

Request for Information

General Information

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1. Background

The NASA Aeronautics Research Mission Directorate has recently restructured NASA's aeronautics research into three separate programs: *Airspace Systems*, *Aviation Safety*, and *Fundamental Aeronautics*. The specific purpose of this Request for Information (RFI) is to solicit external interest in collaborative, public-private research partnerships under NASA's Airspace Systems Program:

Airspace Systems Program: The top-level goal of this program is the development of high capacity, efficient, and safe airspace and airportal systems that will enable the Next Generation Air Transportation System (NGATS), as defined by the Joint Planning and Development Office (JPDO).

While not part of this RFI, separate RFIs will also be issued for two other NASA aeronautics research programs:

Fundamental Aeronautics Program: The top-level goal of this program is the development of system-level, multi-disciplinary capabilities for both civilian

and military applications. This program provides long-term investment in research to support and sustain expert competency in critical core areas of aeronautics technology.

Aviation Safety Program: This program will build upon the unique safety-related research capabilities of NASA to improve aircraft safety for current and future civilian and military aircraft, and to overcome aircraft safety technological barriers that would otherwise constrain the full realization of the Next Generation Air Transportation System. This program will also provide long-term investment in research to support and sustain expert competency in critical core areas of aviation and aircraft safety.

2. Description

Under this RFI, NASA solicits interest primarily from industry to collaborate at the systems level in Airspace Systems. NASA seeks to enter into research collaborations that benefit both industry and NASA and intends to use its authority under the National Aeronautics and Space Act of 1958, as amended (“Space Act”), to enter into non-reimbursable agreements where each party funds its own participation in the research effort. One or more agreements are anticipated and will be negotiated on a case-by-case basis. Responses from individual or industry teams, including existing or proposed consortia, are encouraged. Of particular interest are industry consortia to help NASA develop a research portfolio that will lead to revolutionary system level capabilities that can be feasibly implemented to enable the NGATS. While academia may respond to this RFI, it is anticipated that a NASA Research Announcement (NRA) soliciting participation by educational institutions and companies engaged in basic research will be issued in early 2006.

This RFI seeks information from potential sources that have an interest in non-reimbursable collaborative R&D activities that address future and emerging airspace capacity and airportal issues in support of the NGATS. The Airspace Systems Program is addressing these issues through the NGATS Airspace Project and NGATS Airportal Project that will leverage core capabilities in adaptive air-ground and air-air automation, airspace/airportal simulation and modeling, experimentation and validation, and systems analysis and integration. See **Appendix A** for additional detail on the Airspace Systems Program and each project.

NASA intends to provide long-term support for the project areas discussed above, to focus its resources on fundamental airspace and airportal technology, and to build upon that investment to develop system-level, multidisciplinary technologies that will enable the NGATS. The RFI solicits proposals that complement NASA’s fundamental technology developments by extending the work to a system-wide level, including operational considerations.

Consistent with the Space Act, a key element of the restructured aeronautics program is to ensure that the nation's aeronautical expertise and unique facilities are maintained as national assets for the benefit of both the civilian and military aeronautics communities.

3. Process

NASA Headquarters oversees the Aeronautics Research Programs and implementation occurs principally at four NASA field centers (Ames Research Center, Dryden Flight Research Center, Glenn Research Center, and Langley Research Center). In Fiscal Year 2006 a four-step process will be used to define the aeronautics research programs:

Step 1: Assess the long-term research needs and goals in the Airspace Systems Program and establish technical roadmaps to accomplish those goals. In developing those roadmaps, prioritize according to NASA's unique strengths and capabilities. Establish multi-center, multidisciplinary teams across the NGATS Airspace and NGATS Airportal projects. These roadmaps will be discussed further at the 44th American Institute of Aeronautics and Astronautics (AIAA) Aerospace Sciences Meeting and Exhibit, January 9-12, 2006 in Reno, Nevada.

Step 2: Solicit information through this RFI on the key areas of interest from the external community and determine potential areas to form collaborative arrangements.

Step 3: Develop research proposals by the field centers in each of the two thrust areas and establish NASA research teams. The responses to this RFI will provide important source material to the NASA proposal teams to be used in establishing specific collaborative partnerships as part of their proposals to NASA Headquarters.

Step 4: NASA intends to issue NASA Research Announcements (NRA, see NASA Federal Acquisition Regulation Supplement Part 35) to solicit proposals for foundational research in areas where NASA needs to enhance its core capabilities. Foundational research is defined as research that furthers our fundamental understanding of the underlying principles associated with complex airspace problems. NASA anticipates that educational institutions, non-profit organizations and industry engaged in foundational research will be the primary recipients of awards under the NRA.

4. Information for Respondents

4.1 How to Respond

NASA anticipates providing additional information about its Aeronautics Research Programs on or about January 12, 2006, at the AIAA conference in

Reno, Nevada. NASA also anticipates providing this additional information on the following website: www.aeronautics.nasa.gov.

The website above will be used to post information about, or modifications to, this RFI. Prospective respondents are urged to periodically check this web site for updates.

Respondents are requested to provide a description of a proposed non-reimbursable partnership between NASA and industry. Responses shall describe: (1) the respondent's team and expertise, key personnel and capabilities, and the R&D collaboration approach and areas of interest; (2) respondent's facilities and resources (including test data) to be provided as part of the collaboration; and (3) what is expected or requested of NASA as part of the collaboration (including Government facilities or other resources). Partnerships will be limited to US companies.

The proposal must be a maximum of five (5) pages, with minimum 12-point Times font. All proposals shall clearly indicate which one of the two thrust areas in the Airspace Systems Program is addressed in the proposed partnership, by placing the name of one program thrust (either "NGATS Airspace" or "NGATS Airportal") in the upper right hand corner of each page in your proposal. All proposals shall include an e-mail address for the point-of-contact in order to expedite communications. All questions posed by email shall get a response.

Please submit all responses in electronic format to the Point-of-Contact listed below by **NOON Eastern Standard Time, January 31, 2006**:

Name: Dr. John Cavolowsky
Title: Deputy Program Manager for Technical Integration,
Airspace Systems Program
Phone: 650-604-4434
Email: rfi_asp@nasa.gov

Questions regarding this RFI should also be addressed to the above Point-of-Contact.

4.2 Evaluation Factors

The evaluation process NASA intends to use for selecting collaborative partnerships (under non-reimbursable Space Act Agreement[s]) has been designed for this RFI. Respondents are reminded that this process does not involve the procedures set forth in the Federal Acquisition Regulation (FAR) nor the NASA FAR supplement since this announcement will not result in the award of a contract, grant, or cooperative agreement.

Responses will be assessed on the following evaluation factors:

- Overall responsiveness to furthering the goals of this RFI, in particular the objectives and results-oriented goals of NASA's Airspace Systems Program.
- Technical confidence in the research proposed under the collaborative activity.
- Management confidence in the structure and management of the proposed collaborative activity.

The NASA Point-of-Contact referenced in Section 4.1 will provide the RFI responses to the NASA planning lead of the thrust area identified by the respondent. Based upon assessment of the responses, as part of the process of submitting proposals under Step 3 (see "Process" above), the planning leads may contact RFI respondents to finalize terms and conditions of agreements.

4.3 General Information

4.3.1 Proprietary or Confidential Information

Respondents are NOT to provide any information that is considered proprietary, trade secrets, or privileged or confidential.

4.3.2 Intellectual Property

Intellectual property rights between NASA and collaboration partners can be negotiated to fit the goals of the parties. Under NASA's standard approach, title to inventions remain with the respective inventing parties without any exchange of rights unless otherwise agreed. Proprietary data developed and provided by the collaboration partner to NASA remains proprietary. NASA takes no rights in background inventions or data developed prior to or outside of collaborative agreements under this RFI.

NASA requires that consortia and teams agree to intellectual property rights among members prior to finalizing terms and conditions of a non-reimbursable Space Act Agreement.

Respondents to this RFI may comment on this general approach and/or suggest alternate approaches to intellectual property rights between NASA and the partner.

4.3.3 Compliance with U.S. Laws, Regulations, and Policies

Proposals must comply with all applicable U.S. laws, regulations and policies.

4.3.4 Use of Government Resources

In support of this RFI, the Government will consider requests from respondents for Government furnished resources and technologies. Requests for use of

Government equipment, facilities or services should be provided to the Point-of-Contact for this RFI.

4.3.5 Period of Performance

The Government anticipates that proposed research collaborations under Space Act Agreements will have an initial period of performance of five (5) years, unless otherwise agreed to by the parties

4.3.6 RFI Issuance and Response Selection

NASA will not issue paper copies of this RFI. NASA reserves the right to select for negotiations all, some, or none of the proposed collaborative partnerships in response to this RFI.

APPENDIX A: Information on AIRSPACE SYSTEMS

NASA has defined a four-level approach to technology development and integration and will conduct research across each of these levels to address evolving air transportation system challenges: At Level 1, NASA will conduct foundational research to further the fundamental understanding of the underlying physics and an ability to model that physics. At Level 2, NASA will leverage the foundational research to develop technologies and analytical tools focused on discipline-based solutions relative to next generation airspace and airportal issues. At Level 3, NASA will seek to integrate multi-disciplinary methods and technologies to balance solutions across disciplines. At Level 4, NASA will build upon results from activities in Level 1 through Level 3 to support the development of high capacity, efficient, and safe airspace and airportal systems that will enable the Next Generation Air Transportation System (NGATS), as defined by the Joint Planning and Development Office (JPDO).

The Airspace Systems Program is dedicated to the mastery and intellectual stewardship of airspace and airportal foundational research and discipline-based technology development for the nation. NASA will focus the research in areas that are appropriate to the Agency's unique capabilities. NASA research is long-term and cutting edge and is both focused and integrated across disciplines. NASA will invest broadly and deeply in integrated solutions for a safe, efficient, high-capacity airspace system in the air and on the ground at Levels 1 and 2, our key investment areas. It is anticipated that collaborative activities with industry partners will occur mainly at Level 3 and 4 in a manner to identify and optimally address emerging and future airspace and airportal issues associated with enabling the NGATS.

The interaction with the aeronautics and aviation capacity community at the systems level (Levels 3 and 4) is unique because NASA does not build or implement air traffic management systems. NASA looks toward collaborations associated with system-level design and operation to ensure our ability to provide integrated solutions for safe, efficient, high capacity airspace and airportal systems. NASA intends to collaborate with industry consortia to provide value to industry of a more enduring nature, rather than immediate problem solving.

Collaboration at the lower levels of research is also possible; however NASA anticipates focusing a significant portion of its core competencies and resources to these research areas and will be interested in research by others that fill gaps and deficiencies in NASA research.

A.1 ADDITIONAL INFORMATION ON AIRSPACE SYSTEMS & COLLABORATION INTERESTS

The following five technology development areas describe the objective, anticipated results and potential investment areas for the NGATS Airspace Project and the NGATS Airportal Project: (1) The “Evaluator”; (2) Four-dimensional (4-D) trajectory operations; (3) automated separation assurance; (4) dynamic airspace configuration; and (5) super-density surface and terminal area traffic optimization.

A.1.1 The Evaluator: Research is needed to develop a software-based concept developed by the JPDO called the “Evaluator” to support a future decision-making environment in the air and on the ground. The Evaluator is expected to employ 4-D trajectory proposals from all airspace and airportal users, assess them for compatibility with airspace system capacity, and produce conflict-free trajectory contracts. The Evaluator will continually update the contracts with position and intent data for each aircraft in the National Airspace System (NAS). Users will be able to view projected and actual conflicts and negotiate their resolution in real time. Air traffic management service providers will be able to plan airspace configurations and allocate resources in real time based on changing needs. Based on a set of jointly determined rules, the service provider will also provide final arbitration decisions when users are unable to resolve conflicts.

A.1.2 Four-dimensional trajectory-based operations: Research is needed to develop systems, tools, and procedures for using time-based flight paths from beginning-to-end (including ground segments) to improve system efficiency while maintaining safety, security, and environmental compatibility. Research is needed to produce real-time 4-D trajectory calculations to meet multiple objectives (separation assurance, time, fuel efficiency, low emissions, etc.). Solutions must also integrate the Evaluator and 4-D trajectory-based operations with safe surface traffic optimization tools and systems.

A.1.3 Automated separation assurance: Research is needed to develop systems, tools, and procedures to delegate separation assurance functions to automatic systems on the ground and in the cockpit, thus offloading controllers to focus on solving strategic control problems, optimizing traffic flow during changing weather conditions, accommodating pilot requests for route changes, and other events. Solutions must integrate automated separation assurance methods with centralized and de-centralized control, and enable the use of automated separation to accommodate mixed equipage operations. Methods are needed to predict, detect and resolve conflicts; prevent runway incursions; and ensure graceful degradation and recovery from failure of automated separation in a centralized and/or de-centralized system. Research is also needed to balance arrivals and

departures in terminal airspace.

A.1.4 Dynamic airspace configuration: Research is needed to develop a new framework for airspace allocation that no longer relies on navigational aids and sectors, and instead allocates airspace as a resource to meet demand while meeting safety and environmental requirements. Methodologies are needed for quickly designing airspace configurations to accommodate user trajectories while dynamically reconfiguring airspace in real-time during daily operations. Airspace configurations will be driven by national security and defense requirements (Departments of Defense and Homeland Security), domestic and international user needs, special-use airspace requirements, safety, environmental compatibility, and NAS efficiency.

A.1.5 Super-density surface and terminal area traffic optimization: Research is needed to develop distributed air-ground solutions that safely integrate surface and air portal traffic optimization tools and systems with the Evaluator and 4-D trajectory operations. Solutions must support equivalent visual operations in all conditions. Super-density surface and terminal area traffic optimization will leverage adaptive air-ground automation tools to enhance ground-operation situational awareness, traffic flow management tools to improve throughput, collaborative decision making tools to enhance efficiency, and runway incursion prevention tools to maintain safety. Other tools are necessary to balance arrivals and departures and enable dynamic terminal airportal configurations. Other tools for detecting and avoiding wake vortices with greater accuracy and precision are needed to enable significant reductions in separation between aircraft during take off and landing while minimizing environmental impacts

A.2 PROJECTS

Consistent with those NGATS technology development areas, the Airspace Systems Program will focus on two major projects: **NGATS Airspace** and **NGATS Airportal**. The projects are organized by domain requiring substantially similar discipline capabilities to provide their unique deliverables. To that end, fundamental capabilities developed in one project will be leveraged for the benefit of the other to make efficient use of Airspace Systems Program resources. Deliverables from each project will be integrated for gate-to-gate solutions. Prioritization of specific research activities associated with each project will be vetted with the JPDO.

A.2.1 NGATS Airspace Project: This project addresses the following technology development areas as defined by the JPDO:

- The Evaluator at a strategic NAS-level;
- 4-D trajectory-based operations at a strategic NAS-level;
- Automated separation assurance; and
- Dynamic airspace configuration.

COLLABORATION INTERESTS: In order to address these technology development

areas, NASA seeks industry collaboration on system-level capabilities in the following areas:

Integrated Adaptive Air and Ground Automation Concepts and Technologies:
Traffic flow management, separation assurance, collaborative decision-making, shared situational awareness, centralized and/or distributed control, air-to-ground and air-to-air information sharing, dynamic airspace design, and 4-D trajectory operations and performance-based operations.

Airspace Modeling and Simulation: Tools development, multi-agent modeling, advanced concept modeling, safety and failure analysis, and fast-time simulation.

System Analysis and Integration: Airspace requirements definition; integration and architecture; and system engineering and analysis.

A.2.2 NGATS Airportal Project: The NGATS Airportal Project will address technology development in three areas:

- The Evaluator at the terminal and airport surface level;
- 4-D trajectory-based operations at the terminal and airport surface level; and
- Super-density surface and terminal area traffic optimization.

COLLABORATION INTERESTS: In order to address these technology development areas, NASA seeks industry collaboration on system-level capabilities in the following areas:

Integrated Adaptive Air and Ground Automation Concepts and Technologies:
Traffic flow management, separation and spacing assurance, collaborative decision-making, shared situational awareness, wake and other hazard definition, efficient and safe wake spacing, runway incursion prevention, closely spaced parallel approaches, arrivals and departures balancing, dynamic terminal and airportal configurations, surface traffic optimization, and integrated regional airportal accessibility and design.

Airportal Modeling and Simulation: Tools development, multi-agent modeling, advanced concept modeling, safety and failure analysis, and fast-time simulation.

System Analysis and Integration: Airportal requirements definition; integration and architecture; system engineering and analysis.