



NASA SBIR 2009 Phase I Solicitation

A3.02 NextGen Airportal

Lead Center: LaRC

Participating Center(s): AFRC, ARC

Airportal research focuses on key capabilities that will increase throughput of the airport environment, and that achieve the highest possible efficiencies in the use of airport resources such as terminal airspace, runways, taxiways, and gates. Of particular interest is the development of the following core capabilities within Airportal:

- Optimization of surface aircraft traffic;
- Dynamic airport configuration management (including the optimal balancing of Airportal resources for arrival, departure, and surface aircraft operations);
- Predictive models to enable mitigation of wake vortex hazards;
- New procedures for performing safe, closely spaced, and converging approaches at closer distances than are currently allowed;
- Modeling, simulation, and experimental validation research focused on single and multiple regional airports (metroplex);
- Other innovative opportunities for transformational improvements in Airportal/metroplex throughput.

Inherent to the ASP approach is the integration of airborne 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 Next Gen/Airportal effort. The general areas of interest are surface movement optimization, converging and parallel runway operations, safety risk assessment methodologies, and wake vortex solutions inside Metroplex boundaries. Specific research topics for Next Gen/Airportal include:

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- Human/automation interface concepts and standards for flight crews and air traffic control personnel specific to surface/airportal operations;
 - Integration of decision-support tools across different airspace domains;
 - Advanced technologies and approaches to achieving 2-3X improvement in the throughput of airports and metroplexes;
 - Automatic taxi clearance and aircraft control technologies;
 - Scheduling algorithm for aircraft deicing and integration with a surface traffic decision-support tool;
 - Collaborative decision making between airlines and airport traffic control tower personnel for optimized surface operations, including push back scheduling and management of airport surface assets;
 - Real-time assessment of the performance of surface operations;
 - Computationally efficient solution methods for surface traffic planning optimization problems;
 - Automation concepts and technologies for handling off-nominal situations and failure recovery mechanism;
 - Design of computer-human interface (CHI) for ground-based automated surface traffic management;
 - 4D taxi clearances and air-ground trajectory negotiation for landing aircraft;
 - Innovative concepts, technologies, and procedures for safely increasing throughput of runways, especially combinations of parallel, converging, and intersecting runways;
 - Innovative concepts, technologies, and procedures to maintain airport runway throughput under off-nominal conditions such as zero-zero ceiling and visibility;
 - Innovative ideas for very closely spaced parallel runway operations, including airborne spacing algorithms and wake vortex avoidance procedures;
 - Algorithms for determining wake vortex encounters from aircraft flight data recorders;
 - Wake vortex hazard research, especially: establishment of wake vortex encounter hazard threshold, encounter assessment tools, development of a wake vortex hazard metric, flight crew awareness and response techniques;
 - Fusion of data from weather sensors and models for automated input into atmospheric prediction models (e.g., Terminal Area Simulation System—TASS) used for assessments of atmospheric hazards to aviation and for initializing wake vortex prediction software;
 - Innovations in sensors for detection of wake vortices as well as with weather sensors in support of wake vortex predictions;
 - Measurements of wind, temperature, and turbulence from departing and arriving aircraft;
 - Radar simulation tools for wake vortices.

Note: The development of technologies for the airborne detection of wake vortices is covered in Subtopic A1.04.

