NASA SBIR 2006 Phase I Solicitation

A3.02  Next Generation Air Transportation - Airportal

Lead Center: LaRC

Participating Center(s): ARC

The airportal research of NASA's Airspace Systems (AS) Program focuses on key capabilities that will increase throughput of an airport runway complex and achieve the highest possible efficiencies in the use of airportal resources such as runways, taxiways, terminal airspace, gates, and aircraft servicing equipment. The primary capabilities addressed are: (1) Super-density operations, (2) Equivalent visual operations, and (3) Aircraft trajectory-based operations.

Super-density operations will entail reduced aircraft wake vortex separation standards and less restrictive runway/taxiway operations.

Equivalent visual operations will provide aircraft with the critical information needed to maintain safe distances from other aircraft during non-visual conditions, including a capability to operate at "visual performance" levels on the airport surface during low-visibility conditions.

Aircraft trajectory-based operations will utilize 4D trajectories (aircraft path from block-to-block, including path along the ground, and also including the time component) as the basis for planning and executing system operations.

NASA's AS Program has identified the following Next Generation Air Transportation System (NGATS) Airportal research activities: Optimization of surface traffic; Dynamic airport configuration management; Advanced technologies to detect and avoid wake vortex hazards; New procedures for performing safe, closely spaced and converging approaches at closer distances than are currently allowed; and Modeling, simulation, and experimental validation research focused on single and multiple regional airports. Inherent within the AS Program approach is the integration of wake vortex solutions within the overall surface management optimization scheme.

In order to meet these challenges, innovative and technically feasible approaches are sought to advance technologies in research areas relevant to NASA's NGATS-Airportal effort. The general areas of primary interest are Surface Management Optimization and Wake Vortex Hazard Solutions. Specific research topics for NGATS-Airportal include:
• Airborne spacing algorithms and wake avoidance procedures for airports with closely spaced runways;
• All-weather wake vortex sensors (includes sensor/data processing innovations and basic physics of wake vortex sensing);
• Automated separation assurance and runway/taxiway incursion prevention algorithms;
• Automatic taxi clearance and aircraft control technologies;
• Characterization of wake vortex and atmospheric hazards to flight in terms of aircraft and flight crew responses;
• Collaborative decision making between airlines and air traffic control tower personnel for optimized surface operations, including push back scheduling and management of airport surface assets;
• Dynamic airport configuration management;
• "Evaluator" integrated solutions for airportal management functions over multiple planning intervals;
• High resolution CFD and real-time modeling of wake vortex strength and location;
• High resolution measurement and/or prediction of terminal area atmospheric profiles (includes sensor and data processing innovations, weather forecasting, and the potential use of aircraft as sensors);
• Human/automation interaction and performance standards;
• Integration of decision-support tools across different airspace domains;
• Methodologies and/or algorithms to estimate environmental impacts of increased traffic on the surface and in the terminal airspace;
• Modeling and simulation of single airport operations for validating taxi planning concepts;
• Optimized 4D trajectory generation and conformance monitoring for surface and terminal airspace operations, including departure and arrival planning for individual flights;
• Scheduling algorithm for aircraft deicing and integration with a surface traffic decision-support tool;
• Surface and terminal airspace traffic modeling and simulation of multiple regional airports;
• Virtual towers;
• Wake vortex alleviation/mitigation technologies.