Integration of Advanced Concepts and Vehicles into the Next Generation Air Transportation System

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NASA Research Announcement (NRA) Description
Goal and Objectives

- **Goal:** Based on a user perspective, help inform future research related to NextGen by NASA and the broad aeronautics community

- **Objectives:** Research the issues associated with deploying new or advanced air vehicles within NextGen in order to:
  - Understand how advanced vehicles will operate within NextGen
  - Understand the tradeoffs involved for both vehicles and the ATM system
  - Indicate the most productive areas for future research, including further development of a modular analysis infrastructure
Approach

• The study will examine the interactions, impacts, safety concerns, and tradeoffs among the air traffic system, characteristics of advanced vehicles, and the operation and performance of NextGen

• The approach encompasses the following:
  – Select and describe a set of advanced vehicles that could be operating in the 2025 NextGen
  – Develop procedures describing the operation of these vehicles within the NextGen ConOps
  – Identify and address the safety issues associated with each set of procedures
  – Conduct modeling and analyses to determine the impact of the procedures and vehicles on the operation of NextGen and the tradeoffs involved
Procedures for Advanced Vehicles in NextGen

• The study will develop and analyze procedures to accommodate advanced aircraft in NextGen, describing how these vehicles will operate and constraints imposed by NextGen requirements and concepts.

• Procedures will include a detailed description of how each type of vehicle will operate, including:
  – Air traffic management
  – Flight trajectories
  – Safety assurance
  – Terminal operations
  – How operation of NextGen and its performance will be affected by each type of vehicle.

• Procedures should flow from the ConOps, attributes of the vehicles, and performance desired by the users.

• Procedures should cover a broad range of weather, traffic density, and other conditions, and could vary according to these conditions.
Examples of vehicles to be considered include:

- Very light jets
- Very large transports
- Uncrewed aerial systems
- Supersonic transports
- Rotorcraft
- Vertical and short landing and takeoff (V/STOL) aircraft
- Space launches
- Other unconventional aircraft

Examples of relevant vehicle attributes to be considered:

- Vehicle operational envelope
- Sensitivity to weather effects (turbulence, icing, temperature, winds)
- Maneuver limitations
- Sensitivity of performance and fuel efficiency to altitude and other factors
- Runway requirements
- Departure and approach constraints (e.g., climb and descent limitations)
- Environmental impacts (noise and emissions)
Safety Assessment

• Safety is an integral part of NASA aeronautics research and this NRA

• Study should include a safety assessment that addresses potential safety issues associated with the vehicles and procedures
  – Identification of potential risk
  – Relative likelihood
  – Potential severity
  – Mitigation strategies and their effectiveness
  – Potential impacts and tradeoffs versus performance
  – Additional insights into future operations or shortfalls in current practice
Analysis of Tradeoffs

- Intent is to gain insight into effective procedures and tradeoffs, not to downselect strategies or procedures.

- Analysis of the procedures will focus on tradeoffs among:
  - Efficient operation of NextGen
  - Effective use of the advanced vehicles
  - Impact on other users of the airspace
  - Modifications to the vehicles to accommodate safe and efficient operation of NextGen
  - Modifications to the NextGen ConOps to accommodate safe and efficient employment of the vehicles

- Analysis should be informed by modeling results, quantitative analyses, and other methods.

- Analysis should be linked to generic attributes, so that the results can be applied to other types of vehicles.
Analytical Models

- Use or adapt existing models as much as possible
- When new or modified models are needed, they should be developed as part of the study
- Analysis structure should remain compatible with the key performance metrics and structure established for NextGen
- The metrics selected for the analysis should relate to JPDO-developed NextGen metrics, but could reflect a greater level of detail (JPDO “What?” versus NASA NRA “How?”)
NASA-sponsored Models

- A number of models are available, including
  - Airspace Concept Evaluation System (ACES)
  - Air Traffic Operations System (ATOS)
  - Future Airspace Concept Evaluation Tool (FACET)
Implications for Future Research

• Key issues for further research should flow from the conduct of the study
• These will include:
  – Topics for which further knowledge needs to be developed
  – Limitations on the study that resulted from the lack of additional knowledge or analysis tools
  – Recommendations and rationale for further development of models and other analytical techniques
  – How recommended models would support the development of a modular infrastructure to better understand the effects of technology on development of NextGen
Study Considerations (1)

- Broad viewpoints are desired
- Multiple aspects require a broad range of capabilities
  - Air traffic management/control
  - Advanced vehicle concepts and operations
  - Safety methodology
  - Systems analysis, modeling, and simulation
- Capture best candidate concepts and ideas
- Intent is to understand issues, not to downselect concepts and procedures
Study Considerations (2)

- Tasks include workshops to engage interested parties
  - Review study approach and results
  - Afford opportunities for interaction with stakeholders
  - Broaden the perspective and knowledge base of the study
  - Provide opportunity for coordination with parallel studies on critical NextGen trades

- Build on prior and ongoing research, including models that have been brought to bear

- Coordinate effort with other relevant studies, including JPDO-sponsored trade studies
Summary
Key Points

• Focus is on interactions among operating procedures, characteristics of advanced vehicles, and the NextGen ConOps
• Intent is to understand impacts and tradeoffs and their implications for NASA research, not to downselect specific procedures
• Safety is an essential consideration
• Study schedule necessitates use or adaptation of existing models as far as possible
• Knowledge dissemination and engagement of interested parties is an integral part of the effort
• Teaming is encouraged
• Desired outcomes are:
  – Improved understanding of operations under NextGen
  – Knowledge to help inform future research by NASA and the broader aeronautics community
  – A path to a modular analysis infrastructure for examining NextGen technologies
## Key NRA Information

<table>
<thead>
<tr>
<th>Expected budget</th>
<th>$6M</th>
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<tr>
<td>Maximum duration of awards</td>
<td>18 months</td>
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<tr>
<td>Expected date for solicitation</td>
<td>Late Aug.- early Sept. 2007</td>
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| Key deliverables | • Interim report on approach and early results  
                  • Publishable final report  
                  • Workshops to review approach and study results     |
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