NASA SBIR 2011 Phase I Solicitation

A3.01   Concepts and Technology Development (CTD)

Lead Center: ARC

Participating Center(s): AFRC, LaRC

The Concepts and Technology Development (CTD) Project supports NASA Airspace Systems Program objectives by developing gate-to-gate concepts and technologies intended to enable significant increases in the capacity and efficiency of the Next Generation Air Transportation System (NextGen), as defined by the Joint Planning and Development Office (JPDO).

The CTD project develops and explores fundamental concepts, algorithms, and technologies to increase throughput of the National Airspace System (NAS) and achieve high efficiency in the use of resources such as airports, en route and terminal airspace. The CTD research is concerned with conducting algorithm development, analyses and fast-time simulations, identifying and defining infrastructure requirements, field test requirements, and conducting field tests.

Innovative and technically feasible approaches are sought to advance technologies in research areas relevant to NASA's CTD effort. The general areas of primary interest are:

Traffic Flow Management

- Flow management to mitigate large-scale climate disruptions, such as volcanic ash, or other natural disaster phenomena.

Super Density Operations

- Environmental and traffic efficiency metrics and assessments to compare different super-density operations concepts and technologies.

- Application of environmental and traffic efficiency metrics specifically for congested airspace or mixed

equipage scenarios.

- Cost-effective integration of advanced speed control capabilities into the cockpit to enable environmentally friendly super density operations.

Separation Assurance

- Develop and demonstrate a prototype capability to output real-time schedules (e.g., from Traffic Management Advisor) from current operational en route computers (e.g., ERAM and/or Host) to an external system to support trajectory-based operations research and simulation.

Trajectory Design

- Trajectory design and conformance monitoring for surface, terminal area, and en route.

- Trajectory implementation/execution in flight deck automation and automated air traffic control.

- Innovative methods to improve individual aircraft (surface, climb, descent and cruise) trajectories and air traffic operations to reduce the environmental impact.

Dynamic Airspace Configuration

- Flexible/adaptable airspace boundaries for NextGen operations in both en route and terminal airspace.

- Generic-airspace operations, including airspace design attributes and human factors considerations such as procedures and decision support tools.

- Tubes-in-the-sky operational concept development, including air/ground equipage requirements and design of a dynamic tube network.

- Dynamic airspace allocation to facilitate operations of UAVs and/or commercial space vehicles in the national airspace system .

Human Factors

- Design considerations for Tower/surface controller tools.

- Graphical user-interface systems for air traffic management/flight deck and ground-based automation simulation and testing applications.

Weather

- Common situational awareness between flight deck and ground automation systems for weather avoidance (may be related to 4D weather cube)

- Integrating weather products into decision support tools

- Airspace capacity estimation in presence of weather

- Means for creating realistic, consistent 3-D weather objects/imagery across numerous automation systems (e.g., a flight simulator out-the-window scene, cockpit radar display, airline operations weather display, ground radar image of the same weather object).

Atmospheric Hazards

- Development of wake vortex detection and hazard metric tools.

- Wake modeling and sensing capabilities implemented into the flight deck for airborne aircraft separation and spacing.

- Development of enroute wake turbulence identification and mitigation tools, processes, and systems.

- Novel, compact, and field-deployable laser remote sensing technologies for measuring meteorological parameters (e.g., wind, temperature, pressure, and turbulence) at ranges >1km in support of characterization of aircraft generated wake vortices.

Methods and Methodologies

- Algorithms and methods to satisfy multi-criteria design needs in air traffic management.

- Integrated hardware/software tool for accelerating general optimization tasks.

- Applying novel computing concepts to ATM problems.

- Experimental methodology, including scenario development, for incorporating rare events in realistic and dynamic human-in-the-loop air traffic management research, and methods for analyzing cause and effect in post experiment data.

- Stand-alone graphical user interface capabilities for data collection and processing of meteorological remote sensing technologies.

Other

- Derived sensor information from both ground-based radar trackers and ADS-B information for derivation of airspeed and local wind information.