NASA SBIR 2011 Phase I Solicitation

A3.02 Systems Analysis Integration Evaluation (SAIE)

Lead Center: LaRC

Participating Center(s): AFRC, ARC

SAIE will provide systems level analysis of the NAS characteristics, constraints, and demands such that a suite of capacity-increasing concepts and technologies for system solutions are enabled and facilitated, integrated, evaluated and demonstrated. SAIE is responsible for characterizing airspace system problem spaces, defining innovative approaches, assessing the potential system-level benefits, impacts and safety.

Specific innovative research topics being sought by SAIE include:

Airspace System Level Concepts Development

- NextGen airspace system safety assessment, graceful degradation, fault tolerant, and recovery concepts and methodologies.

- System level capacity and environmental (e.g., CO_2, NOx emissions and noise) improvement concepts and assessments and methodologies.

- System level NextGen assessments, concepts and methodologies that incorporate and/or inform future vehicle and fleet designs.

- Autonomous and distributed system concepts.

- Concepts that study system-wide effects of various functional allocations.

- Revolutionary airspace system concepts, designs and methodologies.

Trajectory Modeling and Uncertainty Prediction

- Analysis of growth of uncertainty as a function of look-ahead time on different phases of flight.

- Development of methods to determine, for a target concept/system, the TP accuracy needed to be able to achieve the minimum acceptable system/concept performance as well as identify sources of errors.

- Development of methods for managing/reducing trajectory uncertainty to meet specified performance requirements.

- Identify critical aircraft behavior data for exchange for interoperability.

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

Roles and Responsibilities in NextGen

- Systems analysis concepts, assessments and methodologies to optimize air-ground and automation functional allocation for NextGen (e.g., functional allocation options between human/machine and among AOC, flight deck and service provider).

- Airspace systems-level concepts, assessments and methodologies using increasing levels of autonomy.

Modeling and Simulation (should be relevant to NASA Airspace Program objectives)

- Develop new methods that help in assessing and designing airspace to improve system level performance (e.g., increase capacity, reduce complexity, optimize or improve performance of the air transportation network architecture).

- Explicit methodologies relevant to applications can include:

  - Rigorous predictive modeling of uncertainty in various parts of the system and its propagation.

  - Multiobjective decision making algorithms for all aspects of decision making and optimization in the system.

  - Model/dimension reduction for improved computational tractability.

  - Methods for managing multiscale phenomena in the NAS.

  - Methods for quantifying and managing complexity and uncertainty.

  - Methods for assessing the necessary balance between predictability and flexibility in the system, especially in the presence of autonomy.