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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA) HEADQUARTERS
AERONAUTICS RESEARCH MISSION DIRECTORATE
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RESEARCH OPPORTUNITIES IN AERONAUTICS – 2013
(ROA-2013)

NASA RESEARCH ANNOUNCEMENT (NRA): NNH13ZEA001N

SOLICITING BASIC AND APPLIED RESEARCH PROPOSALS

CATALOG OF FEDERAL DOMESTIC ASSISTANCE (CFDA) NUMBER: 43.002

ISSUED: December 18, 2012

PROPOSALS DUE

STARTING NO EARLIER THAN January 28, 2013

THROUGH NO LATER THAN September 30, 2013

RESEARCH OPPORTUNITIES IN AERONAUTICS (ROA) – 2013

EXECUTIVE SUMMARY

This NASA Research Announcement (NRA), entitled *RESEARCH OPPORTUNITIES IN AERONAUTICS (ROA) – 2013*, solicits foundational research in support of the Aeronautics Research Mission Directorate (ARMD), National Aeronautics and Space Administration (NASA). This NRA covers a variety of topics in aeronautics fundamental research that are being pursued by NASA personnel. Specific research thrusts are outlined in the Appendices. A major focus of this NRA is to encourage collaboration between other organizations and NASA to help achieve specific goals in a variety of foundational aeronautics research programs.

Details for award scope are provided for each project task area listed in the Appendices. Awards will be made as grants, cooperative agreements or contracts, depending on the nature of the proposing organization and/or program requirements. It is anticipated that the majority of awards will be cooperative agreements or contracts due to the expected collaborative nature of the work specified in the technical appendices. Section D of the *NASA Guidebook for Proposers* (<http://www.hq.nasa.gov/office/procurement/nraguidebook>) provides a discussion regarding funding mechanisms. The typical period of performance for an award is three years, although a few programs may specify shorter or longer (maximum of five years) periods. Note that it is generally NASA's policy to conduct research with non-U.S. organizations on the basis of no exchange of funds. Details of the solicited program elements along with any changes or modifications to any of these guidelines will be specified in the descriptions in the Appendices of this solicitation. Proposal due dates are given in Tables 2 and 3 which are located at the end of this NRA.

RESEARCH OPPORTUNITIES IN AERONAUTICS (ROA) – 2013

TABLE OF CONTENTS

SUMMARY OF SOLICITATION

	Page
I. Funding Opportunity Description	1
(a) Strategic Goals of NASA’s Research Program	1
(b) NASA’s Aeronautics Research Mission Directorate Programs	2
(c) References to Unique NASA Capabilities	3
(d) NASA Safety Policy	3
(e) Availability of Funds for Awards	3
(f) Changes from ROA-2011	3
II. Award Information	4
(a) Funding and Award Policies	4
(b) Successor Proposals and Resubmissions	4
III. Eligibility Information	5
(a) Eligibility of Applicants	5
(b) Number of Proposals and Teaming Arrangements	5
(c) Cost Sharing or Matching	6
IV. Proposal and Submission Information	6
(a) Proposal Instructions and Requirements	6
(b) Content and Form of the Proposal Submission	7
(i) Electronic Proposal Submission	7
(ii) Proposal Format and Contents	8
(iii) Additional ROA Requirement for Budget Format	9
(iv) Submission of Proposals via NSPIRES, the NASA Proposal Data System	11
(v) Submission of Proposals via Grants.gov	13
(vi) Notice of Intent to Propose	14
(vii) Conflict of Interest Check Information	14
(c) Proposal Submission Dates, Time, and Location	15
(d) Proposal Funding Restrictions	15
(e) Restrictions on Awards	16
(f) Proposal Requirements for Relevance	16
V. Proposal Review Information	17
(a) Evaluation Criteria	17
(b) Review and Selection Processes	17
(c) Partial Awards and Participation with Others	18
(d) Selection Announcement and Award Dates	18
(e) Process for Appeals	18

(i) Ombudsman Program	18
(ii) Protests	18
(iii) Requests for Reconsideration	19
VI. Award Administration Information	19
(a) Notice of Award	19
(b) Administrative and National Policy Requirements	19
(c) Award Reporting Requirements	19
VII. Points of Contact for Further Information	20
VIII. Ancillary Information	21
(a) Announcement of Updates/Amendments to Solicitation	21
(b) Electronic Submission of Proposal Information	21
IX. Concluding Statement	21
TABLE 1. NASA Strategic Goals and Outcomes	23
TABLE 2. Solicited Research Programs (in order of proposal due dates)	24
TABLE 3. Solicited Research Programs (in order of Appendices A–E)	25

RESEARCH OPPORTUNITIES IN AERONAUTICS (ROA) – 2013

TABLE OF CONTENTS

APPENDICES

APPENDIX A. FUNDAMENTAL AERONAUTICS PROGRAM

A.1 Overview	A-1
A.2 Fixed Wing Project	A-2
A.3 Rotary Wing Project	A-5
A.4 High Speed Project	A-7
A.5 Aeronautical Science Project	A-10

APPENDIX B. AVIATION SAFETY PROGRAM

B.1 Overview	B-1
B.2 System-Wide Safety Assurance Technologies Project	B-2
B.3 Vehicle Systems Safety Technologies Project	B-5
B.4 Atmospheric Environment Safety Technologies Project	B-7

APPENDIX C. AIRSPACE SYSTEMS PROGRAM

C.1 Overview	C-1
C.2 NextGen-Concepts and Technology Development Project	C-2
C.3 NextGen-Systems Analysis, Integration, and Evaluation Project	C-16

APPENDIX D. INTEGRATED SYSTEMS RESEARCH PROGRAM

D.1 Overview	D-1
D.2 Environmentally Responsible Aviation Project	D-2
D.3 Unmanned Aircraft Systems (UAS) Integration in the National Airspace System (NAS) Project	D-6

APPENDIX E. AERONAUTICS STRATEGY AND MANAGEMENT PROGRAM

E.1 Overview	E-1
E.2 Innovative Concepts for Aviation Project	E-1

RESEARCH OPPORTUNITIES IN AERONAUTICS (ROA) – 2013

SUMMARY OF SOLICITATION

I. FUNDING OPPORTUNITY DESCRIPTION

(a) Strategic Goals of NASA's Research Program

The National Aeronautics and Space Administration's (NASA) Mission,

To pioneer the future in space exploration, scientific discovery, and aeronautics research,

draws support from NASA's world-class capability for aeronautical research founded on a tradition of expertise in aeronautical engineering and core research areas. The Aeronautics Research Mission Directorate (ARMD) is responsible for achieving NASA Strategic Goal 4, "Advance aeronautical research for societal benefit". The objectives of ARMD are three fold to meet this Goal: (1) take responsibility for the intellectual stewardship of the core competencies (to include facilities) of aeronautics for the Nation in all flight regimes, (2) establish a technical challenge-based approach to research that enables near-term results while focusing on long-term cutting edge research, and (3) ensure long-term, stable, strategic investment in aeronautics research to benefit both civilian and military applications.

In addition, the ARMD research plans directly support the National Aeronautics R&D Policy and accompanying Executive Order 13419 signed by the President on December 20, 2006 and the National Plan for Aeronautics R&D and Related Infrastructure that was released in December 2007 and updated in February 2010. A Technical Appendix to the National Plan was approved on December 22, 2008, and contains additional technical content on Aeronautics R&D goals and objectives and a preliminary assessment of current relevant Federal Aeronautics R&D activities. Specifically, ARMD conducts high-quality, cutting-edge research that includes foundational research across a breadth of core aeronautics competencies that supports aeronautics and space exploration activities; research in key areas related to the development of advanced aircraft technologies and systems, including those related to aircraft safety, environmental compatibility, and fuel efficiency; systems-level technology assessments in relevant environments; and research that supports the Next Generation Air Transportation System (NextGen) in partnership with the Joint Planning and Development Office (JPDO). In addition, ARMD is pursuing a coordinated approach to managing the Nation's research, development, test, and evaluation (RDT&E) infrastructure with other agencies, particularly the DOD. Additional information about ARMD can be found at <http://www.aeronautics.nasa.gov>.

An important goal of the ARMD NRA is to generate knowledge that can benefit the Nation. Therefore, it is expected that award recipients will publish their work and will

utilize peer-reviewed publications to the greatest practical extent.

Further valuable, in-depth insight into NASA's strategic plan and supporting aeronautical research areas may be found in the *2011 NASA Strategic Plan* available at http://www.nasa.gov/pdf/516579main_NASA2011StrategicPlan.pdf

The NASA strategic goals from *The 2011 NASA Strategic Plan* are given in Table 1.

(b) NASA's Aeronautics Research Mission Directorate Programs

ARMD addresses the above objectives in six programs: the Fundamental Aeronautics Program, the Aviation Safety Program, the Airspace Systems Program, the Integrated Systems Research Program, the Aeronautics Test Program, and the Aeronautics Strategy and Management Program. The Airspace Systems Program will directly address the Air Traffic Management (ATM) research needs of the Next Generation Air Transportation Systems (NextGen) initiative as defined by the Joint Planning and Development Office (JPDO). The Aviation Safety Program will take a proactive approach to safety challenges with new and current vehicles and with operations in the Nation's current and future air transportation system. The Fundamental Aeronautics Program will pursue long-term, cutting edge research in all flight regimes to produce data, knowledge, and design tools that will be applicable across a broad range of air vehicles that fly through any atmosphere at any speed. The Integrated Systems Research Program will conduct research at an integrated system-level on promising concepts and technologies and explore/assess/demonstrate the benefits in relevant environments. The Aeronautics Test Program (ATP) is focused on ensuring a healthy suite of facilities and platforms to meet the nations testing needs including the development of new test instrumentation and test technologies. The Aeronautics Strategy and Management Program provides research and programmatic support that benefits each of the other five ARMD programs. The program efficiently manages directorate functions including: Innovative Concepts for Aviation, Education and Outreach, and Cross Program Operations.

This NASA Research Announcement (NRA) solicits proposals for five of these programs: (1) Fundamental Aeronautics Program, (2) Aviation Safety Program, (3) Airspace Systems Program, (4) Integrated Systems Research Program, (5) Aeronautics Strategy and Management Program. Appendices A-E provide a detailed description for each of the research programs listed above. Each of these appendices is prefaced with an Overview section that provides an introduction to the research program content that all interested applicants to this NRA are encouraged to read. Proposals in response to this NRA should be submitted to the most relevant aeronautics program elements described in Appendices A-E (see also the *Table of Contents* that prefaces this NRA). Table 2 lists these programs in the order of their calendar deadlines for the submission of proposals, while Table 3 lists them in the order in which they appear in the appendices of this NRA. Questions about each specific program should be directed to the Program Officer(s) identified in the *Summary of Key Information* subsection that concludes each program description.

These appendices also provide clarifications or modifications, if any, to the general guidelines contained in this *Summary of Solicitation* for the individual program elements.

(c) References to Unique NASA Capabilities

NASA's Aeronautics Research Mission Directorate uses a variety of specialized test and high-end computational facilities to achieve its mission. Any need for these specific facilities for the proposed research must be explicitly described in the proposal, including the asset, rationale and justification of the need, how it supports the investigation, and when during the proposed period the resource will be required. As evaluation panels review the intrinsic merit of the proposed investigation, they will be asked to consider the realism and reasonableness of the request for unique NASA capabilities and whether it is an appropriate utilization of a highly constrained asset. Proposals selected for funding will be considered for an allocation of the requested NASA resources needed for their investigation, but availability of the resource to support the fully requested level cannot be guaranteed.

(d) NASA Safety Policy

Safety is the freedom from those conditions that can cause death, injury, occupational illness, damage to or loss of equipment or property, or damage to the environment. NASA's safety priority is to protect the public, astronauts and pilots, the NASA workforce (including employees working under NASA award instruments), and high-value equipment and property.

(e) Availability of Funds for Awards

Prospective proposers to this NRA are advised that funds are not in general available for awards for all of its solicited programs at the time of its release. The Government's obligation to make awards is contingent upon the availability of sufficient appropriated funds from which payment can be made and the receipt of proposals that NASA determines are acceptable for award under this NRA.

(f) Changes from ROA-2011

Proposers should be aware of the following changes in this NRA from ROA-2011.

- The Point of Contact information has changed – see Section VII
- Since no omnibus NRA was released in Fiscal Year 2012, this NRA is being designated as ROA-2013
- Congress has restricted awards involving China as well as awards to certain firms having tax liabilities or federal criminal convictions. Please see Section IV (e).

II. AWARD INFORMATION

(a) Funding and Award Policies

The amount of funds expected to be available for new awards for proposals submitted in response to this NRA is given in the *Summary of Key Information* subsection that concludes each program description in the appendices. The number of awards that may be made for each program element is also given in this location. Any deviation from the usual maximum duration for awards of three years will also be noted (some programs may specify only one year for activities of limited scope to as long as five years for extensive, comprehensive studies). While the *Summary of Key Information* provides estimates for the funding and the number of awards, these amounts may vary greatly depending on merit of the proposals submitted and the funding available at the time of selections.

In all cases, NASA's goal is to initiate new awards within 46 days after the selection of proposals is announced for each program. However, this time period may be longer based on the workload experienced by NASA, the availability of appropriated funds, and any necessary post-selection negotiations with the proposing organization(s) needed for the award(s) in question. Regarding this last item, every proposer is especially encouraged to submit full and detailed explanations of the requested budget (see further below) to help expedite the processing of the award should their proposal be selected.

Awards made through this NRA will be in the form of grants, cooperative agreements, or contracts depending on the nature of the work proposed, the submitting organization, and/or the specific requirements for awards given in each program description in the appendices. The type of award to be offered to selected proposers will generally follow the policies in Appendix D.1 of the *NASA Guidebook for Proposers*, although in a few cases only one type of award may be offered as specified in the program description. A NASA awards officer will determine the appropriate award instrument for the selections resulting from this solicitation. Grants and cooperative agreements will be subject to the provisions of the *NASA Grants and Cooperative Agreement Handbook*, hereafter referred to as the *Grants Handbook* (<http://prod.nais.nasa.gov/portals/pl/index.html>) and Appendix D of the *NASA Guidebook for Proposers*. In the case of any conflict, the *Grants Handbook* takes precedence. Contract awards will be subject to the provisions of the Federal Acquisition Regulations (FAR) and the NASA FAR Supplement <http://prod.nais.nasa.gov/portals/pl/index.html>. Depending upon the Technical, Scientific and Research requirements (i.e., by Project or Thrust Area) ARMD may make Multiple Year Awards under this NRA. Multiple Year Awards will be managed in accordance with Appendix D of the *NASA Guidebook for Proposers*.

(b) Successor Proposals and Resubmissions

Generally, Principal Investigators holding previous awards selected through any of the programs offered through earlier NRAs are welcome to submit "successor" proposals that seek to continue a previously funded line of research (see Section 1.5 of the *NASA Guidebook for Proposers*). However, in order to ensure equitable treatment of all

submitted proposals, NASA does not extend any special consideration to such successor proposals in terms of preferential handling, review, or priority for selection. Note that the instructions regarding successor proposals in the *NASA Guidebook for Proposers* may have changed from past years. Proposers are strongly encouraged to review them.

Applicable proposals that were submitted but not selected for any previous NASA solicitation(s) may be submitted either in a revised or original form. Such submissions will be treated as a new proposal and will be subjected to a full peer review.

Funds provided as a result of instruments awarded under this NRA cannot be applied as contributions under Space Act Agreements that NASA may execute in support of related programs.

III. ELIGIBILITY INFORMATION

(a) Eligibility of Applicants

Participation in this program is open to all categories of U.S. and non-U.S. organizations, including educational institutions, industry, and not-for-profit institutions. Historically Black Colleges and Universities (HBCUs), Other Minority Universities (OMUs), small disadvantaged businesses (SDBs), veteran-owned small businesses, service disabled veteran-owned small businesses, HUBZone small businesses, and women-owned small businesses (WOSBs) are encouraged to apply. Participation by eligible non-U.S. organizations in this program is welcome but subject to NASA's policy of no exchange of funds, in which each government supports its own national participants and accounts for associated costs (further information on foreign participation is provided in Section 1.6 of the *NASA Guidebook for Proposers*).

Other government agencies, Federally Funded Research and Development Centers (FFRDCs), and NASA Centers are not eligible to submit proposals under this NRA or participate as team members under proposals submitted by eligible entities. NASA Centers will be involved to the extent they are carrying out responsibilities in connection with cooperative agreement or contracts. Additional information on collaboration opportunities may be found in appendices (A-E). Questions regarding NASA roles under cooperative agreements should be sent to the designated Point of Contact listed in the appropriate technical appendix (A-E).

(b) Number of Proposals and Teaming Arrangements

There is no restriction on the number of proposals that an organization may submit to this solicitation or on the teaming arrangements for any one proposal. However, each proposal must be a separate, stand-alone, complete document for evaluation purposes. The NRA is structured in a way that facilitates responses to individual subtopic areas. However, some project areas provide special instructions for addressing more than one subtopic in a single proposal. The proposer is responsible for reviewing any additional information that may be provided in project area instructions.

(c) Cost Sharing or Matching

If an institution of higher education or other not-for-profit organization is selected to receive a grant or cooperative agreement, cost sharing is not required, although NASA can accept cost sharing if it is voluntarily offered (see the *Grants Handbook*, Section B, Provision 1260.123, “Cost Sharing or Matching”). If a commercial organization is selected to receive a grant or cooperative agreement, cost sharing is typically required unless the commercial organization can demonstrate that it does not expect to receive substantial compensating benefits for performance of the work. If this demonstration is made, cost sharing is not required but may be offered voluntarily (see also Section D, Provision 1274.204, of the *Grants Handbook*). See also Section V(a) below.

IV. PROPOSAL AND SUBMISSION INFORMATION

(a) Proposal Instructions and Requirements

All information needed to respond to this solicitation is contained in this ROA NRA and in the companion document entitled *Guidebook for Proposers Responding to a NASA Research Announcement* (hereafter referred to as the *NASA Guidebook for Proposers*) located at <http://www.hq.nasa.gov/office/procurement/nraguidebook>. By reference, the 2012 edition of the *NASA Guidebook for Proposers* is incorporated into this NRA, and proposers are responsible for understanding and complying with its procedures for the successful, timely preparation and submission of their proposals. Proposals that do not conform to its standards may be declared noncompliant and rejected without review.

The introductory material, as well as the appendices, of the *NASA Guidebook for Proposers* provide additional information about the entire NRA process, including NASA policies for the solicitation of proposals, guidelines for writing complete and effective proposals, and NASA’s general policies and procedures for the review and selection of proposals and for issuing and managing the awards to the institutions that submitted selected proposals.

Questions regarding this NRA or its program elements should be directed to the cognizant Program Officer listed in the program element’s description. Clarifications or questions and answers will be posted on the relevant program element(s)’s web page(s).

A group of *Frequently Asked Questions* provides additional miscellaneous information about a variety of the NASA proposal and award processes, policies, and procedures. The *Frequently Asked Questions* with general applicability to the majority or all of the solicitation are posted on the ARMD ROA page on NSPIRES. In addition, each Project Element may post additional *Frequently Asked Questions* in their respective pages on NSPIRES.

(b) Content and Form of the Proposal Submission

(i) Electronic Proposal Submission

All proposals submitted in response to this ROA NRA must be submitted in a fully electronic form. No hard copy of the proposal will be accepted. Electronic proposals must be submitted by one of the officials at the proposal principal investigator's organization who is authorized to make such a submission; electronic submission by the authorized organization representative (AOR) serves for the proposal as the required original signature by an authorized official of the proposing organization.

Proposers may opt to submit proposals in response to this ROA NRA via either of two different electronic proposal submission systems: either via the NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES), the NASA proposal data system (<http://nspires.nasaprs.com>; see Section IV(b)(iv) below), or via Grants.gov (<http://www.grants.gov>; see Section IV(b)(v) below). Proposers are discouraged from submitting the same proposal to both electronic submission systems. NASA plans to use the NSPIRES system to facilitate the review process so all proposals received through Grants.Gov will be transferred into NSPIRES.

Note carefully the following requirements for submission of an electronic proposal regardless of the intent to submit via NSPIRES or Grants.gov.

- Every organization that intends to submit a proposal to NASA in response to this NRA, including educational institutions, industry, and not-for-profit institutions, must be registered in NSPIRES. This applies equally for proposals submitted via Grants.gov, as well as for proposals submitted via NSPIRES. Every organization that intends to submit a proposal through Grants.gov must also be registered in Grants.gov. Registration for either proposal data system must be performed by an organization's electronic business point-of-contact (EBPOC) in the Central Contractor Registry (CCR).
- Any organization requesting NASA funds through the proposed investigation must be listed on the Proposal Cover Page. NASA will not fund organizations that do not appear on the Proposal Cover Page.
- Each individual team member (e.g., PI, co-investigators, etc.), including all personnel named on the proposal's electronic cover page, must be individually registered in NSPIRES. This applies equally for proposals submitted via Grants.gov, as well as for proposals submitted via NSPIRES.
- Each individual team member (e.g., PI, co-investigators, etc.), including all personnel named on the proposal's electronic cover page, must specify an organizational affiliation. The organizational affiliation specified must be the organization through which the team member is participating in the proposed investigation. If the individual has multiple affiliations, then this organization may be different from the individual's primary employer or preferred mailing address.

Generically, an electronic proposal consists of one or more electronic forms, including an electronic cover page and one or more attachments. The attachments contain all sections of the proposal, including the science/technical/management section, as well as all required and allowed appendices; see Section IV(b)(ii) below for further requirements.

Submission of electronic proposals via either NSPIRES or Grants.gov requires several coordinated actions from the proposing organization. In particular, when the PI has completed entry of the data requested in the required electronic forms and attachment of the allowed PDF attachments, including the science/technical/management section, an official at the PI's organization who is authorized to make such a submission, referred to as the authorized organization representative (AOR), must submit the electronic proposal (forms plus attachments). Coordination between the PI and his/her AOR on the final editing and submission of the proposal materials is facilitated through their respective accounts in NSPIRES and/or Grants.gov. Note that if one individual is acting in both the PI and AOR roles, he/ she must ensure that all steps in the process are taken, including submitting the proposal from the organization.

(ii) Proposal Format and Contents

All proposals submitted in response to this NRA must include the appropriate required electronic forms available through either of two proposal submission systems, NSPIRES or Grants.gov.

The science/technical/management section and other required sections of the proposal must be submitted as searchable, unlocked PDF files that are attached to the electronic submission using one of the proposal submission systems. Proposers must comply with any format requirements specified in this NRA and in the *NASA Guidebook for Proposers* (e.g. Section 2.3 of the *NASA Guidebook for Proposers*). Only appendices/attachments that are specifically requested in either this NRA or in the *NASA Guidebook for Proposers* will be permitted; proposals containing unsolicited appendices/attachments may be declared noncompliant. Section 2 of the *NASA Guidebook for Proposers* provides detailed discussions of the content and organization of proposals suitable for all program elements in this NRA, as well as the default page limits of a proposal's constituent parts.

Note that some of the program elements in the Appendices of this NRA may specify different page limits for the main body of the proposal; if so, these page limits will be prominently given in the *Summary of Key Information* subsection that concludes each program element description. In the event the information in this NRA is different from or contradictory to the information in the *NASA Guidebook for Proposers*, the information in this NRA takes precedence.

A detailed Work Plan delineating how the Recipient/Awardee will accomplish the Goals and Objectives of the proposed Program, Thrust or Project Area (including applied Research Methodologies, Processes, and Resources, etc.) shall be included as part of the proposal. The Work Plan shall be evaluated in accordance with the requirements set forth in each of the applicable Appendices. For entities seeking contracts, a Statement of

Work (SOW) should be included as part of the proposal for the award of a contract. The SOW should include the following in the order listed: (1) Scope (2) Objectives (3) SOW tasks organized in a Work Breakdown Structure (WBS) (4) Program Schedule & Milestones (5) Measurable metrics, and (6) deliverables, which should be defined and described under the applicable task / WBS portion of the SOW. The SOW does not count against the page limit and should be inserted at the end of the proposal.

If a commercial organization seeks an award of a cooperative agreement that will involve cost sharing (see Section III (c)) or if milestone payments are anticipated, it is requested that a schedule of milestone payments be included in the proposal. The schedule should include a description of the milestone as a performance benchmark as well as the associated amount of funds to be paid or transferred upon successful completion of the milestone. The schedule does not count against the page limit of the proposal (See 1274.204(d) and 1274.908 of the *Grants Handbook*).

Important note on creating PDF files for upload: It is essential that all PDF files generated and submitted meet NASA requirements. This will ensure that the submitted files can be ingested by NSPIRES regardless of whether the proposal is submitted via NSPIRES or Grants.gov. At a minimum, it is the responsibility of the proposer to: (1) ensure that all PDF files are unlocked and that edit permission is enabled – this is necessary to allow NSPIRES to concatenate submitted files into a single PDF document; and (2) ensure that all fonts are embedded in the PDF file and that only Type 1 or TrueType fonts are used. In addition, any proposer who creates files using TeX or LaTeX is required to first create a DVI file and then convert the DVI file to Postscript and then to PDF. See http://nspires.nasaprs.com/tutorials/PDF_Guidelines.pdf for more information on creating PDF documents that are compliant with NSPIRES. We have noted recent occurrences in which PDF files generated from newer versions of Microsoft Word have not been ingested properly into NSPIRES. PDF files that do not meet NASA requirements cannot be ingested by the NSPIRES system; such files may be declared noncompliant and not submitted to peer review for evaluation. Section 2.3.1 (c) of the *2012 NASA Guidebook for Proposers* describes how to review files generated in NSPIRES to ensure that all text, figures, tables, and required forms are complete and accurate.

(iii) Additional ROA Requirement for Budget Format

The uniform policy concerning the review of proposals submitted in response to this ROA NRA against the cost evaluation criterion is described in Appendix C of the *NASA Guidebook for Proposers*. Peer reviewers will provide recommendations on the budget summary and budget justification for cost realism and cost reasonableness to ensure that the proposed technical work is feasible. NASA program personnel will conduct the complete evaluation of cost including the detailed budget and budget justification for all relevant factors including cost realism, cost reasonableness, total cost and comparison of the proposed cost to available funds.

In order to allow this division of review responsibilities, NASA will provide limited but sufficient proposal budget information to the peer review (work effort and personnel,

other direct costs including procurements and subawards/subcontracts) while reserving certain proposal budget details for NASA's use (costs of direct labor, indirect costs, total costs).

Therefore, ARMD places additional requirements on the submission of proposals in response to this ROA NRA. Where the requirements in this NRA conflict with requirements and instructions found elsewhere (e.g., in the *NASA Guidebook for Proposers*, NSPIRES instructions, or Grants.gov instructions), the requirements in this NRA have precedence. It is important that all proposers responding to this ROA NRA follow these additional instructions carefully to enable an appropriate evaluation of their proposals.

In addition to the budget summary information provided in the NSPIRES or Grants.gov Cover Page forms, all proposers are required to include more detailed budgets and budget justifications, including detailed subcontract/subaward budgets, in a format of their own choosing in the *Budget Justification*. For this NRA, this additional budget must be divided into three parts: the "*Budget Justification: Narrative*"; the "*Budget Justification: Details*," both as described in Section 2.3.10 of the *NASA Guidebook for Proposers*; and the "*Total Budget*," a requirement specific to this ROA NRA.

The *Budget Justification: Narrative* includes the *Table of Proposed Work Effort* and the description of facilities and equipment, as well as the rationale and basis of estimate for all components of cost including procurements, travel (destination, purpose and number of travelers), publication costs, and all subawards/subcontracts. The *Table of Proposed Work Effort* must include the names and/or titles of all personnel (including postdoctoral fellows and graduate students) necessary to perform the proposed investigation regardless of whether these individuals require funding from the current proposal. The number of person-months each person is expected to devote to the project must be given for each year.

The *Budget Justification: Details* must include the detailed proposed budget including all of the Other Direct Costs and Other Applicable Costs specified in the *NASA Guidebook for Proposers*. For this NRA, the *Budget Justification: Narrative* and the *Budget Justification: Details* should not specify the cost of Direct Labor or any Administrative Costs (e.g., overhead).

While the appropriate award instrument will be determined by the Government, offerors must indicate the assumed type of award used during budget preparation. If a contract is assumed, offerors must indicate the type of contract proposed (i.e. cost plus fixed fee, cost sharing, fixed price, etc.). Note that some topics described in Appendices A-E may specify an expected award type.

The *Total Budget* file must specify the complete set of cost components including all costs discussed in the *Budget Narrative* and *Budget Details*, as well as the Total Estimated Cost, cost of Direct Labor, and Administrative Costs (overhead). The *Total*

Budget document will not be provided to the non-government peer review, but will be used by NASA in the evaluation of total cost and comparison of the proposed cost to available funds. Proposers may also choose to include any data they consider to be sensitive financial information in the *Total Budget* file required by this Section of the ROA NRA. However, if any such information is excluded from the *Budget Justification: Narrative* and *Details* sections, a note should be included in the applicable section of the *Budget Justification: Narrative* or *Details* section to clarify where the information is located in the *Total Budget* file.

The required *Budget Justification: Narrative* and *Details* section of the proposal may be incorporated into the proposal document as these will be provided to the peer review (for submission via NSPIRES, the *Budget Justification: Narrative* and *Details* must be incorporated into the single proposal PDF file). Regardless of whether the proposal is submitted via NSPIRES or Grants.gov, proposers to the ROA must provide the *Total Budget* in a file called “totalbudget.pdf,” which is uploaded as a separate attachment in either NSPIRES or Grants.gov.

The peer reviewers only have access to the *Budget Justification: Narrative* and *Details*, and will not have access to the Total Estimated Cost, the cost of Direct Labor, and Administrative Costs (e.g., overhead). Therefore, failure to provide sufficient budget justification and data in the *Budget Narrative* (including the *Table of Proposed Work Effort*) and the *Budget Details*, will prevent the peer review from appropriately evaluating the cost realism of the proposal. A finding by the peer review of “insufficient information to properly evaluate cost realism” will be considered a weakness of the proposal. Inconsistent budget information between these budget descriptions will also be considered a weakness of the proposal.

(iv) Submission of Proposals via NSPIRES, the NASA Proposal Data System

Proposals may be submitted electronically via NASA’s master proposal data base system, the NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES). In order to submit a proposal via NSPIRES, this NRA requires that the proposer register key data concerning the intended submission with NSPIRES; NSPIRES is accessed at <http://nspires.nasaprs.com>. Potential applicants are urged to access this site well in advance of the proposal due date(s) of interest to familiarize themselves with its structure and enter the requested identifier information.

It is especially important to note that every individual named on the proposal’s electronic *Cover Page* form (see below) as a proposing team member in any role, including co-investigators and collaborators, must be registered in NSPIRES and that such individuals must perform this registration themselves; no one may register a second party, even the Principal Investigator of a proposal in which that person is committed to participate. This data site is secure and all information entered is strictly for NASA’s use only.

All team members identified on the NSPIRES proposal cover page may indicate their commitment to the proposed work via NSPIRES.

- Each team member will receive an email from NSPIRES indicating that he/she has been added to the proposal and should log in to NSPIRES. Once logged in, the team member should follow the link in the "Reminders and Notifications" section of his NSPIRES homepage, titled "Need Co-I and/or Collaborator Statement of Commitment For: Proposal to Solicitation <<solicitation number>>." On the "Team Member Statement of Commitment -Confirmation" page, the team member should read the commitment language, click the "Accept" button, and then click "OK".
- PI's may monitor the status of team member commitments by examining the "Commitment Confirmed" column on the Team Member page of the NSPIRES proposal cover page record.
- If desired, statements of commitment from team members may be provided as letters attached to the proposal application

All proposals submitted via NSPIRES in response to this NRA must include a required electronic *Cover Page* form that is accessed at <http://nspires.nasaprs.com>. This form is comprised of several distinct sections: a *Cover Page* that contains the identifier information for the proposing institution and personnel; a *Proposal Summary* that provides an overview of the proposed investigation that is suitable for release through a publicly accessible archive should the proposal be selected; and a *Budget Summary* of the proposed research effort. Unless specified in the program description itself, no other forms are required for proposal submission via NSPIRES. See the *NASA Guidebook for Proposers*, Sections 2 and 3, for further details.

The required elements of the proposal, including the science/technical/management section, must be submitted as one or more PDF documents that are attached to the *Cover Page* using the tools in NSPIRES. It is possible that the complete proposal is submitted as a single, searchable, unlocked PDF document, that contains the complete proposal, including the science/ technical/ management section and budget justification (but not the *Total Budget*), assembled in the order provided in the *NASA Guidebook for Proposers* (see Section 2.3) and uploaded using the tools in NSPIRES. The Total Budget must be uploaded as a separate attachment in a file named "totalbudget.pdf". One advantage of submitting the proposal as one PDF document as described above is that it is easier for the proposer to create a table of contents that will be correct. If separate files are uploaded, there may be slight differences in page numbering due to the concatenation process. Any mismatch with the table of contents caused by this process does not impact the evaluation of the proposal.

NSPIRES will provide a list of all elements that make up an electronic proposal, and the system will conduct an element check to identify any item(s) that is (are) apparently missing or incomplete.

Proposers are encouraged to begin their submission process early. Tutorials and other NSPIRES help topics may be accessed through the NSPIRES online help site at <http://nspires.nasaprs.com/external/help.do>. For any questions that cannot be resolved with the available on-line help menus, requests for assistance may be directed by E-mail

to nspires-help@nasaprs.com or by telephone to (202) 479-9376, Monday through Friday, 8:00 a.m. – 6:00 p.m. Eastern Time.

(v) Submission of Proposals via Grants.gov

NASA also offers proposers the option to utilize Grants.gov to prepare and submit proposals in response to this ROA NRA. Grants.gov allows organizations to electronically find and apply for competitive grant opportunities from all Federal grant-making agencies; it provides a single access point for over 1000 grant programs offered by the 26 Federal grant-making agencies. The U.S. Department of Health and Human Services is the managing partner for Grants.gov.

In order to submit a proposal via Grants.gov, Grants.gov requires that the Principal Investigator download an application package from Grants.gov. Identifying the appropriate application package requires the funding opportunity number for that program; the funding opportunity number may be found in the *Summary of Key Information* subsection that concludes each program description. Proposals submitted via Grants.gov must be submitted by the AOR.

Submitting a proposal via Grants.gov requires the following steps:

- Proposers must still register in NSPIRES even if they submit their proposal through Grants.gov (otherwise proposals cannot be ingested into NSPIRES for review and selection).
- Grant researchers (PIs) do NOT need to register with Grants.gov. To find solicitations, ref. "Find Grant Opportunities" at http://www.grants.gov/applicants/find_grant_opportunities.jsp. Using a Basic Search, enter the Funding Opportunity Number to retrieve the application package all NASA application packages may be found by searching on CFDA Number 43.002.
- Download and install any required Grants.gov software applications or tools.
- Download the application package from Grants.gov at <http://www.grants.gov>.
- Complete the required Grants.gov forms including the SF424 (R&R) Application for Federal Assistance, R&R Other Project Information, R&R Senior/Key Person Profile, and R&R Budget.
- Complete the required NASA-specific forms: NASA Other Project Information, NASA Principal Investigator and Authorized Representative Supplemental Data Sheet, NASA Senior/Key Person Supplemental Data Sheet (this form is only required if there are Senior/Key Persons other than the Principal Investigator), and proposal summary form.
- Complete any NASA program-specific form that is required for the specific program element. This form, which is required by many NRAs, is included as a PDF form within the proposal application package downloaded from Grants.gov. The form, once completed, is attached to the NASA Other Project Information form.

- Create a proposal in PDF including the Science/Technical/Management section and all other required sections. Attach the proposal and any allowed appendices/attachments (also in PDF) to the appropriate Grants.gov form(s).
- Submit the proposal via the authorized organization representative (AOR); the PI may not submit the application to Grants.gov unless he/she is an AOR.

Potential applicants are urged to access Grants.gov site well in advance of the proposal due date(s) of interest to familiarize themselves with its structure and download the appropriate application packages and tools.

Additional instructions for formatting and submitting proposals via Grants.gov may be found in Sections 2 and 3 of the *NASA Guidebook for Proposers*. Instructions for the use of Grants.gov may be found in the *Grants.gov User Guide* at <http://www.grants.gov/assets/ApplicantUserGuide.pdf>.

Instructions for NASA-specific forms and NASA program-specific forms may be found in the application package. For any questions that cannot be resolved with the available on-line help menus and documentation, requests for assistance may be directed by E-mail to support@grants.gov or by telephone to (800) 518-4726., Monday through Friday, 7:00 a.m. – 9:00 p.m. Eastern Time.

(vi) Notice of Intent to Propose

For most of the programs advertised through this solicitation, a brief Notice of Intent (NOI) to propose is encouraged, but not required, for the submission of proposals to this solicitation. The information contained in an NOI is used to help expedite the proposal review activities and, therefore, is of considerable value to both NASA and the proposer. To be of maximum value, NOIs should be submitted by the proposal principal investigator to NSPIRES, NASA's master proposal data system located at <http://nspires.nasaprs.com>, by the dates given in Tables 2 or 3 below for each program in the Appendices. Note that NOIs may be submitted within NSPIRES directly by the proposal principal investigator; no action by an organization's AOR is required to submit an NOI.

Grants.gov does not provide NOI capability; therefore, NOIs must be submitted via NSPIRES regardless of whether the proposal will be submitted via NSPIRES or Grants.gov. Interested proposers must register with NSPIRES before it can be accessed for use; see Section IV(b)(i) above. Since NOIs submitted after the deadline may still be useful to NASA, late NOIs may be submitted by E-mail as directed in Section 3.1 of the *NASA Guidebook for Proposers*.

(vii) Conflict of Interest Check Information

In order to ensure that all proposal evaluations are conducted as fairly as possible, it is important to ascertain whether prospective reviewers may have conflicts of interest that might affect their capacity to function with impartiality. To facilitate the process of

identifying potential conflicts of interest, it is necessary to collect information about the organizations participating in each proposal. A NASA program-specific form will be used to collect this information. This form will be part of a submission to the NSPIRES system. Proposers using Grants.gov will have to ensure that they complete the NASA program-specific form as described in section I(b)(iii). Failure to submit this form via the NSPIRES system may result in the proposal being deemed nonresponsive to the NRA.

(c) Proposal Submission Dates, Time, and Location

For each program in Appendices A through E of this NRA, the electronic proposal must be submitted in its entirety by 11:59 p.m. Eastern Time on the appropriate proposal due date given in Tables 2 or 3 below. All proposals must be submitted electronically using NSPIRES or Grants.gov (see Sections IV(b)(i–v), above).

Proposals that are late will be handled in accordance with NASA’s policy as given in Section (g) of Appendix B of the *NASA Guidebook for Proposers* (also see Sections 3.2 and F.23). Proposals received after the due date may be returned without review. If a late proposal is returned, it is entirely at the discretion of the proposer whether or not to resubmit it in response to a subsequent appropriate solicitation. It is not possible to submit a late proposal electronically via NSPIRES unless the electronic Cover Page was initially created prior to the proposal due date. Late proposals may not be submitted via Grants.gov.

(d) Proposal Funding Restrictions

In addition to the funding restrictions and requirements given in the *NASA Guidebook for Proposers* and the *Grants Handbook*, the following restrictions are applicable to this ROA NRA.

- The estimated funding and number of proposals anticipated to be funded, as shown in the *Summary of Key Information* at the end of each program element, are subject to the availability of appropriated funds, as well as the submission of a sufficient number of proposals of adequate merit.
- The construction of facilities is not an allowed activity for any of the programs solicited in this NRA unless specifically stated. For further information on the allowability of costs, refer to the cost principles cited in the *Grants Handbook*, Section 1260.127.
- Typically travel, including foreign travel, is allowed as may be necessary for the meaningful completion of the proposed investigation, as well as for publicizing its results at appropriate professional meetings.
- Profit for commercial organizations is not allowable under grant or cooperative agreement awards but is allowable under contract awards.
- U.S. research award recipients may directly purchase supplies and/or services from non-U.S. sources that do not constitute research, but award funds may not be used to fund research carried out by non-U.S. organizations. However, subject to export control restrictions, a foreign national may receive remuneration through a NASA award for the conduct of research while employed either full or part time by a U.S. organization (see Section 1.6 of the *NASA Guidebook for Proposers*).

e) Restrictions on Awards

As directed by Grant Information Circular 12-01A in connection with issuing new Broad Agency Announcements (e.g., Announcements of Opportunity, NASA Research Announcements, and Cooperative Agreement Notices), grant officers shall add the following paragraph (See Assurance of Compliance – China Funding Restriction paragraph Section iv below) to the current proposal requirements set forth at 14 CFR § 1260.10 (c)(1) so that proposers, by submission of their proposal, represent that they are not China or a Chinese-owned company, and that they will not participate, collaborate, or coordinate bilaterally with China or any Chinese-owned company, at the prime recipient level or at any subrecipient level, whether the bilateral involvement is funded or performed under a no-exchange of funds arrangement.

Assurance of Compliance – China Funding Restriction (DEVIATION FEB 2012)

(iv) An Assurance of Compliance with The Department of Defense and Full-Year Appropriation Act, Public Law 112-10 Section 1340(a); The Consolidated and Further Continuing Appropriation Act of 2012, Public Law 112-55, Section 539; and future-year appropriations herein after referred to as “the Acts”, whereas:

(1) NASA is restricted from using funds appropriated in the Acts to enter into or fund any grant or cooperative agreement of any kind to participate, collaborate, or coordinate bilaterally with China or any Chinese-owned company, at the prime recipient level and at all subrecipient levels, whether the bilateral involvement is funded or performed under a no-exchange of funds arrangement.

(2) Definition: “China or Chinese-owned Company” means the People’s Republic of China, any company owned by the People’s Republic of China, or any company incorporated under the laws of the People’s Republic of China.

(3) The restrictions in the Acts do not apply to commercial items of supply needed to perform a grant or cooperative agreement.

(4) By submission of its proposal, the proposer represents that the proposer is not China or a Chinese-owned company, and that the proposer will not participate, collaborate, or coordinate bilaterally with China or any Chinese-owned company, at the prime recipient level or at any subrecipient level, whether the bilateral involvement is funded or performed under a no-exchange of funds arrangement.

(f) Proposal Requirements for Relevance

Proposals for all NASA sponsored research programs are usually evaluated on three criteria: intrinsic merit, relevance to NASA’s objectives, and cost realism and reasonableness (see Appendix C of the *NASA Guidebook for Proposers*). These criteria may be modified in the Appendices of this NRA. Each program element includes a specific description of how it is relevant to the NASA Strategic Plan. Therefore, unless otherwise stated in the program element, it is not necessary for individual proposals to show relevance to NASA’s broader goals and objectives. The proposal should instead focus on demonstrating relevance by discussing how the proposed investigation addresses the goals and objectives of the specific program element.

Note that this NRA references the strategic goals and objectives in the 2011 NASA Strategic Plan (see Section I(a) and Table 1).

V. PROPOSAL REVIEW INFORMATION

(a) Evaluation Criteria

Each proposal will be evaluated by peers of the proposing personnel to assess the proposal's intrinsic scientific and technical merit, its relevance to NASA's stated objectives, and its cost realism and reasonableness. See Appendix C.2 of the *NASA Guidebook for Proposers* for further discussion of these criteria and their relative weights. Some of the projects in the attached Appendices contain additional or tailored evaluation criteria. If any criteria in Appendices A-E conflicts with any other part of the NRA, the criteria identified in the Appendices take precedence over this and other sections of the NRA. The evaluation factors include factors evaluated by peer reviewers, as well as factors evaluated by NASA program personnel. Note the following specific points:

- Some of the programs discussed in the Appendices will provide specific factors, based on the solicited research objectives, which will be considered when evaluating a proposal's technical merits and/or its relevance to program objectives.
- As discussed in Section IV(e) above, relevance will be judged in part by the proposal's focus on specific objectives for the ARMD program element.
- Opinions on a proposal's cost may be offered by peer review (for cost realism and cost reasonableness), but NASA personnel will conduct the complete cost evaluation (for cost realism, cost reasonableness, total cost and comparison to available funds). Proposers must follow the budget format requirements in Section IV(b)(iii).
- The selection official may take program balance into account when selecting proposals for funding.
- Cost sharing is generally not considered as part of the evaluation (see Section III(c) above). However, cost sharing may become a factor at the time of selection when deciding between proposals of otherwise equal technical merits.

(b) Review and Selection Processes

Review of proposals submitted to this NRA will be consistent with the general policies and provisions given in Sections C.1 through C.4 of Appendix C of the *NASA Guidebook for Proposers*, and selection procedures will be consistent with the provisions of Section C.5 of that document.

Unless otherwise specified, the Program Director responsible for a thrust area is the final Selecting Official. In cases where a conflict of interest exists, the Selecting Official will be designated by the Associate Administrator for Aeronautics.

(c) Partial Awards and Participation with Others

NASA reserves the right to select only a portion of a proposed investigation, usually at a level of support reduced from that requested in the original proposal or may also offer tentative selections in which NASA requests investigators to team in a joint investigation. Additionally, NASA may decide to award an effort for less than the full period of the proposal. In these cases, the proposer will be given the opportunity to accept or decline such selection. If the proposer accepts such an offer, a revised budget and statement of work may be required before funding action on the proposal can be initiated. If the proposer declines the offer of a partial selection, or participation in a joint investigation, the offer of selection may be withdrawn in its entirety by NASA.

(d) Selection Announcement and Award Dates

NASA's stated goal is to announce selections as soon as possible. However, NASA does not usually announce new selections until the funds needed for those awards are approved through the Federal budget process. Therefore, a delay in the budget process for NASA usually results in a delay of the selection date(s). After 150 days past the proposal due date for which a proposal was submitted, proposers may contact the responsible Program Officer listed at the conclusion of that program description in the appendices for the status of the selection activity.

Those proposers not selected will be notified by postal or electronic mail and offered a debriefing consistent with the policy in Section C.6 of the *NASA Guidebook for Proposers*.

(e) Process for Appeals

(i) Ombudsman Program

The NASA Procurement Ombudsman Program is available under this NRA as a procedure for addressing concerns and disagreements. The clause at NASA FAR Supplement (NFS) 1852.215-84 ("Ombudsman") is incorporated into this NRA. The cognizant ombudsman is

Ronald A. Poussard
Director, Contract Management Division
Office of Procurement
NASA Headquarters
Washington, DC 20546
Telephone: 202-358-0445.

(ii) Protests

Only prospective offerors seeking contract awards under this NRA have the right to file a protest, either at the Government Accountability Office (GAO) or with the Agency, as defined in FAR 33.101. The provisions at FAR 52.233-2 ("Service of Protest") and NASA FAR Supplement (NFS) 1852.233-70 ("Protests to NASA") are incorporated into

this NRA. Under both of these provisions, the designated official for receipt of protests to the Agency and copies of protests filed with the GAO is

William P. McNally
Assistant Administrator for Procurement
Office of Procurement
NASA Headquarters Mail Stop 5G70
Washington, DC 20546.

(iii) Requests for Reconsideration

A Principal Investigator (PI) whose proposal has been declined may request an oral debriefing from the Program Officer. Following the debriefing, dissatisfied PIs may submit in writing a Request for Reconsideration to the Selecting Official. Details on this process may be found in Appendix H.3 of the *2012 NASA Guidebook for Proposers*.

VI. AWARD ADMINISTRATION INFORMATION

(a) Notice of Award

Notification of both the selected, as well as the nonselected proposers, will be consistent with the policy given in Section C.5.3 of the *NASA Guidebook for Proposers*. For selected proposers, the offeror's business office will be contacted by a NASA Awards Officer, who is the only official authorized to obligate the Government. For a grant or cooperative agreement, any costs incurred by the offeror in anticipation of an award will be subject to the policies and regulations of the *Grants Handbook* (see Section B, Part 1260.125(e)).

(b) Administrative and National Policy Requirements

This solicitation does not invoke any special administrative or national policy requirements, nor do the awards that will be made involve any special terms and conditions that differ from NASA's general terms and conditions as given in the *Grants Handbook* and the *NASA Guidebook for Proposers*. Please note that it is expected that proposers will comply with Homeland Security Presidential Directive/ HSPD-12. HSPD-12 applicability will be determined during negotiation for award for selected proposals.

(c) Award Reporting Requirements

The reporting requirements for awards made through this NRA will be consistent with Exhibit G of the *Grants Handbook*. Any additional requirements will be specified in the program description.

VII. POINTS OF CONTACT FOR FURTHER INFORMATION

General questions and comments about the policies of this NRA may be directed to:

Susan Minor
Deputy Director, Integration and Management Office
Aeronautics Research Mission Directorate
NASA Headquarters
E-mail: NASA-roa@nasa.gov

Note: Proposals shall not be submitted to this E-mail address. Proposals shall be submitted electronically as described in Section IV above.

Specific questions about a given program element in this NRA should only be directed to the Program Officer(s) listed in the *Summary of Key Information* subsection that concludes each program description.

No communication concerning this NRA may be made to any other NASA official other than those specifically listed in this NRA.

Inquiries about accessing or using the NASA proposal data base located at <http://nspires.nasaprs.com> should be directed by an E-mail that includes a telephone number to nspires-help@nasaprs.com or by calling (202) 479-9376. This help center is staffed Monday through Friday, 8:00 a.m. – 6:00 p.m. Eastern Time.

Inquiries about accessing or using Grants.gov located at <http://www.grants.gov> should be directed by an E-mail to support@grants.gov or by calling (800) 518-4726. This customer support contact center is staffed Monday through Friday, 7:00 a.m. – 9:00 p.m. Eastern Time.

VIII. ANCILLARY INFORMATION

(a) Announcement of Updates/Amendments to Solicitation

It is possible that additional programmatic information for any of NASA's programs may develop before their proposal due dates. If so, such information will be added as a formal amendment to this NRA as posted at its homepage at <http://nspires.nasaprs.com>. It is the responsibility of the prospective proposer to check this NRA's homepage for updates concerning the program(s) of interest.

Any clarifications or questions and answers that are published will be posted either with the summary ROA NRA information or on the relevant program element(s)'s web page(s) at <http://nspires.nasaprs.com>.

(b) Electronic Submission of Proposal Information

On-time electronic submission over the World Wide Web is required for every proposal. While every effort is made to ensure the reliability and accessibility of this Web site and to maintain a help center via E-mail and telephone, difficulty may arise at any point on the Internet, including the user's own equipment. Therefore, prospective proposers are urged to familiarize themselves with this site and to submit the required proposal materials well in advance of the deadline(s) of the program(s) of interest. Difficulty in registering with or using a proposal submission system (either NSPIRES or Grants.gov) is not, in and of itself, a sufficient reason for NASA to consider a proposal that is submitted after the proposal due date (see Section IV(c)).

IX. CONCLUDING STATEMENT

Through this ROA NRA, NASA encourages the participation of the aeronautics communities in its Aeronautics Research Mission Directorate research and technology programs. Comments about this NRA are welcome and may be directed to the point of contact for general questions and comments identified in Section VII above.

Jay Dryer
Director
Fundamental Aeronautics Program

Doug Rohn
Director
Aviation Safety Program

John Cavolowsky
Director

Airspace Systems Program

Ed Waggoner

Director

Integrated Systems Research Program

Timothy Marshall

Director

Aeronautics Test Program

Jaiwon Shin

Associate Administrator

Aeronautics Research Mission Directorate

2

TABLE 1. NASA STRATEGIC GOALS

TABLE 1A. NASA’S STRATEGIC GOALS

- Strategic Goal 1: Extend and sustain human activities across the solar system.
- Strategic Goal 2: Expand scientific understanding of the Earth and the universe in which we live.
- Strategic Goal 3: Create the innovative new space technologies for our exploration, science, and economic future.
- Strategic Goal 4: Advance aeronautical research for societal benefit.
- Strategic Goal 5: Enable program and institutional capabilities to conduct NASA’s aeronautics and space activities.
- Strategic Goal 6: Share NASA with the public, educators, and students to provide opportunities to participate in our Mission, foster innovation, and contribute to a strong national economy.

TABLE 1B. NASA’S Aeronautics Goals, Objectives, Outcomes

- Strategic Goal 4: Advance aeronautics research for societal benefit.
 - Outcome 4.1: Develop innovative solutions and advanced technologies through a balanced research portfolio to improve current and future air transportation.
 - *Objective 4.1.1: Develop advanced technologies to improve the overall safety of the future air transportation system.*
 - *Objective 4.1.2: Develop innovative solutions and technologies to meet future capacity and mobility requirements of the Next Generation Air Transportation System (NextGen).*
 - *Objective 4.1.3: Develop tools, technologies, and knowledge that enable significantly improved performance and new capabilities for future air vehicles.*
 - Outcome 4.2: Conduct systems-level research on innovative and promising aeronautics concepts and technologies to demonstrate integrated capabilities and benefits in a relevant flight and/or ground environment.
 - *Objective 4.2.1: Develop advanced tools and technologies that reduce the technical risk associated with system-level integration of promising aeronautical concepts.*

2
 From *The 2011 NASA Strategic Plan*, available at
http://www.nasa.gov/pdf/516579main_NASA2011StrategicPlan.pdf

TABLE 2. SOLICITED RESEARCH PROGRAMS (IN ORDER OF PROPOSAL DUE DATES)

APPENDIX	PROGRAM	NOI DUE DATE	PROPOSAL DUE DATE
C.2	NextGen - Concepts and Technology Development (CTD1)	1/28/2013	3/4/2013
E.2	Innovative Concepts for Aviation Project (LEARN1)	6/14/2013	7/30/2013

Notes: It is expected that additional project areas will be added in future amendments.

TABLE 3. SOLICITED RESEARCH PROGRAMS (IN ORDER OF APPENDICES A–E)

APPENDIX	PROGRAM	NOI DUE DATE	PROPOSAL DUE DATE
C.2	NextGen - Concepts and Technology Development (CTD1)	1/28/2013	3/4/2013
E.2	Innovative Concepts for Aviation Project (LEARN1)	6/14/2013	7/30/2013

Notes: It is expected that additional project areas will be added in future amendments.

APPENDIX A: Fundamental Aeronautics Program

A.1 Program Overview

Currently the United States (US) is highly dependent on the health of the aviation and aerospace industry as it contributes to the transport of passengers and cargo domestically and abroad and to the security of the US homeland. The ability to transport people and goods point-to-point domestically and internationally is critical to all levels of the economy. Further, it is essential that this ability be realized with as much flexibility, affordability, and environmental responsibility as possible. The public and economic benefits from continued growth in the transport of passengers and cargo are dependent on future air vehicles that can meet demanding environmental and performance challenges. In addition, the United States' strategic decision to move forward with a manned space program for purposes of human exploration and scientific discovery is also dependent on advancements in aeronautical technology and innovations. Specifically, aeronautical technology will address spacecraft flight through planetary atmospheres, thereby addressing the mounting cost and mitigate the high risk challenges of space access and exploration. To these ends, the Fundamental Aeronautics (FA) Program is chartered to address national challenges in air transportation and enable advanced technological capabilities for improving the performance and environmental impact of future air vehicles.

The FA Program consists of four projects:

- The Fixed Wing (FW) Project conducts research and explores and develops tools, technologies, and concepts to enable revolutionary advances in energy efficiency and environmental compatibility of future generations of transport aircraft.
- The Rotary Wing (RW) Project develops and validates tools, technologies and concepts to overcome key barriers for rotorcraft vehicles, resulting in increased rotorcraft speed, range and payload, and decreased noise, vibration, fuel burn and emissions.
- The High Speed (HS) Project addresses challenges preventing practical, commercial supersonic flight including sonic boom; supersonic aircraft fuel efficiency; airport community noise; high altitude emissions; prediction of vehicle control, operation and performance; and the ability to design future vehicles in an integrated, multidisciplinary manner.
- The Aeronautical Sciences (AS) Project addresses exploratory and cross-cutting challenges and technologies that are necessary for a broad range of air vehicles including enabling efficient and accurate design and analysis of advanced air vehicles and propulsion systems through development of validated physics-based tools.

The work in the Fundamental Aeronautics Program directly benefits the public through the development of techniques and concepts for both subsonic and supersonic vehicles that are cleaner, quieter, and more energy efficient. Research efforts in revolutionary

aircraft configurations, lighter and stiffer materials, improved propulsion systems, and advanced concepts for high-lift and drag reduction all target the efficiency and environmental compatibility of future air vehicles. NASA will benefit from fundamental technology advances that can impact our ability to both access space and survive the planetary entry, descent, and landing phase. The program also helps the country develop and maintain excellence in the aeronautics workforce by providing significant research opportunities in all of its projects.

A major emphasis of the Fundamental Aeronautics Program is on the mastery and intellectual stewardship of key core competencies of Aeronautics for the Nation across all flight regimes. However, NASA will principally conduct long-term research that is both focused and integrated across disciplines in areas that are appropriate to our unique capabilities. NASA will invest broadly and deeply producing knowledge, technology, and tools that are applicable across a broad range of air vehicles.

The awards from this NRA will support U.S. leadership in aerospace through its commitment to identify and advance innovative ideas, concepts, technologies, and approaches to the aeronautics challenges described below for each of the four Fundamental Aeronautics thrust areas.

A.2 Fixed Wing Project (FW)

1. Project Overview

A major focus of the Fixed Wing (FW) project is to develop improved prediction methods and technologies for lower noise, lower emissions, and higher performance for subsonic aircraft. Increased performance requires increased energy efficiency and operability for advanced airframe and engine systems and subsystems. The ten-year strategy includes providing novel test methods and validated prediction tools that can be used to improve system trades for advanced concepts that are capable of meeting long-term noise, emissions, and performance targets. The following objectives address the overall project goals, not all of which are within the scope of this solicitation.

- Improvements in prediction tools and new experimental methods that provide fundamental properties and establish validation data
- Noise prediction and reduction technologies for airframe and propulsion systems
- Emissions reduction technologies, alternative fuels, and particulate measurement methods
- Improved vehicle performance through design and development of lightweight, multifunctional and durable structural components, efficient aerodynamics throughout the flight envelope, and higher bypass ratio engines with efficient power plants

Table 1 summarizes the Project's vehicle technology goals for future generation aircraft and represents the "corners" of the trade space. It is desirable to identify technology and

vehicle solutions that simultaneously meet the goals for noise, emissions, and energy usage (fuel burn).

Table 1 – NASA’s Technology Goals for Future Subsonic Vehicles

CORNERS OF THE TRADE SPACE	N+1 (2015)*** Technology Benefits Relative to a Single Aisle Reference Configuration	N+2 (2020)*** Technology Benefits Relative to a Large Twin Aisle Reference Configuration	N+3 (2025)*** Technology Benefits
Noise (cum below Stage 4)	- 32 dB	- 42 dB	- 71 dB
LTO NOx Emissions (below CAEP 6)	-60%	-75%	better than -75%
Performance: Aircraft Fuel Burn	-33%**	-50%**	better than -70%
Performance: Field Length	-33%	-50%	exploit metroplex* concepts

*** Technology Readiness Level for key technologies = 4-6

** Additional gains may be possible through operational improvements

* Concepts that enable optimal use of runways at multiple airports within the metropolitan areas

For air vehicles, two critical performance measures central to the design challenges are the drag from external and internal aerodynamic flows and the vehicle’s propulsion system efficiency. This solicitation seeks proposals for focused research efforts to significantly improve the flow modeling and simulation capability for aerospace vehicles throughout the flight envelope – by accelerating the development of:

- Advanced turbulence modeling concepts and techniques, and
- Faster and higher fidelity computational fluid dynamics (CFD) capabilities for more accurate external and internal flow field predictions

2.0 Description of Solicited Research

The FW Project is not soliciting research topics at this time. Please continue to monitor this solicitation for future amendments.

3.0 Summary of Key Information

Expected annual program budget for new awards	TBD
Number of new awards pending adequate proposals of merit	TBD
Maximum duration of awards	TBD
Due date for Notice of Intent to propose (NOI)	TBD
Due date for proposals	TBD
General information and overview of this solicitation	See the <i>Summary of Solicitation</i> of this NRA.
Detailed instructions for the preparation and submission of proposals	See the <i>NASA Guidebook for Proposers Responding to a NASA Research Announcement – 2012</i> at http://www.hq.nasa.gov/office/procurement/nraguidebook/
Page limit for the central Science-Technical-Management section of proposal	TBD
Submission medium	Electronic proposal submission is required; no hard copy is required. See also Section IV in the <i>Summary of Solicitation</i> of this NRA and Chapter 3 of the <i>NASA Guidebook for Proposers</i> .
Web site for submission of proposal via NSPIRES	http://nspires.nasaprs.com/ (help desk available at nspires-help@nasaprs.com or (202) 479-9376)
Expected type of award	TBD
Funding opportunity number	TBD
NASA points of contact	TBD

A.3 Rotary Wing (RW)

1. Project Overview

The goal of the Rotary Wing project of the NASA Fundamental Aeronautics Program is to enable radical improvements in the transportation system using rotary wing vehicles. To meet this goal will require the development of validated high-fidelity, multi-disciplinary analysis and design tools. In addition, demonstrations of advanced rotorcraft technology are required that:

- Enable variable-speed rotor concepts
- Simultaneously increase aerodynamic efficiency, control dynamic stall, reduce vibration, reduce noise
- Reduce interior noise and vibration
- Contribute to the commercial viability of large rotary wing transport systems in NextGen.

Several facets will be addressed at the fundamental research level: efficiency, including aerodynamic performance and structural weight; productivity, which requires high speed, large payload, long range, and good maneuverability; and environmental acceptance, particularly noise and handling qualities. Without intending to predict where the design process will lead when truly effective design and analysis tools are available, some very promising (and very challenging) configurations can be identified to drive the required fundamental research. The challenges faced in rotary wing aviation are among the most complex and demanding of any configuration: highly complex, three-dimensional rotor and fuselage structures, unsteady flows in speed regimes from low subsonic to high transonic, dynamically stalled components, harsh operating environments, highly-loaded propulsion systems, and a vehicle that is statically unstable. The Rotary Wing project will focus its research effort in the most persistent technical challenge areas in order to produce advances in prediction tool capability and technology.

The Rotary Wing project will utilize this NASA Research Announcement (NRA) to leverage in-house foundational research with academic institutions, non-profit organizations and industry performing foundational and applied research to address technology needs that are focused on unique aspects of rotorcraft configurations.

2.0 Description of Solicited Research

The RW Project is not soliciting research topics at this time. Please continue to monitor this solicitation for future amendments.

3.0 Summary of Key Information

Expected annual program budget for new awards	TBD
Number of new awards pending adequate proposals of merit	TBD
Maximum duration of awards	TBD
Due date for Notice of Intent to propose (NOI)	TBD
Due date for proposals	TBD
General information and overview of this solicitation	See the <i>Summary of Solicitation</i> of this NRA.
Detailed instructions for the preparation and submission of proposals	See the <i>NASA Guidebook for Proposers Responding to a NASA Research Announcement – 2012</i> at http://www.hq.nasa.gov/office/procurement/nraguidebook/
Page limit for the central Science-Technical-Management section of proposal	TBD
Submission medium	Electronic proposal submission is required; no hard copy is required. See also Section IV in the <i>Summary of Solicitation</i> of this NRA and Chapter 3 of the <i>NASA Guidebook for Proposers</i> .
Web site for submission of proposal via NSPIRES	http://nspires.nasaprs.com/ (help desk available at nspires-help@nasaprs.com or (202) 479-9376)
Expected type of award	TBD
Funding opportunity number	TBD
NASA points of contact	TBD

A.4 High Speed Project Project (HS)

1. Project Overview

The High Speed Project is aligned with the Fundamental Aeronautics Program strategy of developing the technological capabilities necessary to overcome national challenges in air transportation including reduced noise, emissions, and fuel consumption and increased mobility through faster means of transportation.

The overall goal of the High Speed Project is to develop and validate the tools, technologies, and concepts to overcome the barriers to practical high-speed vehicles. For the 2013 - 2017 time period, the project has put a priority on the development of tools and integrated concepts that will enable demonstration of overland supersonic flight with an acceptable sonic boom. In order to address this priority, the project has defined two technical challenges. These technical challenges define a focused effort for the 5-year time period that will, if successful, result in a significant step towards overcoming this barrier. The two challenges are:

1. Low Sonic Boom Design Tools: Tools and technologies enabling the design of supersonic aircraft that reduce sonic boom noise to 80 PLdB or lower validated as ready for application in a flight demonstrator.
2. Sonic Boom Community Response metrics and methodologies: Validated field study methodology including indoor and outdoor noise metrics, survey tools, and test protocols to support community studies with a demonstrator aircraft.

In addition to the barrier of sonic boom noise, there are other barriers that must be overcome if practical high speed vehicles are to be developed. Arguably, the second such barrier is an acceptable level of airport community noise. For the 2013-2017 time frame, the High Speed Project has established a technical challenge to address this barrier:

3. Low Noise Propulsion for Low Boom Aircraft: Design tools and innovative concepts for integrated supersonic propulsion systems with noise levels of 10 EPNdB less than FAR 36 Stage 4 demonstrated in ground test.

There are other known barriers to practical high speed vehicles. Although the High Speed Project has not defined focused technical challenges in the 2013-2017 for these barriers, it will continue to invest in research themes that will contribute to overcoming these barriers in the future. The research theme investment areas and the key deliverables anticipated over the next 5 years are as follows:

- Reduce or eliminate the impact of high altitude emissions
 - Assessment of the global impact of emissions from high flying high speed aircraft
- Maximize the cruise efficiency of high speed airframes and propulsion systems

- Validated tools for prediction of supersonic boundary layer transition and understanding of its impact on the achievement of supersonic laminar flow.
 - Analysis tools and concepts for efficient low boom supersonic propulsion system inlets and nozzles.
- Develop multi-discipline solutions to the impact of Aeroservoelasticity on high speed aircraft
 - Methods for assessing the potential for aeropropulsoservoelasticity and understanding its impact
 - Aeroservoelastic assessment, design and control for small supersonic civil aircraft
- Develop flight systems technologies to maximize the capabilities of high speed aircraft in the airspace system
 - Cockpit display of sonic boom carpet for flight management
 - External vision systems for low boom aircraft designs
- Develop scramjet propulsion technologies for high speed vehicles
 - Support for DoD research on robust scramjet propulsion and scale up of existing systems to larger flow path sizes

The High Speed Project is committed to engaging with the aeronautics research community in order to expand the success and the impact of its funded research. This engagement includes both partnerships and external research investment. The objective of this investment will be to stimulate innovative and creative research in conjunction with the NASA internal efforts in order to successfully overcome the barriers discussed above. The project will solicit and select university, small business, and industry participation, through the NASA Research Announcement (NRA) process.

2. Description of Specific Solicited Research

The High Speed Project is not soliciting research topics at this time. Please continue to monitor this solicitation for future amendments.

3.0 Summary of Key Information

Expected annual program budget for new awards	TBD
Number of new awards pending adequate proposals of merit	TBD
Maximum duration of awards	TBD
Due date for Notice of Intent to propose (NOI)	TBD

Due date for proposals	TBD
General information and overview of this solicitation	See the <i>Summary of Solicitation</i> of this NRA.
Detailed instructions for the preparation and submission of proposals	See the <i>NASA Guidebook for Proposers Responding to a NASA Research Announcement – 2012</i> at http://www.hq.nasa.gov/office/procurement/nraguidebook/ .
Page limit for the central Science-Technical-Management section of proposal	TBD
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Web site for submission of proposal via NSPIRES	http://nspires.nasaprs.com/ (help desk available at nspires-help@nasaprs.com or (202) 479-9376)
Expected contract type	TBD
Funding opportunity number	TBD
NASA technical point of contact concerning this program	TBD
NASA Procurement point of contact concerning this program	TBD

A.5 Aeronautical Sciences Project (AS)

1. Project Overview

The Aeronautical Sciences (AS) Project is focused on enabling efficient and accurate design and analysis of advanced air vehicles and propulsion systems by developing validated physics-based tools and exploratory cross-cutting technologies for a broad range of aeronautics disciplines. These disciplines include advanced fluid mechanics, combustion, structures & materials, measurement and controls. The Aeronautical Sciences Project also develops improved MDAO and systems analysis tools to enable multi-disciplinary integration.

The Fluid Mechanics Discipline encompasses advanced turbulence modeling, boundary layer transition prediction and modeling, numerical methods, and flow control development and prediction for a wide range of airframe and propulsion system flow problems of interest. Canonical data is developed and used to validate the modeling improvements developed in this discipline. Development of more accurate physics-based methods such as large eddy simulation (LES) is emphasized.

The Structures and Materials Discipline emphasizes improved multifunctional and high temperature materials for airframe and engine application, as well as modeling and simulation tool development to improve validated first-principles materials and structural modeling. Development of ceramic matrix composite (CMC) materials for high-temperature engine application is of particular emphasis in the discipline.

The MDAO (Multi-Disciplinary Design, Analysis & Optimization) and Systems Analysis Discipline develops MDAO and aircraft system-level tools to improve integration of discipline-based technologies and enable improved assessment of system-level benefits. An open-source framework is emphasized to better leverage external partners and increase interaction and benefit to the community.

The Combustion Discipline is developing more accurate physics-based models for complex multi-species reacting flows representative of aircraft engine combustors. This is done through a combination of high-fidelity benchmark experiments and the use of advanced unsteady turbulence modeling and large eddy simulation (LES) methods. Advanced concepts such as active combustion control and pressure-gain combustion cycles are also investigated.

The Controls Discipline encompasses work across aircraft flight controls and advanced propulsion controls. Development of technologies to enable distributed engine control systems are an area of emphasis in this discipline.

The Innovative Measurements Discipline conducts research to advance the state-of-the-art in cross-cutting sensing and measurement technologies for aircraft and propulsion systems. Areas of development include advanced optical measurements, enhanced sensing, and improved data acquisition.

The Aeronautical Sciences Project also addresses cross-cutting discipline-based research needs of the other 3 projects of the Fundamental Aeronautics Program (FAP): Fixed Wing (FW), Rotary Wing (RW), and High Speed (HS). The emphasis of the FW Project is to develop validated tools and technologies to enable reduced noise, reduced emissions, and improved performance for subsonic aircraft. The RW Project addresses the priority technical challenges that limit rotorcraft from becoming a more effective contributor to the national civil aviation system, complementing the civil fixed wing aircraft fleet. The HS Project conducts research to address the efficiency, environmental, and performance barriers that prevent practical supersonic cruise over land.

2. Description of Specific Solicited Research

The Aerosciences Project is not soliciting research topics at this time. Please continue to monitor this solicitation for future amendments.

3.0 Summary of Key Information

Expected annual program budget for new awards	TBD
Number of new awards pending adequate proposals of merit	TBD
Maximum duration of awards	TBD
Due date for Notice of Intent to propose (NOI)	TBD
Due date for proposals	TBD
General information and overview of this solicitation	See the <i>Summary of Solicitation</i> of this NRA.
Detailed instructions for the preparation and submission of proposals	See the <i>NASA Guidebook for Proposers Responding to a NASA Research Announcement – 2012</i> at http://www.hq.nasa.gov/office/procurement/nraguidebook/ .
Page limit for the central Science-Technical-Management section of proposal	TBD
Submission medium	Electronic proposal submission is required; no hard copy is required. See also Section IV in the <i>Summary of Solicitation</i> of this NRA and Chapter 3 of the <i>NASA Guidebook for Proposers</i> .

Web site for submission of proposal via NSPIRES	http://nspires.nasaprs.com/ (help desk available at nspires-help@nasaprs.com or (202) 479-9376)
Expected contract type	TBD
Funding opportunity number	TBD
NASA technical point of contact concerning this program	TBD
NASA Procurement point of contact concerning this program	TBD

APPENDIX B: Aviation Safety Program

B.1 Program Overview

The current U.S. air transportation system is widely recognized as among the safest in the world. Over the past ten years, the commercial accident rate has continued to drop, a credit to industry and government working together to solve problems and proactively identify new risks. However, the demand for air traffic is expected to continue to increase substantially in the next 15 to 20 years, and while NextGen will meet this demand by making passage through the increasingly crowded skies efficient and speedy, it will come with increased reliance on automation and increased operating complexity. Therefore, the vigilance of the aviation community must continue in order for the U.S. to meet the public expectations for safety in this complex, dynamic domain.

To meet the challenge, the Aviation Safety Program (AvSP) develops cutting-edge technologies to improve the intrinsic safety of current and future aircraft that will operate in NextGen. AvSP's contributions range from providing fundamental research and technologies on known or emerging safety concerns, to identifying emerging issues and to working with partners in developing new capabilities for NextGen. AvSP transfers knowledge and technology to the aviation community for both hardware and software systems.

The objectives of the AvSP are to proactively identify, research, develop, and mature tools, methods, and technologies for improving overall safety of new and legacy vehicles and systems operating in NextGen. The resulting capabilities will enable design solutions and operating concepts for present and future vehicles and systems.

The AvSP increases capabilities to predict and prevent safety issues by developing technologies to monitor for safety issues and minimize them should they occur; designing safety issues out of complex systems and system behaviors; and analyzing designs and operational data for potential hazards.

For more information, see http://www.aeronautics.nasa.gov/programs_avsafe.htm

B.2 System-Wide Safety Assurance Technologies Project (SSAT)

1. Project Overview

Public benefits derived from continued growth in the transport of passengers and cargo are dependent on the improvement of the intrinsic safety attributes of current and future air vehicles that will operate in the Next Generation Air Transportation System (NextGen). The System-Wide Safety and Assurance Technologies Project (SSAT) project will identify risks and provide knowledge required to safely manage increasing complexity in the design and operation of vehicles and the air transportation systems, including advanced approaches to enable improved and cost-effective verification and validation of flight-critical systems. SSAT is focused on methods to assess and ensure system-wide safety of complex aviation systems. The project will emphasize proactive methods and technologies, and utilize a systems analysis approach to identify key issues and maintain a portfolio of research leading to potential solutions. A proactive approach to managing system safety requires (1) the ability to monitor the system continuously and to extract and fuse information from diverse data sources to identify emergent anomalous behaviors after new technologies, procedures, and training are introduced; and (2) the ability to reliably predict probabilities of the occurrence of hazardous events and of their safety risks.

The goal of the System-Wide Safety and Assurance Technologies (SSAT) project is to develop validated multidisciplinary tools and techniques to ensure system safety in NextGen and enable proactive management of safety risk through predictive methods. The project consists of four key technical challenges: Assurance of Flight Critical Systems, Discovery of Precursors to Incidents, Assuring Safe Human-Systems Integration, and Prognostic Algorithm Design for Safety Assurance. Each of these areas supports the project goal and its focus on ensuring system safety and developing proactive technologies to enable a successful transition to NextGen. Each technical challenge is designed to address key issues related to NextGen.

The SSAT technical challenges were identified based on a number of key criteria, including the priorities defined in the National Aeronautics Research and Development Plan, the NRC Decadal Survey of Civil Aeronautics, and the JPDO Integrated Work Plan. The NASA Aviation Safety program also conducted a Systems Analysis study, published in 2010, that gives a prioritization of key challenges facing the aviation safety community. The report identifies the types of accidents with the greatest impact to overall safety risk in US civil aviation. The report also presents an analysis of the Future Safety Risk---so-called “Tall Poles” in Aviation Safety. The Technical Challenges in the SSAT Project directly address the following key Future Safety Risks:

1. Loss of Control – In Flight
2. Approach and Landing Accident Reduction
3. Human Fatigue
4. Increasing Complexity and Reliance on Automation

5. Inadequate Protection, Analysis, and Dissemination of Safety Data

Research on each of these technical challenges delivers results to key stake holders including the FAA, JPDO, Airline Carriers, the Aeronautics industry, and the General Aviation Community. These technical challenges also fully support the goal of the SSAT project.

1. **Assurance of Flight Critical Systems:** This technical challenge involves research in verification and validation for flight critical systems in support of system-wide safety in NextGen.
2. **Discovery of Precursors to Safety Incidents:** This technical challenge focuses on the development of advanced tools and techniques to discover precursors to aviation safety incidents in NextGen.
3. **Assuring Safe Human-Systems Integration:** This technical challenge focuses on the development of robust human-automation systems by incorporating known limits of human performance in support of NextGen.
4. **Prognostic Algorithm Design for Safety Assurance:** This technical challenge focuses on the development of advanced tools and techniques to estimate the remaining useful life of a complex system and make decisions under uncertainties that are related to faults and failures.

2.0 Description of Solicited Research

The SSAT Project is not soliciting research topics at this time. Please continue to monitor this solicitation for future amendments.

3.0 Summary of Key Information

Expected annual program budget for new awards	TBD
Number of new awards pending adequate proposals of merit	TBD
Maximum duration of awards	TBD
Due date for Notice of Intent to propose (NOI)	TBD
Due date for proposals	TBD
General information and overview of this solicitation	See the <i>Summary of Solicitation</i> of this NRA.

Detailed instructions for the preparation and submission of proposals	See the <i>NASA Guidebook for Proposers Responding to a NASA Research Announcement – 2012</i> at http://www.hq.nasa.gov/office/procurement/nraguidebook/
Page limit for the central Science-Technical-Management section of proposal	TBD
Submission medium	Electronic proposal submission is required; no hard copy is required. See also Section IV in the <i>Summary of Solicitation</i> of this NRA and Chapter 3 of the <i>NASA Guidebook for Proposers</i> .
Web site for submission of proposal via NSPIRES	http://nspires.nasaprs.com/ (help desk available at nspires-help@nasaprs.com or (202) 479-9376)
Expected type of award	TBD
Funding opportunity number	TBD
NASA points of contact	TBD

B.3 Vehicle Systems Safety Technologies Project (VSST)

1. Project Overview

The Vehicle Systems Safety Technologies Project (VSST) is developing technologies to improve vehicle safety by proactively mitigating current and future risks. These technologies will have the potential to reduce accidents and incidents through enhanced vehicle design, structure, systems, and operating concepts. More specifically, the VSST Project objective is to:

Identify vehicle-related risks and develop technologies needed to avoid, detect, mitigate, and recover from hazardous flight conditions, and to maintain vehicle airworthiness and health.

To accomplish this objective, the following technical challenges are being addressed:

- Improving crew decision-making and response in complex situations (TC-1)
- Maintaining vehicle safety between major inspections (TC-2)
- Assuring safe and effective aircraft control under hazardous conditions (TC-3)

These technical challenges are motivated in large part by the leading causal and consequential factors associated with aircraft accidents. The first two technical challenges deal directly with primary causal factors cited in aircraft accidents, i.e., crew errors and aircraft system failures, while the third directly addresses the predominant consequence, aircraft loss of control, of these and other causal factors. The focus of TC-1 is to increase pilots' ability to avoid, detect, and recover from adverse events that could otherwise result in accidents and incidents, with technologies being developed that provide new capabilities to enable pilots to better understand and respond safely to complex situations. TC-2 is focused on the identification and proactive mitigation of critical airframe, engine, and avionics failures, with technologies being developed that provide new integrated health management and failure prevention capabilities that assure vehicle systems integrity between major inspections and provide vehicle state awareness during flight. The focus of TC-3 is to prevent aircraft loss of control by understanding vehicle dynamics and providing the appropriate control response under multiple hazards, with integrated guidance, control, and systems technologies being developed to enable safe and effective crew/system control under hazardous conditions.

A second, and equally important, motivation for research addressing these challenges is a recognition that future aircraft and operational environments could introduce additional safety risks. The Next Generation (NextGen) National Airspace System (NAS) is envisioned to provide a safe, efficient and reliable air transportation system for 2025 that removes many of the constraints in our current system, supports a wider range of operations, and thus delivers an overall system capacity up to three times that of current operating levels. It is also anticipated that operation within NextGen will be comprised of current and future aircraft configurations, both piloted and unmanned. Future aircraft, systems, and operational trends with the potential to impact aviation safety therefore need to be identified and considered. Some of these trends include the following: systems are becoming more complex and more automated; materials and structures are becoming more advanced but with less history of performance; future vehicle designs provide

improved performance but at the expense of reduced inherent stability; flight operations are becoming more precise and will need to be coordinated with other traffic and ground-based air traffic managers; and a capability is envisioned that can support equivalent all-weather capability, 24/7, to any runway. These trends are being examined to identify new vehicle safety risks related to the three VSST technical challenges.

2.0 Description of Solicited Research

The VSST Project is not soliciting research topics at this time. Please continue to monitor this solicitation for future amendments.

3.0 Summary of Key Information

Expected annual program budget for new awards	TBD
Number of new awards pending adequate proposals of merit	TBD
Maximum duration of awards	TBD
Due date for Notice of Intent to propose (NOI)	TBD
Due date for proposals	TBD
General information and overview of this solicitation	See the <i>Summary of Solicitation</i> of this NRA.
Detailed instructions for the preparation and submission of proposals	See the <i>NASA Guidebook for Proposers Responding to a NASA Research Announcement – 2012</i> at http://www.hq.nasa.gov/office/procurement/nraguidebook/
Page limit for the central Science-Technical-Management section of proposal	TBD
Submission medium	Electronic proposal submission is required; no hard copy is required. See also Section IV in the <i>Summary of Solicitation</i> of this NRA and Chapter 3 of the <i>NASA Guidebook for Proposers</i> .
Web site for submission of proposal via NSPIRES	http://nspires.nasaprs.com/ (help desk available at nspires-help@nasaprs.com or (202) 479-9376)
Expected type of award	TBD
Funding opportunity number	TBD
NASA points of contact	TBD

B.4 Atmospheric Environment Safety Technologies (AEST)

2. Project Overview

The Atmospheric Environment Safety Technologies (AEST) Project will investigate sources of risk and provide technology needed to help ensure safe flight in and around atmospheric hazards. In-flight icing, both engine and airframe, will be the major focus of AEST. Research will also include investigations of other high priority atmospheric hazards and sensor technologies required for their detection. The project will utilize a systems analysis approach to identify key issues and maintain a portfolio of research leading to potential solutions. The AEST Project will meet its objective by addressing the following three Technical Challenge Areas:

1. **Engine Icing Characterization and Simulation Capability:** Develop knowledge bases, analysis methods, and simulation tools needed to address the problem of engine icing, in particular, ice-crystal icing

Goals: Eliminate turbofan engine interruptions, failures, and damage due to flight in high ice-crystal content clouds
2. **Airframe Icing Simulation and Engineering Tool Capability:** Develop and demonstrate 3-D capability to simulate and model airframe ice accretion and related aerodynamic performance degradation for current and future aircraft configurations in an expanded icing environment that includes freezing drizzle and rain

Goals: Achieve acceptance of simulation tools for design and certification of swept wing configurations over an expanded range of icing conditions
3. **Atmospheric Hazard Sensing & Mitigation Technology Capability:** Improve and expand remote sensing and mitigation of hazardous atmospheric environments and phenomena

Goals: Mature technologies for real-time sensing and measurement of icing, turbulence, and wake vortex hazards for real-time information to the pilot and operators in the National Airspace System (NAS) and to address low visibility conditions for safer runway operations; develop technologies for a lightning immune composite aircraft.

2.0 Description of Solicited Research

The AEST Project is not soliciting research topics at this time. Please continue to monitor this solicitation for future amendments.

3.0 Summary of Key Information

Expected annual program budget for new awards	TBD
Number of new awards pending adequate proposals of merit	TBD
Maximum duration of awards	TBD
Due date for Notice of Intent to propose (NOI)	TBD
Due date for proposals	TBD
General information and overview of this solicitation	See the <i>Summary of Solicitation</i> of this NRA.
Detailed instructions for the preparation and submission of proposals	See the <i>NASA Guidebook for Proposers Responding to a NASA Research Announcement – 2012</i> at http://www.hq.nasa.gov/office/procurement/nraguidebook/
Page limit for the central Science-Technical-Management section of proposal	TBD
Submission medium	Electronic proposal submission is required; no hard copy is required. See also Section IV in the <i>Summary of Solicitation</i> of this NRA and Chapter 3 of the <i>NASA Guidebook for Proposers</i> .
Web site for submission of proposal via NSPIRES	http://nspires.nasaprs.com/ (help desk available at nspires-help@nasaprs.com or (202) 479-9376)
Expected type of award	TBD
Funding opportunity number	TBD
NASA points of contact	TBD

APPENDIX C: Airspace Systems Program

C.1 Program Overview

The Airspace Systems Program (ASP) performs foundational research to enable the development of revolutionary improvements to, and modernization of, the National Airspace System, as well as the introduction of new systems for vehicles whose operation can take advantage of the improved, modern air traffic management (ATM) system. The benefit to the flying public from ASP research, although clearly focused on development of capabilities that enable more efficient operations and reduce flight delays, will be realized as a reduction in doorstep-to-destination trip duration.

ASP research is focused to achieve the vision of NextGen including; accommodating projected growth in air traffic while preserving and enhancing safety; providing all airspace system users more flexibility and efficiency in the use of airports, airspace and aircraft; meeting our civil aviation, national defense, and homeland security needs as a national priority; and maintaining pace with a continually evolving scientific and technical environment.

ASP research occurs principally at two field centers, Ames Research Center and Langley Research Center. A subset of this in house research is in partnership with other federal agencies and international partners to achieve mutually beneficial goals and conservation resources. Additional ASP portfolio research is funded by ASP and performed by industry and academia.

The objectives of ASP are to:

- Perform research to enable new aircraft system capabilities and air traffic technology to increase the capacity and mobility of the nation's air transportation system
- Perform research to maximize operational throughput, predictability, efficiency, flexibility, and access into the airspace system while maintaining safety and environmental protection.
- Explore and develop concepts and integrated solutions to define and assess the allocation of centralized and decentralized automation concepts and technologies necessary for NextGen.
- Perform research to support the sustainment of a world-class aeronautics workforce
- Transition research results through dissemination, integration and transition.

ASP is comprised of two projects: NextGen Concepts and Technology Development (CTD) and NextGen System Analysis, Integration and Evaluation (SAIE). The two projects are formulated to make major contributions to air traffic needs of the future through the development and research of foundational concepts and technologies and their analysis, integration and maturation in relevant, system-level environments. Both projects are, much like the airspace system itself, highly integrated, and pay close attention to critical system integration and transition interfaces in the national airspace

system.

For more information, please see http://www.aeronautics.nasa.gov/programs_asp.htm

C.2 NextGen – Concepts and Technology Development Project (CTD)

C.2.1 Project Overview

The CTD project is primarily responsible for facilitating the Research and Development (R&D) through developing and exploring 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. In pursuit of that aim, researchers will develop algorithms, conduct analyses and simulations, identify and define infrastructure requirements, identify and define field test requirements, and conduct field tests, to increase throughput of the NAS and achieve high efficiency in the use of resources such as airports, en route and terminal airspace. For a description of the NextGen System Analysis, Integration, and Evaluation (SAIE) Project, please refer to the SAIE project overview, Section C.3.1.

C.2.2 Description of Solicited Research

Background: In the context of the NAS, choke points refer to any areas or conditions in the en route, terminal, oceanic, tower, airport, and surface operations that constrain the response to actual demand in current operations. In these areas or conditions, demand and capacity are not balanced and demand management techniques, such as speed reductions, rerouting, path stretching, holding, ground delays, and capping or tunneling, need to be implemented.

The solicitation requires that the Contractor use documents, data, and scenarios available from the FAA, JPDO, NASA's ARMD Strategic Architecture and Analysis Office, and NASA's Airspace Systems Program, as well as related publications from professional journals and conferences.

Objectives: The objectives of this NRA solicitation are as follows:

1. Conduct causal choke point analysis in the entire NAS. The focus of analysis should be on en route, terminal, oceanic, tower, and airport related choke points that can be addressed by ground-based and/or aircraft-based concepts, technologies, and procedures. Various NextGen architectures proposed by JPDO, FAA, and NASA's Strategic Architecture and Analysis Office will be used for this analysis.
2. Identify the impact of each of the critical choke points on economic value, delays, fuel consumption, and the environment.
3. Verify the existence and causes of choke points, obtaining input from multiple stakeholders, including airspace/airport users.

4. Conduct analysis of the relevant NASA concepts and technologies and how they will address choke points.
5. Conduct analysis that will reflect the economic impact of resolving the identified choke points, including instances when resolving multiple choke points is required to achieve measurable economic impact
6. Conduct cost analysis of choke point mitigation strategies particularly focused on NASA concepts and technologies.
7. Identify demonstration candidates to address the top 10 choke points.

Description of Tasks and Deliverables

Task 1: Work plan development

The first task is to plan the work. This task will include the refinement of goals, technical approach, schedule, resources, risk, management plan, teaming, tiger team formulation process, cost, and methods to track progress, in coordination with NASA. While the initial work plan will be outlined in the proposers' response to the solicitation, the final working plan will be developed in close collaboration with NASA.

The proposal would include the prior experience with work planning of this scope and describe specific items that will be included in the work plan and how the Contractor will manage them.

Deliverable 1: Detailed contractor work plan delivery (final deliverable due 3 months from the award)

Task 2: Detailed choke points analysis

Conduct a comprehensive analysis to identify choke points in the entire National Airspace System (NAS) based on current traffic demand (2008-2012). The choke points should cover the entire en route, terminal, oceanic, airport, and surface operations throughout the NAS. The analysis would also include the variations of demand/capacity imbalances at these choke points under different weather/atmospheric conditions and sensitivities to them. The Contractor would use multiple data sources to conduct these analyses. The Contractor will also identify choke points under future demand sets that reflect 1.5X, 2X, and 3X traffic conditions. The focus of analysis should be on en route, terminal, oceanic, tower, and airport-related choke points that can be addressed by ground-based and/or aircraft-based concepts, technologies, and procedures. Various NextGen architectures and technologies proposed by JPDO, FAA, NASA's Strategic Architecture and Analysis Office, and NASA's Airspace Systems Program will be used for this analysis. The number of choke points should be in the range of 50-100.

The proposal would clearly describe those architectures that will be used, choke point analysis methodology, analysis methodology of economic impact of choke points, and how this task shall be conducted by the Contractor. The proposal would clearly describe

the type of analysis and methods using current data, additional modeling and simulation for current as well as future scenarios.

Deliverable 2.1: Detailed choke points analysis methodology description (final deliverable due 6 months from the award)

Deliverable 2.2: Detailed choke points analysis report for top 50 choke points in the NAS (final deliverable due 14 months from the award)

Task 3: Identify and gather stakeholder feedback related to critical choke points

One of the approaches for conducting Task 3 is described below. However, the proposer is free to suggest other approaches to identify and gather stakeholder feedback related to critical choke points that increase the cost of air traffic operations.

Task 3 includes the identification of critical choke points. Identification could be done using approaches like a tiger team consisting of multiple stakeholders, including but not limited to airspace user representatives, air traffic management subject matter experts, aviation economists, airport/ramp operators, analysts, university researchers, representatives from organizations such as: Airlines for America, FAA representatives, contractor representatives. This tiger team, along with NASA representatives, would rank the choke points based on their impact using metrics and clear criteria such as lost economic value, delays, fuel efficiency, schedule integrity, and others. The team will rank the critical choke points based on the impact. The tiger team may choose to conduct a workshop at a NASA Center location to enhance understanding and gain consensus about the choke points and their impacts.

Upon identification of the critical choke points, the Contractor shall conduct a detailed causal analysis to explain the causes of the demand/capacity imbalance for these critical choke points. The Contractor has the flexibility to offer the methods that are most appropriate for the causal analysis. The data analysis, modeling, simulation using prior data and future traffic scenarios should consider nominal and off-nominal scenarios. To the extent possible, the Contractor will use the JPDO NextGen common reference data set to generate metrics on economic value, delays, fuel efficiencies, environmental impacts, and stakeholder values. The Contractor will consider system-wide as well as individual aircraft-level metrics. To the extent possible, the Contractor would also use demand sets, scenarios, baseline capacities, fleet mixes, and weather conditions developed by JPDO and NASA's Strategic Architecture and Analysis Office. However, the Contractor could offer substitute or additional data sets, scenarios, baseline capacities, fleet mixes, weather conditions.

A potential approach is for the Contractor will interview and/or survey airspace users to gain additional insights into the choke points and how and when they manifest and evolve. These insights should reflect user experiences, impacts, and lost economic value.

The user survey will be a joint activity between NASA and the selected Contractor. The Contractor would design the surveys. The Contractor will manage scheduling of in-person interviews or surveys. The surveys and interviews should contain various points of view, and should include, but are not limited to, pilots, controllers, dispatchers, flow managers, ramp/airport management teams, airline CEO's/CFO's, modernization leads, and will consider a variety of levels of airspace user. Further, the Contractor will conduct an analysis of economic impacts of these choke points as demand exceeds over-capacity conditions. The Contractor would work with NASA project and program personnel to keep the airline and other stakeholder community tightly engaged. The Contractor is free to propose different or additional methods to gather same data.

The proposal would include a detailed methodology to accomplish stakeholder feedback gathering, analysis, and their linkage to the choke points. The proposal will detail the methods of data collection, the audience that will be reached to, what additional feedback data will be collected and how it will be analyzed. The proposal would also include how key partnerships with airspace users and the FAA and other stakeholders will be developed and prior related experience. The proposal will clearly describe how they will closely work with NASA Airspace Systems Program projects and researchers while developing external partnerships with users. The proposal would describe the criteria and method used to identify and categorize the critical choke points. The proposal would also describe all the metrics that will be used to conduct the choke points analysis. The proposal will also describe the type of scenarios, demand sets, architectures, fleet mixes that will be used in the analysis. The anticipated number of categories (or the method to derive them) and type of categories will be clearly described in the proposal. The proposal shall describe the approach to keep the airline and other stakeholder community tightly engaged in this activity as their feedback and inputs are valuable source for this effort.

Deliverable 3: Detailed stakeholder feedback report related to choke points analysis (final deliverable due 18 months from the award)

Task 4: Identify relationship of choke points, causal factors, and NASA's concepts and technologies that may mitigate choke points

Consider NASA concepts and technologies, developed by NASA's Airspace Systems Program, and conduct a thorough analysis to examine the previously identified choke points and how these choke points will be addressed. The Contractor and the tiger team would identify specific metrics and the extent to which the choke points could be alleviated by the NASA concepts and technologies. NASA, the Contractor and the tiger team will identify the gaps and overlaps in addressing these choke points using NASA technology as the basis. NASA's aircraft and ground based concepts and technologies shall be considered while examining the choke points. Further, all concepts and

technologies (stand-alone and integrated) related to surface operations, super density operations, traffic flow management, weather integration, trajectory operations, dynamic airspace configuration, and separation assurance shall be considered while examining how these choke points will be addressed. The Contractor shall would conduct analysis to identify interrelationship among choke points.

The Contractor and the tiger team will conduct a thorough analysis of how these choke points shall be addressed by singular or integrated concepts and technologies developed by NASA or other organizations (e.g., JPDO's enterprise architecture and FAA's architecture) and shall further uncover near-term opportunities to address choke points.

The Contractor will also identify additional requirements for concepts and technologies if the choke points are not addressed or not addressed effectively by NASA, JPDO and FAA proposed concepts and technologies available.

The proposal will describe the methods that will be used to identify the relationship of choke points, causal factors, and NASA's Airspace Systems Program concepts and technologies that will mitigate (and to what extent) the impacts of choke points. The proposal will also clearly describe how gaps and overlaps in concepts and technologies will be identified. The methods used to detect the interrelationships among choke points, and associated concepts and technologies that will address the choke points.

Deliverable 4: Choke points and mitigation strategy using NASA concepts and technologies (final deliverable due 22 months from the award)

Task 5: Initial cost and benefits estimation of solution strategies to address top 10 choke points

The analysis results and insights from the tiger team will be used to conduct an initial cost and benefits analysis to address the top 10 choke points. These initial costs will include costs to demonstrate technologies as well as costs to implement these technologies. The Contractor and the tiger team, consisting of various stakeholders, will develop recommendations for the top 5 demonstration candidates based on cost, economic value, ease of implementation, time to impact, partnership and cost-sharing potential, and stakeholders' interest.

The proposal will clearly describe the approach to cost estimation and benefits analysis to address the top choke points using NASA's concepts and technologies in the system. The proposal will clearly describe the criteria for selecting the top 10 choke points.

The proposal will also include any additional research, development, validation, and analysis activities that will be proposed as part of this proposal that are not explicitly called out in the above-mentioned tasks and deliverables but will be useful for the objectives of this solicitation.

Deliverable 5: Report on costs associated with solution strategies to address top 10 choke points (final report due 24 months from the award)

Task 6: Software tools and documentation

All analysis algorithms and method descriptions, data reduction and analysis software source code, and software usage documentation (such as user manuals) will be delivered to NASA. The proposer will offer a training class to demonstrate how the algorithms work and how to use the software.

The proposer will clearly articulate their approach to delivering initial and updated software source code and associated versions with user manuals.

Deliverable 6: Analysis algorithms, software source code, and software usage documentation

For all tasks and deliverables, the proposed work must clearly address uncertainty quantification and propagation throughout the analysis processes. All analyses must be conducted with explicit uncertainty quantification and propagation. Point outcomes will not be deemed satisfactory.

For all tasks and deliverables, the proposed work must clearly and explicitly address the sensitivity of the outcome to the assumptions. In addition to other assumptions, sensitivity to two major types of assumptions must be addressed: the limitations/simplifications in scenarios and the inherent assumptions of the simulations.

For all tasks and deliverables, proposed work must clearly address phenomena that arise as a result of interactions and interdependencies among the events in the systems and integrated technologies and concepts.

The proposal will clearly articulate how a proposer will address sensitivity analysis, uncertainty quantification and propagation, type of statistics, assumptions, limitations/simplifications, and interactions.

Deliverable	Due Date	Location
Initial Deliverable 1	2 months from award	
NASA Review and feedback on Deliverable 1	15 days from delivery of deliverable 1	
Final Deliverable 1	3 months from award	
Initial Deliverable 2.1: Brief Choke Points	5 months from award	

Analysis Approach to NASA		
Briefing on initial Deliverable 2.1	5 months from award	NASA ARC and LaRC
NASA Review and feedback on Deliverable 2.1	15 days from initial deliverable 2.1	
Final Deliverable 2.1	6 months from award	
Initial Deliverable 2.2	12 months from award	
Briefing on Initial Deliverable 2.2	12 months from award	NASA ARC and LaRC
NASA Review and Feedback on Deliverable 2.2	30 days from initial deliverable 2	
Final Deliverable 2.2	14 months from award	
Initial Deliverable 3	16 months from award	
Briefing on Initial Deliverable 3	16 months from award	NASA ARC and LaRC
NASA Review and feedback on Deliverable 3	30 days from initial deliverable 3	
Final Deliverable 3	18 months from award	
Initial Deliverable 4	20 months from award	
Briefing on initial Deliverable 4	20 months from award	NASA ARC and LaRC
NASA Review and feedback on Deliverable 4	30 days from initial deliverable 4	
Final Deliverable 4	22 months from award	
Initial Deliverable 5	21 months from award	
Briefing on initial Deliverable 5	21 months from	NASA ARC

	award	and LaRC
NASA Review and feedback on Deliverable 5	20 days from initial deliverable 5	
Final Deliverable 5	24 months from award	
Deliverable 6	23 months from award	

C.2.3 Intellectual Property

The Contractor and its team shall deliver to NASA all data, analysis approach, analysis results, and any developed software. Any developed analysis capability shall also be delivered to NASA and made publicly available.

All proposals should specify all hardware, software, or analysis capability required to conduct the research. The proposal should also include a clear statement of what intellectual property is expected to be publicly available at the conclusion of the work.

Delivery of hardware and software source and executable code specified in the proposal and/or this NRA Appendix must include comprehensive interface specifications, instructions for installation and execution, and a technical specification of all hardware and software. The operating system platform should be Linux, Windows XP, or Windows 7. Software language preferences are C++ or Java. Graphical interfaces should utilize the GLUT library. All hardware and software developed or purchased under this NRA will be owned by NASA.

The delivery to NASA of the developed models and software for Government use is a non-negotiable criterion including complete source code for all software required for conducting the entire analysis. It is NASA's intent that all deliverables under the contract be provided to NASA with unrestricted/unlimited rights; thus, any restrictions must demonstrate a significant net benefit to NASA and may result in a lower evaluation.

C.2.4 Programmatic Considerations

This topic has an expected duration and funding level as specified above. Proposals should cover all solicited research in the topic. Proposers should treat this funding amount specification as a guideline that represents NASA's initial estimation of the funding needed to obtain valid results. Proposers should propose an amount of funding appropriate to achieve results that best address the intent of the solicitation. Technical

scope justifications for proposed funding amounts may be included and will assist NASA in the proposal evaluation process. During the award negotiations, NASA may require an adjustment to a proposer's funding level through adjustment of scope.

The actual number and value of the awards will depend on the quality of the proposals received and scope of the proposed work, and there is no guarantee that an award will be made. Multi-year awards are subject to funding availability in subsequent fiscal years. In some cases, only a portion of a proposal may be selected for award.

NASA may select multiple awardees for this solicitation. The proposals (including technical and cost proposals) shall not exceed 50 pages. The contract shall be awarded as firm fixed price contract.

The technical section must clearly describe:

- Relevance to the specified objectives of this solicitation
- Background and objectives of the proposed research
- Technical approaches
- Level of effort to be employed
- Schedule with milestones and specific quantifiable metrics to be used to judge progress toward achieving the proposed goal
- Work plan including a comprehensive Statement of Work
- Anticipated results and deliverables at the end of the development effort
- Qualifications, capabilities, and experience of the team members in the activities related to the content proposed in the work plan
- A clear statement of what intellectual property is expected to be publicly available at the conclusion of the work is required. It is NASA's intent that all deliverables under the contract will be provided to NASA with unrestricted/unlimited rights
- Schedule for oral presentations (Kick-off, Technical Workshop, final review, and Conference Presentation), interim quarterly reports/reviews, and final contractor report (CR). A travel budget to support reviews and other interactions should be included in the proposal

The science-technical-management section should not exceed 15 pages. Supporting information such as budget, resumes, and commitment letters will not be counted toward the 15 page limit. Please refer to section IV of this solicitation, "Proposal and Submission Information", for requirements on proposal content, format, budget details, and submission procedures. Proposers should propose an appropriate level of effort (cost and duration). The estimated level of effort provided with the topic description is for general guidance.

There will be a kick-off meeting at the beginning of the award period, a Technical Workshop, quarterly reviews, and a final review to monitor progress. A specific schedule of technical reports to document results is listed in the description of solicited research. At a minimum, quarterly progress reports/reviews are expected; the information in these reports/reviews will be one of the factors used to determine whether adequate progress has been made.

The intent of the NRA process is to foster strategic partnerships between NASA and the awarded institutions for collaborative research and development of innovative concepts, ideas, technologies and approaches. Therefore collaboration with NASA researchers may be anticipated while performing work under these awards. Communications with NASA during the solicitation period can only occur through the designated POC (see Section C.2.8). There can be no direct or indirect communications with NASA researchers and managers from the time this solicitation is posted to NSPIRES until proposal selections are final. See Questions 34-41 in ROA-2013 NRA Q&A's for guidance on this issue: <http://nspires.nasaprs.com/external/solicitations/summary.do?method=init&solId={0A8625E4-D356-4A03-C358-EFD0D8A5562C}&path=open>.

C.2.5 Evaluation Criteria and Basis for Award

The Technical Review and Evaluation Team will consider the merit of the specific proposals against the established criteria as stated in the NRA and listed below. The evaluation criteria in Appendix B, part (i) and Appendix C, paragraph C.2 of the *"Guidebook for Proposers Responding to a NASA Research Announcement (NRA), January 2012"* are superseded by the following:

The principal elements considered in evaluating a proposal are its relevance to NASA's objectives, intrinsic merit, effectiveness of the proposed work plan, unique evaluation criteria, and proposed cost reasonableness. Failure of a proposal to be highly rated in any one of the following elements is sufficient cause for the proposal to not be selected.

1. Intrinsic Merit (weight: 25%)

- Overall scientific or technical merit of the proposal, including unique and innovative methods, approaches, or concepts.
- Credibility of technical approach, including a clear assessment of primary risks and a means to address them. For analysis tasks, results must include a quantification of uncertainty.
- Proposer's capabilities, related experience, facilities, and techniques, which are integral factors for achieving proposal objectives. Includes principal investigator and key personnel critical in achieving proposal objectives.
- Overall evaluation against the state of the art.

2. Relevance to NASA's objectives (weight: 35%)

- Clear link between the proposed work and the research topic.
- Compatibility between the proposed work products and the research outcomes.

Comprehensiveness of proposed work.

- Potential to extend applicability of the proposed work to one or more of the Research Focus Areas described in the NextGen-CTD reference material available on the ARMD website (http://www.aeronautics.nasa.gov/programs_asp.htm).
- Quality of proposed collaboration with NASA researchers, including joint use of facilities, sharing of materials, and synergistic research goals. Proposals that include a willingness of the principal investigator and/or key personnel to serve a period of residency at the appropriate NASA Center are highly desirable.

3. Effectiveness of the Proposed Work Plan (weight: 15%)

- Comprehensiveness of work plan, effective use of resources, management approach, and proposed schedule for meeting the objectives.
- Measurable metrics toward achieving the proposer's goal must be provided, with a minimum of one metric per year. Proof-of-concept demonstrations are encouraged. Tangible outcomes at the end of the effort are desirable. Annual oral presentations made as part of an open Technical Exchange Meeting for purposes of technology transfer and knowledge dissemination will be expected.
- Quality assurance approaches for analysis and deliverables should be discussed. Research should employ sound analytical techniques, including explicit statements of assumptions and guidelines for results interpretation. Unless explicitly requested to be "informal," all delivered reports should contain well organized and coherent narrative and be of a quality sufficient for direct publication without modification.
- A clear statement of what intellectual property is expected to be publicly available at the conclusion of the work is required. It is NASA's intent that all deliverables under the contract will be provided to NASA with unrestricted/unlimited rights; thus, any restrictions must demonstrate a significant net benefit to NASA, however and may result in a lower evaluation.
- Outline the extent of cost shared elements with respect to the elements funded by the government.

4. Unique Criteria (weight: 15%)

The following additional criteria will be used, beyond the relevance to NASA, technical approach, management plan, and costs to evaluate and select the proposals. All proposed personnel shall be identified by name (except for students) and all personnel including students shall be clearly budgeted in the cost proposal. These criteria will be equally weighted.

- Familiarity with multiple data sources and state-of-the-art data mining and analysis methods to use data sources to conduct choke points analysis.
- Experience in conducting NAS-wide analyses.
- Breadth of team covering operational understanding – the Contractor shall submit letters of commitment.
- Experience of the key personnel proposed for this task.
- Prior experience in managing multi-organization air traffic management research and development projects.
- Additional analysis (beyond what is reflected in the solicitation) proposed that will enable wider impact of NASA concepts and technologies within the award budget limit.

5. Proposed Costs Reasonableness (weight: 10%)

- Evaluation of the cost of a proposed effort includes the reasonableness of the proposed cost, and the comparison of that proposed cost to available funds. See NRA, Section V(a).

C.2.6 Facilities

The following websites provide information on NASA aeronautics facilities capabilities, testing, and contact information. If use of NASA facilities is proposed, the facility costs associated with testing must be covered in the proposal cost. The costs of fabricating test articles, fixtures, and instrumentation required for the testing shall be incurred by the proposer and included in the proposed cost. The proposal will need to specify the test article size, requirements, facility, and approximate testing time. Specific details such as timeframe and duration of testing will be negotiated upon selection of a proposal. A non-NASA facility may be proposed, in which case the costs must also be included in the proposed cost. Information on NASA test facilities can be found at the following websites.

NASA Center	URL
Ames Research Center	http://windtunnels.arc.nasa.gov/ http://ffc.arc.nasa.gov/ (simulations facilities) http://www.aviationsystemsdivision.arc.nasa.gov/index.shtml http://humansystems.arc.nasa.gov/groups/AOL/
Dryden Flight Research Center	http://www.nasa.gov/centers/dryden/capabilities/index.html
Glenn Research Center	http://facilities.grc.nasa.gov/explore/explore_aero.html
Langley Research Center	http://gftd.larc.nasa.gov/index.html http://gftd.larc.nasa.gov/references/GFTD_V14k1.pdf

C.2.7 Summary of Key Information

Expected annual program budget for new awards in this solicitation	~\$1M-2M for base year for this topic
Number of new awards pending adequate proposals of merit	1 to 2 awards are anticipated
Maximum duration of awards	1 year to 2 years based on future funding availability, project technical requirements, and the results of year 1 activities.
Due date for Notice of Intent to propose (NOI)	1/28/2013
Due date for proposals	3/4/2013
General information and overview of this solicitation	See the <i>Summary of Solicitation</i> of this NRA.
Detailed instructions for the preparation and submission of proposals	See the <i>NASA Guidebook for Proposers Responding to a NASA Research Announcement – 2012</i> at http://www.hq.nasa.gov/office/procurement/nraguidebook/
Page limit for the central Science-Technical-Management section of proposal	Maximum of 15 pages; see also Chapter 2 of the <i>Guidebook for Proposers Responding to a NASA Research Announcement-2012</i> at http://www.hq.nasa.gov/office/procurement/nraguidebook/
Submission medium	Electronic proposal submission is required; no hard copy is required. See also Section IV in the <i>Summary of Solicitation</i> of this NRA and Chapter 3 of the <i>NASA Guidebook for Proposers Responding to a NASA Research Announcement-2012</i> at http://www.hq.nasa.gov/office/procurement/nraguidebook/ .
Web site for submission of proposal via the NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES)	http://nspires.nasaprs.com/ NSPIRES Help Desk: nspires-help@nasaprs.com or (202) 479-9376

Expected type of award	Cooperative Agreement or Firm Fixed Price Contract. . If a contract is desired, please provide a draft Statement of Work with your proposal.
Funding opportunity number	NNH13ZEA001N-CTD1
<p>NASA technical point of contact concerning this solicitation:</p> <p>Note:</p> <p>We will post any Q&A that we receive on-line (in the NextGen Concepts and Technology Development section of NSPIRES) so that all will have access to the same information.</p>	<p>Mark Ballin, mark.ballin@nasa.gov Project Scientist NextGen Concepts and Technology Development Project NASA Langley Research Center Hampton, VA 23681-2199</p> <p>Alternate:</p> <p>Rudy Aquilina, rudy.aquilina@nasa.gov Deputy Project Manager NextGen Concepts and Technology Development Project NASA Ames Research Center Moffett Field, CA 94035-0001</p>
NASA Procurement point of contact concerning this solicitation:	<p>Janessa Schantin, janessa.m.schantin@nasa.gov NASA Ames Research Center Moffett Field, CA 94035-0001</p>

C.3 NextGen - Systems Analysis, Integration, and Evaluation Project (SAIE)

1. Project Overview

One of the biggest challenges in expanding air traffic capacity lies in the fielding of new Air Traffic Management concepts and technologies into an integrated Air Traffic Management System such as NextGen. The Systems Analysis Integration and Evaluation (SAIE) Project is responsible for facilitating the R&D maturation of these integrated concepts through evaluation in relevant environments, providing integrated solutions, characterizing airspace system problem spaces, defining innovative approaches, and assessing the potential system impacts and design ramifications of the Airspace Systems Program's portfolio. Opportunities to collaborate with the FAA and industry to further the development of NextGen technologies towards implementation will be sought on a continuing basis. The SAIE Project will conduct research to support two key goals for the Airspace Systems Program (ASP). Specifically, SAIE will contribute to research in the areas of maturing NextGen concepts and technologies towards higher technology readiness levels (TRL) while also providing system level analysis to support program portfolio management. Portfolio management will enable the Program to focus on JPDO Operational Improvements or R&D needs, as well as addressing stakeholder needs for advancing technologies to higher readiness levels. Achieving these Program goals will provide transition paths for the Program's concept and technology research. The Project will utilize selected proposals under the NRA to leverage in-house foundational research with academic institutions, non-profit organizations, and industry performing foundational research to address technology gaps.

2. Description of Solicited Research

The SAIE Project is not soliciting research topics at this time. Please continue to monitor this solicitation for future amendments.

3.0 Summary of Key Information

Expected annual program budget for new awards	TBD
Number of new awards pending adequate proposals of merit	TBD
Maximum duration of awards	TBD
Due date for Notice of Intent to propose (NOI)	TBD
Due date for proposals	TBD

General information and overview of this solicitation	See the <i>Summary of Solicitation</i> of this NRA.
Detailed instructions for the preparation and submission of proposals	See the <i>NASA Guidebook for Proposers Responding to a NASA Research Announcement – 2012</i> at http://www.hq.nasa.gov/office/procurement/nraguidebook/
Page limit for the central Science-Technical-Management section of proposal	TBD
Submission medium	Electronic proposal submission is required; no hard copy is required. See also Section IV in the <i>Summary of Solicitation</i> of this NRA and Chapter 3 of the <i>NASA Guidebook for Proposers</i> .
Web site for submission of proposal via NSPIRES	http://nspires.nasaprs.com/ (help desk available at nspires-help@nasaprs.com or (202) 479-9376)
Expected type of award	TBD
Funding opportunity number	TBD
NASA points of contact	TBD

APPENDIX D: Integrated Systems Research Program

D.1 Program Overview

As the Next Generation Air Transportation System (NextGen) evolves, researchers must address the national challenges of mobility, capacity, safety, security, energy and the environment in order to meet the expected growth in air traffic.

The Integrated Systems Research Program (ISRP) focuses on maturing and integrating NextGen technologies into major vehicle/operational systems and subsystems that will address these national challenges.

Using a system-level approach, NASA researchers explore, assess and demonstrate the benefits of those technologies in an operationally relevant environment.

By focusing on technologies that have already proven their merit at the fundamental research level, this program will help transition them more quickly to the aviation community, as well as inform future fundamental research needs. In addition, the program will focus on integrated system-level research of interest and importance to the aviation stakeholder community.

The Program synchronizes its work with the long-term, fundamental research conducted by other programs within the NASA Aeronautics portfolio, and closely coordinates with research efforts of other federal government agencies.

The Environmentally Responsible Aviation Project, the first project within ISRP, began implementation in FY2010 and will continue through FY2015. The primary goal of this project is to advance vehicle concepts and technologies that can simultaneously reduce fuel burn, noise and emissions.

The second project within ISRP is the Unmanned Aircraft Systems (UAS) Integration in the National Airspace System (NAS) Project. This project began implementation in FY2011 and is slated to continue through FY2015. The goal of this project is to contribute capabilities that reduce the technical barriers related to the safety and operational challenges associated with enabling routine UAS access to the NAS.

The awards as a result of this NRA will help to address the national challenges and transition integrated system-level aeronautics technologies quickly to the aviation community. For more information on ISRP and its focus, please visit http://www.aeronautics.nasa.gov/programs_isrp.htm.

D.2 Environmentally Responsible Aviation Project (ERA)

1. Project Overview

NASA's Environmentally Responsible Aviation (ERA) Project is the project under the Integrated Systems Research Program (ISRP), which started under NASA's Aeronautics Research Mission Directorate (ARMD) in FY 2010. The goal of ISRP is to serve as a technology transition bridge between the lower technology readiness level (TRL) efforts on-going in the fundamental ARMD Programs and higher TRL needs of potential users. NASA's ERA Project will conduct research into technologies and integrated aircraft systems that will allow subsonic transport aircraft entering into service in the 2025 or beyond timeframe to simultaneously reduce noise, emissions and fuel burn. It is believed that to achieve the required aircraft system readiness level (SRL) in this time frame, all critical technologies that could be considered 'enabling technology' need to be at a TRL level of 6 by 2020. NASA subsonic transport system level metrics/goals for ERA are shown in Table 1. As highlighted in the middle column of this table, the ERA Project is focused on the fuel burn (a surrogate for carbon dioxide (CO₂)), landing and takeoff (LTO) nitrogen oxide (NO_x) and noise goals. Furthermore, ERA will focus energy and resources on maturing certain very promising technologies over the next five years.

CORNERS OF THE TRADE SPACE	N+1 = 2015*** Technology Benefits Relative To a Single Aisle Reference Configuration	N+2 = 2020*** Technology Benefits Relative To a Large Twin Aisle Reference Configuration	N+3 = 2025*** Technology Benefits
Noise (cum below Stage 4)	-32 dB	-42 dB	-71 dB
LTO NO _x Emissions (below CAEP 6)	-60%	-75%	better than -75%
Performance: Aircraft Fuel Burn	-33%**	-50%**	better than -70%
Performance: Field Length	-33%	-50%	exploit metro-plex* concepts

***Technology Readiness Level for key technologies = 4-6

** RECENTLY UPDATED. Additional gains may be possible through operational improvements

* Concepts that enable optimal use of runways at multiple airports within the metropolitan area

Table 1 – NASA's Technology Goals for Future Subsonic Vehicles

The projected growth of the air transportation system will increase emissions of greenhouse gases, such as CO₂, NO_x, water vapor, and particulates, and the number of people exposed to airport noise. It is also widely believed that environmental and energy concerns will continue to grow as well, leading to increasingly stringent certification levels for noise and emissions, and an unending requirement for vehicle fuel efficiency improvements. All this must be achieved without adversely affecting the outstanding

record of the global aeronautics enterprise for safety, reliability, and security. It is for these reasons that the ERA project chose the simultaneous reduction of noise, emissions and fuel burn as the focus. The proposed vehicle concept(s) must efficiently operate within the Next Generation Air Transportation System (NextGen) that is currently being developed. Results of this study are meant to be complementary to other ongoing U. S. Government led programs listed in Table 2.

Agency	Project or Activity	Funded Years	Vehicle Focus	Proposed TRL	Goal: Major Reduction/ Minor Reduction
FAA	CLEEN	FY10- FY14	N+1	6-7	Noise Emissions Fuel burn
DoD	ADVENT/ HEETE/ AD-HEETE	FY10- FY14	N+2	>6	Fuel burn <i>Noise</i> <i>Emissions</i>
NASA	ERA	FY10- FY15	N+2	4-6	<u>Simultaneous</u> Noise Emissions Fuel Burn
NASA	FW & HS	FY10- FY15	N+3	2-4	Noise Emissions Fuel Burn
DoD	RCEE	FY10- FY14	Beyond N+3	2-6	Fuel Burn <i>Emissions</i> <i>Noise</i>

Table 2 - Complementary Government Research Programs*

- * CLEEN = Continuous Lower Energy, Emissions and Noise
- ADVENT = Emissions and Noise Adaptive Versatile Engine Technology
- HEETE = Highly Efficient Embedded Turbine Engine
- FW = Fixed Wing; HS = High Speed
- RCEE = Revolutionary Configurations for Energy Efficiency

The NASA ERA Project has been organized into two distinct phases as seen in Figure 1 below. Phase 1 began in FY2010, and will run until the end of FY 2012. Phase 1 has approximately thirty research efforts divided into three sub-projects, each with a project

engineer responsible for guiding those efforts. Many of the current research projects transitioned from NASA's Fundamental Aeronautics Program's Subsonic Fixed Wing Project and are technologies believed ready to advance to TRL 6. The three ERA sub-projects are: 1) Airframe Technology, which includes research into lightweight structures, flight dynamics and control, drag reduction, and noise reduction; 2) Propulsion Technology, which includes research into combustors, propulsor concepts, and the core engine; and 3) Vehicle Systems Integration, which includes research in systems analysis, Propulsion Airframe Integration (PAI), Propulsion Airframe Aeroacoustics (PAA), and advanced vehicle concepts. Additional information on the ERA Project can be found on the ISRP website (http://www.aeronautics.nasa.gov/programs_isrp.htm).

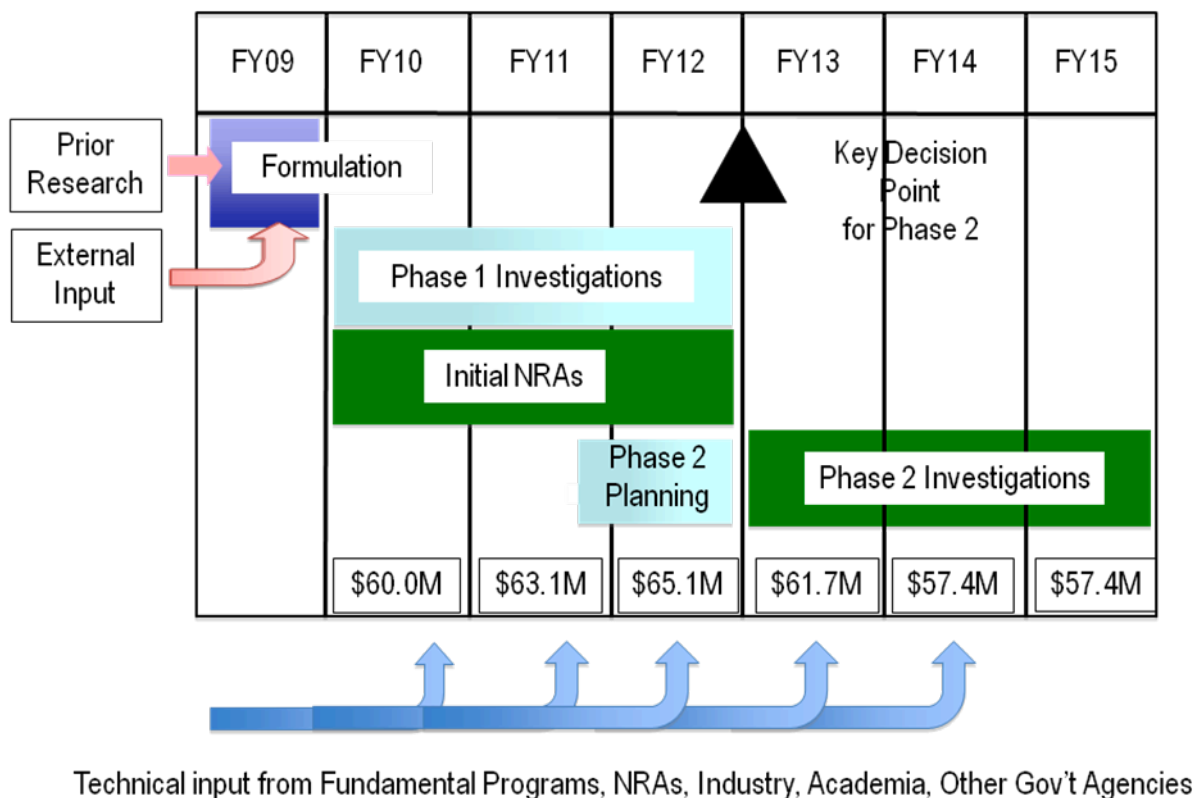


Figure 1- ERA project flow and annual budget

Phase 2, which is planned to begin in FY 2013 and run for the remainder of the ERA project, will be focused on a relatively small number of key technology demonstrations (perhaps 3 to 5) that either show significant promise towards meeting the ERA project goals or perhaps represent enabling technologies. These could be extensions of the ERA Phase 1 work, new technologies, or new system integration work. This solicitation and subsequent studies are expected to provide a menu of potential ERA Phase 2 investigations for NASA consideration.

2. Description of Solicited Research

The ERA Project is not soliciting research topics at this time. Please continue to monitor this solicitation for future amendments.

3.0 Summary of Key Information

Expected annual program budget for new awards	TBD
Number of new awards pending adequate proposals of merit	TBD
Maximum duration of awards	TBD
Due date for Notice of Intent to propose (NOI)	TBD
Due date for proposals	TBD
General information and overview of this solicitation	See the <i>Summary of Solicitation</i> of this NRA.
Detailed instructions for the preparation and submission of proposals	See the <i>NASA Guidebook for Proposers Responding to a NASA Research Announcement – 2012</i> at http://www.hq.nasa.gov/office/procurement/nraguidebook/
Page limit for the central Science-Technical-Management section of proposal	TBD
Submission medium	Electronic proposal submission is required; no hard copy is required. See also Section IV in the <i>Summary of Solicitation</i> of this NRA and Chapter 3 of the <i>NASA Guidebook for Proposers</i> .
Web site for submission of proposal via NSPIRES	http://nspires.nasaprs.com/ (help desk available at nspires-help@nasaprs.com or (202) 479-9376)
Expected type of award	TBD
Funding opportunity number	TBD
NASA points of contact	TBD

D.3 Unmanned Aircraft Systems (UAS) Integration in the National Airspace System (NAS) Project (UASNAS)

1. Project Overview

The desire and ability to fly Unmanned Aircraft Systems (UAS) in the National Airspace System (NAS) is of increasing urgency. The application of unmanned aircraft to perform national security and defense, science, emergency management, as well as future commercial applications are driving the critical need for less restrictive access by UAS to the NAS.

In order for UAS to integrate seamlessly in the NAS, major technical and regulatory challenges must be resolved. Some of the challenges include, but are not limited to:

- Separation assurance (SA)
- Robust and secure communications links
- Radio frequency (RF) spectrum allocation
- Pilot, air vehicle, and ground control station (GCS) airworthiness standards and certifications
- Operational requirements for current and future missions

The goal of the UAS Integration in the NAS Project is to contribute capabilities that reduce technical barriers related to the safety and operational challenges associated with enabling routine UAS access to the NAS. This goal will be accomplished through a two-phased approach based on development of system-level integration of key concepts, technologies and/or procedures, and demonstrations of integrated capabilities in an operationally relevant environment. Phase 1 will take place in FY11 and FY12. Phase 2 will occur in FY13 to FY15. The Phase 1 and 2 technical objectives are as follows:

Phase 1

- Developing a gap analysis between current state of the art and the Next Generation Air Transportation System (NextGen) UAS ConOps
- Validating the key technical elements identified by this project
- Initial modeling, simulation, and flight testing
- Complete sub-Project Phase 1 deliverables (Spectrum requirements, comparative analysis of certification methodologies, etc.)

Phase 2

- Providing regulators with a methodology for developing airworthiness requirements for UAS, and data to support development of certifications standards and regulatory guidance
- Providing systems-level, integrated testing of concepts and/or capabilities that address barriers to routine access to the NAS. Through simulation and flight

testing, address issues including separation assurance, communications requirements, and Human Systems Integration in operationally relevant environments.

2. Description of Solicited Research

The UASNAS Project is not soliciting research topics at this time. Please continue to monitor this solicitation for future amendments.

3.0 Summary of Key Information

Expected annual program budget for new awards	TBD
Number of new awards pending adequate proposals of merit	TBD
Maximum duration of awards	TBD
Due date for Notice of Intent to propose (NOI)	TBD
Due date for proposals	TBD
General information and overview of this solicitation	See the <i>Summary of Solicitation</i> of this NRA.
Detailed instructions for the preparation and submission of proposals	See the <i>NASA Guidebook for Proposers Responding to a NASA Research Announcement – 2012</i> at http://www.hq.nasa.gov/office/procurement/nraguidebook/
Page limit for the central Science-Technical-Management section of proposal	TBD
Submission medium	Electronic proposal submission is required; no hard copy is required. See also Section IV in the <i>Summary of Solicitation</i> of this NRA and Chapter 3 of the <i>NASA Guidebook for Proposers</i> .
Web site for submission of proposal via NSPIRES	http://nspires.nasaprs.com/ (help desk available at nspires-help@nasaprs.com or (202) 479-9376)
Expected type of award	TBD
Funding opportunity number	TBD
NASA points of contact	TBD

APPENDIX E: Aeronautics Strategy and Management Program

E.1 Program Overview

The Aeronautics Strategy and Management Program provides research and programmatic support that benefits each of the other five ARMD programs. The program efficiently manages directorate functions including: Innovative Concepts for Aviation, Education and Outreach, and Cross Program Operations.

E.2 Innovative Concepts for Aviation Project (ICA)

E.2.1 Project Overview

The Innovative Concepts for Aviation (ICA) Project explores novel concepts and processes with the potential to create new capabilities in aeronautics research. The NASA Aeronautics Research Institute (NARI - <http://nari.arc.nasa.gov>) has been established to achieve the project's goals. NARI will complement other ARMD efforts in seeking early-stage innovative concepts applicable to a broad spectrum of aeronautical challenges in the nation's air transportation system by sponsoring research solicitations and by hosting future competitive challenges. The Institute will coordinate these efforts and communicate the outcome of the research conducted to interested parties both internal and external to NASA. NARI's goal is to mature the new concepts in order to either infuse them into ARMD research programs or to achieve practical application by the aeronautics community.

E.2.2 Description of Solicited Research-Leading Edge Aeronautics Research for NASA (LEARN)

(1) Scope

NARI is interested in identifying innovative concepts and novel solutions resulting from a multi-disciplinary teamed approach that will yield significant positive impacts and would result in a strong desire for ARMD or industry to pursue the results of the proposed research. The proposed research should be integrated; thus, proposals consisting of tasks addressing multifaceted questions must demonstrate credible, scientific/technical connections among the tasks. It is expected that teams bring together broadly based expertise from more than a single institution or technical discipline.

In line with the NARI goal to foster novel and innovative concepts, NARI will NOT consider proposals that have one or more of the following features:

- Are not placed in an aeronautics context;
- Are duplicative of efforts either previously studied or currently funded through other mechanisms;
- That utilize existing technology or a combination of systems and technologies

- without introducing a significantly unique or innovative concept;
- That incrementally extends the performance of aeronautics systems or previously studied concepts. There are other ARMD programs for continuing research or evolutionary technology development, <http://www.aeronautics.nasa.gov/>;
- That accomplish an incremental system development or technology demonstration that is closely linked to an existing NASA program/project and would be a near-term progression of the existing program/project;

Since new perspectives can lead to innovative approaches, proposers who have expertise in disciplines not normally focused on aeronautics, but have a research topic that meets the NRA objectives below, are welcome to apply to this solicitation.

(2) Research Objectives

This NASA Research Announcement (NRA) solicits submission of multi-institutional, team-based proposals for research as participating members of LEARN. Proposals must clearly articulate an innovative, broadly based research topic addressing strategically important aeronautics technical challenges that have the potential to meet national aeronautics needs (Section I (a) and (b) of this Research Opportunities in Aeronautics (ROA) NRA) and to mature into the ARMD research programs (Section I (b)), or to achieve practical application by the aeronautics community.

While it is not the intent of this NRA to unduly restrict the research proposed, the following examples may be used to gauge the nature and scope of the types of technical challenges that should be addressed by the content of the proposed work.

(a) 21st Century Integrated Flight Deck

Background: Current research efforts are investigating a variety of advanced flight systems concepts, but the true benefits of each concept cannot be assessed without understanding the compatibility of these technologies when combined into an integrated system.

Research Objective: Generate a Conceptual Design and benefits assessment for an advanced flight deck configuration that integrates the most advanced concepts being considered, including: NextGen compatible Avionics, optimum human factors layout and displays, sensors, non-linear flight controls, autonomous systems for single pilot operations and emergency operations.

(b) Assessing the Highly Distributed U.S. Air Traffic Management (ATM) System Safety

Background: The complexity and interdependencies of the highly distributed ATM system has frustrated attempts to develop a meaningful global assessment.

Research Objective: Develop concept and methods for measuring the safety of the highly distributed U.S. ATM system – current and future. The system concept definition should be in the form of simulations, analysis, engineering models,

mockups, and trade study definitions. The end products would include a final concept, system-level requirements, and needed system structure technology developments.

(c) More Affordable Flight Testing Concepts and Procedures

Background: Testing new concepts and technologies in a relevant flight environment contributes significantly to advancing the state of the art in aeronautics. However, current flight research costs limit the rate of advancement, hence, reduced flight testing costs can provide significant benefits.

Research Objective: Develop future flight testing concepts and procedures that would be an order of magnitude less expensive than current practice.

(d) Assessment of Future Environmental Impact of Increased, Routine UAS Operations in the NAS

Background: In increasing number, Unmanned Aircraft Systems (UAS) will be provided routine access into the National Airspace System (NAS) in the coming years. The greater use of UAS in different sections of airspace that are currently not exposed to aircraft is expected to have a number of environmental, safety and airspace operations impacts. UAS operate differently from typical manned aircraft – manned aircraft generally go from one location to another, while UAS may hover or circle in one location for a significant time. Predictions of the impact of UAS on the NAS are speculative because there are few data upon which to base these predictions.

Research Objective: Develop concept and methods for predicting the impacts (airspace, safety and/or noise and emissions) of much higher levels of UAS operations (10x for example) in the NAS based on a large variety of UAS from small to large, and rotary and fixed wing. The methodologies should account for their speed, maneuverability, climb rate and other performance characteristics. The research should develop effective metrics and tools to assess and communicate UAS's effects so as to understand the impact in context with that of other aviation sources. Exercise the developed tools and methodologies on available data to make predictions of increased UAS in a future NAS.

(e) Novel Multidisciplinary Design Strategies for Complex Aeronautics Systems

Background: The Multidisciplinary Design Optimization field focusing on optimizing the performance and reducing the cost of complex aeronautics systems in the context of integrated design dealing with multiple disciplines and interacting subsystems or systems of systems. Design tools that couple a small number of disciplines in a restricted design space have already reached a certain level of maturity and fidelity.

Research Objective: Identify an aeronautics “challenge problem” with inherently complex and multi-disciplinary obstacles to an optimized solution. The challenge problem can be in aircraft design, propulsion system design, air traffic management, or aviation safety. Proposals should identify scalable solution methodologies that rapidly and accurately incorporate the various inputs. This

design process would then be applied to the challenge problem to demonstrate the potential for aeronautical innovation through multi-disciplinary design.

(f) Exploitation of Aeroelastic and Aeroservoelastic behavior for Improved Aircraft

Background: With better understanding of aeroelastic and aeroservoelastic behavior an opportunity exists to explore the application of relevant innovative tools and computational methods.

Research Objective: Develop processes and frameworks that will lead to the ability to include appropriate fidelity aeroelastic and aeroservoelastic phenomena in the conceptual design processes for a variety of transport category aircraft. The purpose of such capability is to enable early exploration of technologies and design approaches that exploit aeroelastic and aeroservoelastic behaviors to reduce weight, improve efficiency and extend structural life.

(g) High Performance Computing for Autonomous Airborne Applications

Background: Unmanned Aircraft Systems (UAS) will be introduced into the National Airspace System (NAS) in increasing numbers in the coming years. The greater demand on the available command and control (C2) frequency spectrum is expected to be offset by higher levels autonomous capability. To support these operations it will require advanced computing performance embedded in an airborne environment.

Research Objective: Develop high performance computing conceptual system architectures and operational concepts that are compatible with deployment in an airborne environment. At a minimum the concepts should identify innovative cost effective approaches to address the known limitations and constraints to systems operating onboard aircraft. These include mission reliability, thermal and vibration environments, maintainability, volume/weight restrictions, and available power. The concepts should also consider the potential to upgrade and adapt the system to take advantage of advances in high performance computing.

(h) Hybrid Electric Distributed Propulsion Aircraft, Integrated Autonomously Functioning Controller

Background: With the advent of advanced electric components the prospect of Hybrid Electric Distributed Propulsion Aircraft is becoming more realistic; however significant challenges remain in managing the large required energies.

Research Objective: Develop design guidelines and a representative conceptual design for an autonomous aircraft systems controller that integrates aerodynamic and distributed propulsive control functions with electrical system power management. This includes proposing the algorithms necessary to manage the loading and capacity of the electrical power source, storage devices, and the demands of distributed propulsive elements. The controller will accept high-level commands (thrust, speed, climb targets, etc.) and autonomously manage aircraft systems to achieve those targets.

(i) Improve General Aviation (GA) Safety

Background: Current GA community efforts have developed lower cost avionics

and other aircraft systems that have improved some categories of GA safety. However GA operations are still plagued by high fatal accident statistics. Often, pilots inadvertently get in over their head and cannot get out of trouble, resulting in a loss of control accident. This can be due to many factors, including over-reliance on automation, lack of critical information, or inadequate pre-flight planning and in-flight monitoring. More capable avionics or more capable aircraft are not necessarily equal to more safety. What is needed is a data-driven understanding of the state-of-the-pilot and then a fresh look at how the overall general aviation system can provide better situational awareness and support better aeronautical decision making by the pilots.

Research Objective: Generate a concept for guidance to support pilot training, continuing education, proficiency evaluation, pre-flight planning, etc. that would provide better situational awareness and support better aeronautical decision making; and assess the benefits. The concept should leverage and build upon current GA community efforts and existing information. The guidance should be data-driven, i.e.: based on what is known about aircraft state and incorporate a new understanding of the state of the pilot (with an emphasis on aeronautical decision making) in accident-precursor situations.

Proposals must also articulate plans to address NARI objectives of conducting collaborative, cross-disciplinary research, and enhance innovative communication between geographically disparate researchers through the use of information technology.

A proposer may submit proposals to more than one topic area, but each proposal may only address one topic. Additionally, each individual proposal must stand alone; it must not be dependent or otherwise rely on the selection of any other proposal by the same proposer.

(3) Expectations of Teams Integrating into NARI

NARI and LEARN derive strength from the interdisciplinary and collaborative nature of their teams. To this end, LEARN Teams will be expected to explore areas for collaboration with other Teams selected under this NRA and with other partners of NARI. Teams will be required to procure/possess and use collaborative technologies for virtual participation as specified by NARI central office (<http://nari.arc.nasa.gov/collaboration-technology-requirement>). Multi-institutional Teams must ensure that each institutional component of the Team has the capability to fully participate in all virtual meetings. Additionally, an Information Technology (IT) representative must be identified for each Team at each location site who can facilitate virtual participation in meetings and seminars. Teams will be responsible for timely communication and responsiveness to NARI.

Selected Principal Investigators (PIs) will be responsible for:

- Heading their individual Team
- Attending virtual monthly meetings

- Providing project updates and status for monthly and annual reporting
- Posting and maintaining a robust Team website

Additionally, Teams will be expected to contribute to the success of NARI by participating in:

- Virtual seminars
- Providing content to NARI's website

NARI uses a variety of modern telecommunications and information technology tools to conduct virtual meetings, seminars, and conferences; link the Institute Teams; share knowledge; and enable effective interactions both within and amongst Teams. Proposals must present a plan and budget for the adequate availability of IT expertise and equipment to support Team members as they incorporate these tools into their activities. Additionally, proposals must identify a representative from their Team who will work with NARI to evaluate and implement the effective use of IT tools. NARI's IT Team will advise on hardware and software for virtual communications and train the Team's IT representative in the use of the equipment and other tools. Proposers are encouraged to learn about the technology (<http://nari.arc.nasa.gov/collaboration-technology-requirement>), as this will be the basis for Team communication for all Teams selected in this NRA.

(4) Deliverables

The deliverables are:

- A written technical and schedule status report submitted 6 months after the award that includes any significant findings or results to date. For awards that exercise the second year option, another report 6 months after the beginning of the extension.
- Financial reports submitted quarterly during the period of the award, as per the *NASA Grants and Cooperative Agreement Handbook*.
- A final written technical and financial report within thirty days after the conclusion of the first year of effort that describes the work performed, the results of the effort, and lessons-learned.
- For awards that exercise the second year option, a final written technical and financial report within ninety days after the conclusion of the second year of effort that describes the work performed, the results of the effort, and lessons-learned.
- PI participation during monthly "virtual" Team meetings that employ Internet-based video conferencing tools.
- PI attendance to present status and findings during a public NARI Internet broadcast "virtual" seminar near the end of the period of performance (at a date to be announced).
- A copy of any NASA publication, technical conference publication, journal publication, or Invention Disclosure that results from LEARN support.

Second year funding is contingent upon acceptable progress toward completions of the first year's objectives, and only the most promising of the first year's efforts will be

selected for continued support.

All technical reports must be submitted as Portable Document Files (PDF), and cost data as Excel files, attached to an electronic mail message. Templates will be provided describing the format and content of all required reports.

As a matter of NASA policy, all data taken or products created in the performance of a NASA research award are considered to be public domain.

(5) Expected Outcome

Through this solicitation, NARI serves ARMD by sponsoring, developing, and showcasing the exploration of novel and innovative aeronautics concepts originating primarily outside of NASA that have a credible path for infusion into either ARMD research or aviation practice.

It is anticipated that several of the Team research activities will show sufficient promise to be considered for infusion into and be supported by ARMD Projects or may enable the pursuit of new tasks within ARMD Projects. It is also expected that some tasks will be attractive to other government agencies or commercial interests in the aeronautics community, and will be pursued for further development by these entities.

E.2.3 Programmatic Considerations

(1) Funding Information

NASA anticipates that approximately \$2.8M will be available to support the selection of approximately three to four teams for a one-year period of performance to conduct the research solicited by this NRA. Recognizing the difficult nature of the work expected to be proposed for this NRA, and the desirability to build on promising work achieved in the first period, it is anticipated approximately \$1.8M will be available for an additional year for two Teams to continue to build on the accomplishments of their initial effort. The average cooperative agreement award is therefore, anticipated to be approximately \$700K-900K per Team per year. Each team should develop an appropriate annual budget consistent with those values. Smaller award amounts may be proposed, however all amounts must be justified by their contribution to achieving the intended research objective.

The actual number and value of the awards will depend on the quality of the proposals received and scope of the proposed research. In some cases, only a portion of a proposal may be selected for award. Year 2 funding is contingent on acceptable progress in Year 1 (see Section E.2.2 (4)).

Note that all awards are contingent on availability of appropriated funds. If the appropriated funds available are less than anticipated, fewer awards, or decreased awarded funds, may be issued.

(2) Period of Performance

The Cooperative Agreements will have a nominal one-year period of performance with an option for a second year contingent upon the benefit that can be derived from extending the effort for an additional year. A cooperative agreement implies a substantial involvement between, and contribution by, NASA and the recipient, in addition to the provision of research funding. The period of performance will commence upon the date the award agreement is signed.

(3) Cancellation of LEARN

NASA reserves the right to make no awards under LEARN for any reason, including the absence of program funding. NASA assumes no liability for costs or losses incurred by any part as a result of (including bid and proposal costs) for canceling LEARN or for any party's failure to receive actual notice of cancellation. Should cancellation be necessary, an electronic notice will be posted via the NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES; <http://nspires.nasaprs.com>) and published by the NASA Acquisition Internet Service (NAIS; <http://prod.nais.nasa.gov/>).

(4) Schedule for Awards

NASA's goal for announcement of selections is approximately two months after receipt of proposals with initial awards in place one month after selection announcement. However, these estimates may change based on the workload experienced by NASA, the availability of funds, the status of NASA's annual appropriation, and any necessary post-selection negotiations with the proposing organization(s) needed for the award(s) in question.

(5) Description of NASA Contribution

The intent of the NRA process is to foster strategic partnerships between NASA and the awarded institutions for collaborative research and development of innovative concepts, ideas, technologies and approaches. Therefore collaboration with NASA researchers may be anticipated while performing work under these awards. Communications with NASA during the solicitation period can only occur through the designated POC (see Section C.2.8). There can be no direct or indirect communications with NASA researchers and managers from the time this solicitation is posted to NSPIRES until proposal selections are final. See Questions 34-41 in ROA-2013 NRA Q&A's for guidance on this issue: <http://nspires.nasaprs.com/external/solicitations/summary.do?method=init&solId={0A8625E4-D356-4A03-C358-EFD0D8A5562C}&path=open>.

Apart from funding the LEARN activity, NASA's contribution to the proposed cooperative relationship under this NRA, through NARI, is to coordinate and integrate the work of the individual teams, facilitate collaboration among the members of NARI, including its international partners, and support links between the NASA aeronautics communities. NASA does this, in part, by providing the funding, structure, technical officers, and management to support the research and other activities of the individual LEARN teams.

E.2.4 Eligibility Information

(1) Proposing Organizations

NASA welcomes proposals in response to this NRA from all qualified proposers – see Section III (a) of this ROA NRA for Eligibility of Applicants. The expectation is that the LEARN concepts and their development will occur primarily outside NASA, as a result Section III (a) of this ROA NRA is amended for this appendix to allow other non-NASA government agencies, the NASA Jet Propulsion Laboratory (JPL) and other Federally Funded Research and Development Centers (FFRDCs) to respond to this solicitation as well. NASA civil servants are not eligible to submit LEARN proposals under this NRA or to participate as team members under proposals submitted by eligible entities.

Submitters do not need to have extensive aerospace technology experience, but the investigators are required to show they possess the necessary technical expertise to perform their proposed research task(s).

(2) Principal Investigators and Co-Investigators

Every organization submitting a proposal in response to this solicitation must designate a single Principal Investigator (PI) who will be responsible for the quality and direction of the entire proposed investigation and for the use of all awarded funds. Note that this solicitation does not accept the designation of a Co-Principal Investigator; there must be only one PI who is solely responsible for the proposed investigation.

NASA encourages proposers to identify by name only the most important personnel to aid in the execution of the proposed research. Individuals who are critical for the successful completion of an investigation through the contribution of unique expertise and/or capabilities, and who serve under the direction of the PI, should be identified as a Co-Investigator (Co-I). A Co-I must have a well-defined role in the investigation that is explicitly defined in the Management section of the proposal (*see Section E.2.5 (4) below*). In addition, a letter of commitment from each Co-I to participate in the proposed investigation is required, even if the Co-I is from the same institution as the PI.

All funds for a given team will be sent to the PI's institution, which shall in turn provide research and salary funding to non-Governmental and non-JPL Co-Is by routing through the PI home institution and consistent with any bi-lateral agreements established among

the team members. Thus, one Cooperative Agreement will be negotiated per selected proposal. NASA will fund JPL or other Governmental Co-Is directly (see Section E.2.7 (2) below). If the PI holds a joint appointment in more than one institution, either organization could be the "home institution" – depending on their willingness to make the institutional commitment and handle the funds for the entire multi-institutional Team.

(3) Guidelines for Non-U.S. Participation

The ROA NRA and Section 1.6 of the *NASA Guidebook for Proposers Responding to a NASA Research Announcement (NRA) or Cooperative Agreement (CAN)*, January 2013 edition (hereafter referred to as the *Guidebook for Proposers*) provide further information on foreign participation.

(4) Cost Sharing or Matching

If an institution of higher education or other not-for-profit organization is selected to receive a grant or cooperative agreement, cost sharing is not required, although NASA can accept cost sharing if it is voluntarily offered (see the *Grants Handbook*, Section B, Provision 1260.123, "Cost Sharing or Matching"). If a commercial organization is selected to receive a grant or cooperative agreement, cost sharing is typically required unless the commercial organization can demonstrate that it does not expect to receive substantial compensating benefits for performance of the work. If this demonstration is made, cost sharing is not required but may be offered voluntarily (see also Section D, Provision 1274.204, of the *Grants Handbook*). See also Section V(a) of the ROA NRA.

Organizations are not required to propose or provide matching funds for the Cooperative Agreement; nonetheless, NASA will accept cost sharing if it is voluntarily offered.

E.2.5 Proposal and Submission Information

Proposals involving multiple cooperating organizations must be submitted by a single institution, which becomes the Lead Institution. The Lead Institution must be the PI's home institution. LEARN proposals must be submitted by an official at the PI's organization who is authorized to make such a submission.

(1) Proposal Submission Site

Proposers must submit electronic proposals in response to this NRA to the NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES; <http://nspires.nasaprs.com>). The NSPIRES system will guide proposers through submission of all required proposal information. Instructions on registering for an NSPIRES account may be found at: <https://nspires.nasaprs.com/external/aboutRegistration.do>. The presentation *NSPIRES*

Organization Registration, located in the “Tutorials and User Guides” section of this website, provides information on how to register an organization in NSPIRES.

In order to be able to submit a Proposal or a Notice of Intent all investigators proposing to LEARN must be preregistered in NSPIRES and have received a User ID and password. This includes the PI, all Co-Investigators and Collaborators. NSPIRES registration can be done at the website <http://nspires.nasaprs.com>. Early registration is advised. A Help Desk is available at (202) 479-9376 or by E-mail at nspires-help@nasaprs.com.

(2) Questions Related to LEARN

Clarification questions regarding this solicitation should be submitted via E-mail no later than 3 days prior to the proposal due date to the designated points of contact (POC) given in Section E.2.9. Note that, where appropriate, questions and answers will be made publicly available on the NSPIRES web page on which this NRA is posted – see "ROA 2013 NRA Questions and Answers" and "Questions and Answers for LEARN." These questions and answers will be updated periodically. It is the responsibility of interested proposers to check for such information prior to the submission of their proposals.

(3) Notice of Intent to Propose

Notices of Intent (NOIs) to propose are requested by the date given in Section E.2.9 to aid NASA in establishing a peer review process that is free from conflicts of interest and that incorporates the requisite expertise. A separate NOI should be submitted for each intended proposal. The submission of an NOI is not a commitment to submit a proposal, nor is information contained therein considered binding on the submitter. NOIs will be treated as competition-sensitive material. NOIs are to be submitted electronically by entering the requested information through the NSPIRES system at <http://nspires.nasaprs.com>.

(4) Proposal Format and Contents

Proposals submitted in response to this NRA are required to be clearly legible in both the body of the text and in the figure captions. Text within figures and tables may be smaller but must still be judged by the reviewers to be readable.

The Scientific/Technical/Management section may not exceed twenty (20) pages in length, with a minimum 12-point font size and one-inch margins on all sides. This section must cover the following topics:

- The innovative research program to be pursued
- The aeronautics technical challenge addressed
- The relevance of the proposed research to LEARN scope/objectives and especially to the specific research objectives given in Section E.2.2 (2)
- Background and objectives of the proposed research
- Description of what is innovative or novel in the proposed research

- Technical approaches
- Level of effort to be employed
- Targeted/anticipated results
- Specific quantifiable metrics to be used to judge progress
- Detailed work plan: includes a schedule with milestones and measurable metrics, as well as the qualifications, capabilities, and experience of the lead organization and Team members, including PI, Co-Is, and other collaborators
- Although not required, any proposed cost sharing should be described
- Contribution of the proposed work to NASA ARMD technologies
- Statement of what intellectual property is expected to be publicly available at the conclusion of the work (note that it is our intent to share knowledge developed under this solicitation, thus, any restrictions to the objective may impact the evaluation of the proposal)
- A clear statement of how the proposer intends to publicly disseminate results
- Plans for virtual meetings and presentations
- Test facilities to be used including proposed use of NASA facilities
- If any NASA Supercomputing resource usage is proposed, include specific computing requirements (CPUs, hours, memory, storage, timeframe, etc.) and state its criticality to the proposed work (select either one of two from below):
 - Require NASA computation resources as go/no go for proposed work
 - Optional need for NASA computation resources to enhance research execution
- It is expected that individual Teams will often be comprised of members of more than one institution, and in many cases an interdisciplinary approach is also appropriate. Proposals should address the Approach to Team management, discussing how Team members and their individual contributions will be integrated into a productive whole.

Supporting information such as budget, résumés, and commitment letters will not be counted toward the Scientific/Technical/Management section page limit. Please refer to Section IV of this ROA NRA for additional requirements on proposal content, format, budget details, and submission procedures.

Important note on creating PDF files for upload:

There is a 10 MB size limit for proposals (Section 2.3.1(c) of the *Guidebook for Proposers*). Large file sizes can impact the time it takes for NASA and peer reviewers to download and access your proposal. In order to increase the ease in reviewing your proposal, crop and compress any embedded photos and graphic files to an appropriate size and resolution.

(5) References to Unique NASA Capabilities

See Section I (c) of this ROA NRA for proposal requirements.

E.2.6 Proposal Evaluation and Selection

All proposals will be reviewed by a government evaluation team according to the Evaluation Criteria listed in this section. The final panel evaluation is reviewed and approved by the Chairperson of the panel, the NARI Director, and the NARI Oversight Committee.

(1) Evaluation Criteria

The principal elements considered in evaluating a proposal are its relevance to this solicitation's objectives, technical merit, effectiveness of the proposed work plan (including Team qualifications) and cost. Failure of a proposal to be highly rated in any one of the following elements is sufficient cause for the proposal to not be selected.

- Relevance (weight 20%)
 - Evaluation of a proposal's relevance to NASA's objectives includes the consideration of the potential contribution of the effort to the specific research objectives and goals given in this LEARN solicitation to which the proposal is submitted.
 - Potential impact on NASA or national aeronautics challenges if research is successful.
 - Plan to support NARI's objective of conducting collaborative, cross-disciplinary research in all LEARN areas and enhance innovative communication between geographically disparate researchers through the use of information technology.
- Technical Merit (weight 40%)
 - Clear description of what is new or creative in the proposed effort.
 - Overall scientific or technical merit of the proposal, including unique and innovative methods, approaches, or concepts.
 - Evaluation will also include: credibility of technical approach, including a clear assessment of primary risks and a means to address them; proposer's capabilities, related experience, facilities, techniques, or unique combination of these which are integral factors for achieving the proposal's objective.
 - The selection process will also assess the proposal against the state-of-the-art.
- Effectiveness of the Proposed Work Plan (weight 20%):
 - Comprehensiveness of work plan, effective use of resources, management approach, and proposed schedule for meeting the objectives.
 - Proposed Team qualifications.
 - Yearly objectives and milestones with measurable metrics toward achieving the proposer's goal.
 - Documentation of approach and results in the form of final written technical reports is required.
 - A clear statement of what intellectual property is expected to be publicly available at the conclusion of the work. It is NASA's intent that all

- deliverables under the contract be provided to NASA with unrestricted/unlimited rights; thus, any restrictions must demonstrate a significant net benefit to NASA and may cause a lower score.
 - Clear and credible path for infusion of the technology into ARMD research or practical application
 - If applicable, suitability of proposed computational requirements and availability of resources.
- Cost (weight 20%):
 - Proposed cost realism and reasonableness. Appropriateness of proposed level of effort and proposed other direct costs with those required to accomplish the goals of the investigation.
 - Budget justification.
 - Total cost and comparison to available funds.
 - Cost to the government relative to the expected impact and relevance to NASA objectives as compared to competing proposals.

(2) Selection Process

At the conclusion of the review process, draft selection recommendations will be developed by the NARI Director and submitted for concurrence to the NARI Oversight Committee. The Selecting Official for the NRA is the NARI Director.

Proposers should note that issues of programmatic balance could be a major discriminator in proposal final selections. For example, the potential need to represent multiple LEARN research objectives in the final selected NARI portfolio may be a major factor in award selections.

E.2.7 Award Administration Information

(1) Notice of Award

As soon as possible after the selection is concluded, NASA will inform each proposer of the selection or non-selection of their proposal via electronic mail from NSPIRES and will offer a debriefing. For selected proposals, a NASA Awards Officer, who is the only official authorized to obligate the Government, will contact the offeror's business office. Any costs incurred by the offeror in anticipation of an award will not be reimbursed. Awards are made to the proposing institution, not directly to the proposal PI.

(2) Funding

NASA Shared Services Center will negotiate Cooperative Agreements with the selected lead institutions and will administer all funding. For more information see Section II (a) of this ROA NRA. NASA procurement personnel will determine whether all proposed costs are allowable and reasonable, and will negotiate with the proposer to resolve

disagreements prior to making an award. Invoices and payments will be subject to the provisions of the *NASA Grants and Cooperative Agreement Handbook*.

For organizations made eligible by amendments of Section E.2.4 (1) of this Appendix, specific resource arrangements will vary depending on the nature of the lead institution, as follows:

- a) JPL: The necessary resources will be provided via NASA's internal funding procedures. If researchers from other institutions are included on a successful JPL-led proposal, then the necessary resources will be provided by JPL through the funding mechanisms listed here or in Section II (a) of the ROA NRA, as appropriate.
- b) U.S. Government-Owned, Contractor-Operated National Laboratories (not including Civil Service or military staff laboratories): Necessary resources will be provided via an interagency funds transfer and documented under a Memorandum of Agreement between the sponsoring organization and NASA.
- c) Non-NASA Government-Owned and Operated Laboratories: Necessary resources will be funded via an interagency funds transfer and will be documented using a Memorandum of Agreement between the other agency laboratory and NASA.

Negotiated project resources may be used to cover direct project costs.

Any Memorandum of Agreement will be handled by NARI.

(3) Award Reporting Requirements

All information disseminated as a result of this Cooperative Agreement shall contain a statement that acknowledges NASA's support and identifies the award by number. For example, "These results are based upon work supported by the NASA Aeronautics Research Mission Directorate under NARI LEARN award number NNH13ZEA001N-LEARN1," etc.

(4) Use and Disclosure of Research Resulting From Awards

As a Federal Agency, NASA requires prompt public disclosure of the results of its sponsored research (see Appendix F.13 of the Guidebook for Proposers) to generate knowledge that benefits the nation. Thus, it is NASA's intent that all knowledge developed under this solicitation be shared broadly. Award recipients will be expected to publish their work in peer-reviewed, open literature publications to the greatest extent practical.

NASA recognizes that there are cases when data cannot be disclosed in the public domain. Even in these cases, proposers are expected to publish data to the greatest extent possible (e.g., use normalized data or at least discuss new methodologies used with clean "test cases.") NASA also understands that proposers may have legitimate proprietary interests in technology or data they have produced at their own expense. If results must include proprietary or restricted information, that information should be segregated into a separate appendix that will not be publicly disseminated. The publicly releasable version of the final report should be otherwise complete and comprehensive as far as is feasible.

The final reports, but not the intermediate reports, excluding any appendices containing ITAR or proprietary material, will be published on the NARI public website within 2 weeks of receipt of the report.

(5) Intellectual Property Resulting From Awards

Intellectual property provisions (patent rights and data rights) applicable to grants and cooperative agreement awards are subject to the provisions of the *NASA Grants and Cooperative Agreement Handbook*. Intellectual property provisions applicable to contract awards are subject to the provisions of the Federal Acquisition Regulations (FAR) and the NASA FAR Supplement (NFS). The PI is responsible for filing for the New Technology Report (<https://invention.nasa.gov/>) and Patent Application (if needed) early enough to cover dissemination of results presented at public virtual meetings and in the final report.

E.2.8 References

Aeronautics Research Mission Directorate (ARMD):

<http://www.aeronautics.nasa.gov/>

Federal Acquisition Regulation (FAR)

<http://www.acquisition.gov/far/>

Federally Funded Research and Development Centers (FFRDC)

<http://www.nsf.gov/statistics/ffrdclist/start.cfm>

NASA Grants and Cooperative Agreement Handbook

http://prod.nais.nasa.gov/pub/pub_library/grcover.htm

Guidebook for Proposers (NASA Guidebook for Proposers Responding to a NASA Research Announcement (NRA) or Cooperative Agreement Notice (CAN), 2013 Edition)

<http://www.hq.nasa.gov/office/procurement/nraguidebook/>

International Traffic in Arms Regulations (ITAR)

http://pmddtc.state.gov/regulations_laws/itar_official.html

National Aeronautics and Space Administration (NASA)

<http://www.nasa.gov>

NASA FAR Supplement (NFS)

<http://www.hq.nasa.gov/office/procurement/regs/nfstoc.htm>

NASA Solicitation and Proposal Integration Review and Evaluation System (NSPIRES)

<http://nspires.nasaprs.com>

E.2.9 Summary of Key Information

Expected annual program budget for new awards	\$2.8M
Number of new awards pending adequate proposals of merit	Dependent on the quantity and quality of the proposals received.
Maximum duration of awards	2 years
Due date for Notice of Intent to propose (NOI)	06/14/2013
Date of Pre-Proposal Briefing	06/25/2013
Due date for proposals	07/30/2013
General information and overview of this solicitation	See the <i>Summary of Solicitation</i> of this NRA.
Detailed instructions for the preparation and submission of proposals	See the NASA <i>Guidebook for Proposers, January 2013</i> at: http://www.hq.nasa.gov/office/procurement/nraguidebook/
Page limit for the central Science-Technical-Management section of proposal	20 pages
Submission medium	Electronic proposal submission is required; no hard copy is required. See also Section IV in the <i>Summary of Solicitation</i> of this NRA and Section 3 of the NASA <i>Guidebook for Proposers</i> .
Web site for submission of proposal via NSPIRES	http://nspires.nasaprs.com (help desk available at nspires-help@nasaprs.com or (202) 479-9376)
Expected award type	Cooperative Agreements
Funding opportunity number	NNH13ZEA001N-LEARN1
NASA points of contact (POC) NARI will post any Q&A on-line (in the LEARN section of NSPIRES) so that all proposers will have access to the same information.	E-mail questions to: < nasa-learn@mail.nasa.gov > Written responses will be posted on the solicitation website. NARI Director: Michael R. Dudley < michael.r.dudley@nasa.gov > Procurement POC: TBD