS Program objectives are: improve mobility, capacity, efficiency and access of the airspace system; improve collaboration, predictability and flexibility for the airspace users; enable modeling and simulation of air transportation systems; enable runway-independent aircraft and general aviation operations; and maintain system safety and environmental protection. NASA is working to develop, validate, and transfer advanced concepts, technologies, and procedures through partnership with the Federal Aviation Administration (FAA), other government agencies, and in cooperation with the U.S. aeronautics industry.

Subtopics

A3.01 Next Generation Air-Traffic Management Systems

Lead Center: ARC
Participating Center(s): AFRC

The challenges in Air Traffic Management (ATM) are to create the next generation system and to develop the optimal plan for transitioning to the future system. This system should be one that (1) economically moves people and goods from origin to destination on schedule, (2) operates without fatalities or injuries resulting from system or human errors or terrorist intervention, (3) seamlessly supports the operation of unmanned aerial vehicles (UAVs) or remotely operated aircraft (ROAs), (4) is environmentally compatible, and (5) supports an integrated national transportation system and is harmonized with global transportation. This can only be achieved by developing ATM concepts characterized by increased automation and distributed responsibilities. It requires a new look at the way airspace is managed and the automation of some controller functions, thereby intensifying the need for a careful integration of machine and human performance. As these new automated and distributed systems are developed, security issues need to be addressed as early in the design phase as possible.

To meet these challenges, innovative and economically attractive approaches are sought to advance technologies in the following areas:
• Decision support tools (DST) to assist pilots, controllers, and dispatchers in all parts of the airspace (surface, terminal, en route, command center);

• Integration of DST across different airspace domains;

• Next generation simulation and modeling capability—models of uncertainty and complexity, National Airspace System (NAS) operational performance, economic impact;

• Distributed decision making;

• Security of advanced ATM systems;

• System robustness and safety-sensor failure, threat mitigation, health monitoring;

• Weather modeling and improved trajectory estimation for traffic management applications;

• Role of data exchange and data link in collaborative decision-making;

• Modeling of the NAS;

• Distributed complex, real-time simulations—components with different levels of fidelity, human-in-the-loop decision agents;

• Integrated ATM/aircraft systems that reduce noise and emissions;

• Automation concepts for advanced ATM systems and methodologies that address transitioning to more automated systems;

• Application of methodologies from other domains to address ATM research issues;

• Intelligent software architecture;

• Runway-independent (e.g., Vertical Take-off Landing, Short Take-off and Landing, and Vertical/Short Take-off and Landing) aircraft technologies required to meet national air transportation needs, to satisfy requirements for airline productivity, passenger acceptance, and community friendliness, and autonomous operations;

• Automated, real-time detect, see, and avoid operations;

• Intermodal transportation technologies; and

• Each of the abovementioned technologies and other technologies specifically fostering the operation of unpiloted aircraft within NAS under control of the ATM system, including, but not limited to, innovative control, navigation, and surveillance (CNS) concepts; also considering high altitude, long endurance operations.