NASA SBIR 2006 Phase I Solicitation

A1.01 Vehicle-Centric 4D Trajectory and Mission Management

Lead Center: ARC

NASA is concerned with creating new and innovative methods for airborne detection, identification and resolution of tactical hazards to aviation. These hazards may include weather and other atmospheric phenomena, terrain, traffic, aircraft system failures, and aircraft/operator interactions. Research proposals are sought in the area of 4D vehicle-centric trajectory and mission management, with emphasis on mission planning, external hazard response, and workload reduction.

The three major research areas covered by this subtopic are:

**Mission Planning**
Dynamic changes in an aircraft's tactical situation require rapid generation of a flight plan that best accomplishes a global set of mission goals. Mission management (MM) uses cost functions and any-time planning algorithms to produce feasible flight plans. The specific capabilities desired in this area are the generation and specification of 4D trajectories, and defining requirements and constraints (look-ahead time, ground system interface, aircraft system integration, etc.) related to the planning of such trajectories.

**Response to Detected External Hazards**
Sensing systems detect obstacles, weather and other constraints in the flight path; MM commands short-term trajectory change, with compensating downstream legs to minimize schedule impact. Capabilities expected from this research are automated decision making and path planning in the presence of external hazards, along with requirements for the creation of automation systems to accomplish such tasks.

**Workload Reduction**
On-the-fly generation of complex mission-driven flight plans for search patterns, data collection experiments, and tracking problems. Important activities in this area include design criteria and principles for the creation of pilot-flight deck automation interfaces and algorithmic approaches related to trajectory management.

Examples of outcomes NASA expects from these research areas are provided below (this list is not exclusive of other high-potential ideas):

- Automated trajectory generation capability given a short-to-medium term time horizon;
- A flexible input and interface capability for the flight deck in terms of widely varying constraints, goals, costs and supporting systems;
- Procedural and algorithmic methods of achieving mission management goals under different and varying constraints;
- Working interfaces that allow a pilot to view a 4D trajectory and accept or reject it, modify and retransmit a 4D trajectory uploaded from ground-based automation systems, or generate and trial plan a 4D trajectory
for air traffic control approval;

- Automated decision making and path planning capability that allows an aircraft to decide what particular actions are most appropriate to respond to specific situations, along with requirements for and analysis of the appropriate circumstances under which this capability should be exercised.