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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

HEADQUARTERS

OFFICE OF THE CHIEF TECHNOLOGIST

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WASHINGTON, DC 20546-0001

NASA INNOVATIVE ADVANCED CONCEPTS (NIAC)

NASA RESEARCH ANNOUNCEMENT (NRA)

NRA ISSUED: JANUARY 15, 2013

STEP A DUE: FEBRUARY 14, 2013

STEP B DUE: APRIL 18, 2013

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CATALOG OF FEDERAL DOMESTIC ASSISTANCE (CFDA) NUMBER: 43.009

GENERAL INFORMATION

Agency Name: NASA, Office of Chief Technologist (OCT)

Solicitation Name: NASA Innovative Advanced Concepts (NIAC)

Goal / Intent: Early studies of visionary aerospace architecture, mission, and system concepts

Eligibility: This call is open to anyone in the U.S. Teaming by non-U.S. organizations is also permitted, subject to NASA's policy on foreign participation.

Key Dates:

Phase I, Step A Due: FEBRUARY 14, 2013

Phase I, Step B Invitation: March 20, 2013 (TARGET)

Phase I, Step B Due: APRIL 18, 2013

Selection Date: SUMMER 2013 (TARGET)

Award Date: SUMMER 2013 (TARGET)

Typical TRL at beginning of Award: TRL 1 or 2

Typical TRL at end of Award: TRL 2 or early 3

Partnership and Cost Sharing: Permitted

Selection Process: Independent Peer Review

Award Details:

Approximate Award Duration: 9 Months

Expected Typical Award Amount: \$100K

Selecting Official: NASA Space Technology Director (or designee)

Types of Instruments That May Be Used for Awards: Grants, Cooperative Agreements, or Intra-Agency Transfers, Inter-Agency Transfers, or Contracts.

NASA INNOVATIVE ADVANCED CONCEPTS

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NASA INNOVATIVE ADVANCED CONCEPTS

I. FUNDING OPPORTUNITY DESCRIPTION

(a) Introduction and Scope

This call invites innovative, technically credible advanced concepts that could one day change the possible in aeronautics and space.

NIAC will support innovative research through two phases of study. The Phase I awards culminating from this call will be nine-month efforts to explore the overall feasibility and viability of visionary concepts. A follow-on Phase II proposal call will later be released to eligible recipients of Phase I awards, past and present, to further develop the most promising Phase I concepts for up to two years and to explore potential infusion options within NASA and beyond.

NIAC focuses on early studies of **visionary aerospace concepts**. These will be architecture, mission, or system concepts, typically Technology Readiness Level (TRL) 1-2 in maturity (see Appendix A) and aiming ten or more years in the future.

The proposed *concept* must satisfy all of the following attributes:

- An Aerospace Architecture, System, or Mission Concept
 - Proposed with at least one clear application that contributes to NASA strategic goals (See section I. (d))) and/or proposed with clear application(s) to the national space or aeronautics enterprise with potentially wider benefits
- Exciting
 - Enables an entirely new kind of mission, or great leap in capabilities
 - Worth studying now, even if far-term or high risk
- Unexplored
 - Concept is sufficiently new or different that the appropriate developmental step is initial definition and feasibility/benefit analysis
 - Study breaks new ground, changing the conversation about future possibilities or significantly contributing to science/understanding
- Credible
 - Technically sound – based on solid scientific/engineering principles
 - Plausibly implementable – should the proposed study demonstrate sufficient merit, there is at least one reasonable path for further development and eventual implementation (i.e., not requiring any extremely unlikely changes to NASA or U.S. budget, priorities, etc.)

The proposed Phase I *study* must:

- **Develop the concept** — the constituent technology/systems and operations should be identified, defined, or refined. Key properties should be investigated. Potential applications and paths for further advancement (of the overall concept and key elements) should be considered.

- **Assess the concept in an Aerospace or Aeronautics mission context** — determining feasibility and comparing properties/performance with those of current missions/concepts should be the main focus. (This is more important than detailed analysis of the underlying phenomena or technology.) Concepts that may support multiple missions should discuss the range, but must feature detailed analysis of at least one candidate mission application.

(b) Clarification of Process and Key Sections in this NRA

It is critical for investigators to read carefully ALL of the instructions in this NRA. There are significant differences between this call and the one that was used to solicit NIAC Phase I studies in FY 2011 and FY 2012.

The NIAC call for Phase I proposals will be a two-step process. Detailed proposal preparation instructions for Phase I (Steps A and B) are provided in **Section V**. Phase I, Step A will solicit three-page white paper concepts and a separate one-page summary chart. These will be reviewed against the Phase I, Step A evaluation criteria (**Section VI (b)**), and successful proposers will be invited to submit a full proposal in Phase I, Step B. These proposals will be given a full technical peer review according to the Phase I, Step B evaluation criteria (**Section VI (c)**). The overall process for selection is described in **Section VI (d)**. Due dates for Phase I, Step A and invited Phase I, Step B proposals are provided in **Section V(d)**.

NIAC will support innovative research through two phases of study. The Phase I awards culminating from this call will be nine-month efforts to explore the overall viability and advance the TRL of visionary concepts. A follow-on Phase II proposal call will later be released to eligible recipients of Phase I awards, past and present, to further develop the most promising Phase I concepts for up to two years and explore potential infusion options within NASA and beyond. (**See Sections I (b), (c), and (d)**).

NIAC studies are intended to explore revolutionary and innovative mission and architecture concepts that will significantly advance NASA objectives. Detailed descriptions of evaluation criteria that further define what NIAC is and is not seeking are described in **Section VI (b)**. Step A white papers outside the scope of **Section VI (b)** are not likely to progress to Step B. For example, NIAC is not seeking studies or development of narrowly defined technologies, materials, or subsystems.

(c) Strategic Goals of NASA's Research Program

NASA's Vision:

NASA leads scientific and technological advances in aeronautics and space for a Nation on the frontier of discovery.

and NASA's Mission:

Drive advances in science, technology, and exploration to enhance knowledge, education, innovation, economic vitality, and stewardship of the Earth.

NASA's Vision and Mission guide technology objectives in the orderly pursuit of the agency's strategic goals. Accordingly, NASA's Space Technology Program (STP) will endeavor to create the innovative new technologies for our exploration, science, and

economic future, and to advance aeronautics research for societal benefit. The outcomes associated with these goals are as follows:

- Sponsor early innovation in space technologies in order to improve the future capabilities of NASA, other government agencies, and the aerospace industry.
- Infuse game-changing and cross-cutting technologies throughout the nation's space enterprise, to transform the nation's space mission capabilities.
- Develop and demonstrate the critical technologies that will make NASA's exploration, science, and discovery missions more affordable and more capable
- Facilitate the transfer of NASA technology and engage in partnerships with other government Agencies, industry, and international entities to generate U.S. commercial activity and other public benefits.
- Develop innovative solutions and advanced technologies through a balanced research portfolio to improve current and future air transportation.
- 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.

The development of advanced and innovative aerospace technologies is critical for our nation to meet its goals to explore and understand the Earth, our solar system, and the universe. STP efforts will improve the Nation's leadership in key research areas, enable far-term capabilities, and spawn disruptive innovations that make aeronautics, science, space travel, and exploration more effective, affordable, and sustainable.

Investment in innovative low-TRL research increases knowledge and capabilities in response to new questions and requirements, stimulates innovation, and allows more creative solutions to problems constrained by schedule and budget. Moreover, it is investment in that level of research that has historically benefited the nation on a broader basis, generating new industries and spin-off applications.

A long-term, broad, advanced space concepts and technology development program is likely to have many positive outcomes. Chief among these are a more exciting science and exploration future, and a more robust national capability for aerospace activities that will improve our competitive posture in the international marketplace, enable new industries, and contribute to economic growth. STP efforts will also serve as a spark to innovation that can be applied broadly in a more robust technology-based economy, an international symbol of our country's scientific innovation, engineering creativity and technological skill, and a component of the remedy to our nation's scientific and mathematics literacy challenges. NASA's pursuit of a suite of revolutionary discoveries will also lead to major breakthroughs that are needed to address energy, health, transportation, and environmental challenges.

(d) NASA Innovative Advanced Concepts

Through NIAC's contributions to STP's sustained, deliberate investment in a low TRL portfolio, NASA is seeking exciting, unexplored, credible aerospace concepts with at least one mission application that addresses NASA goals or wider benefits with space or aeronautics applications.

The types of efforts being sought include:

- Ideas that may result in beneficial changes to NASA's long-range plans
- Cross-cutting mission concepts that contribute new technological approaches for aerospace applications, and ideally also fulfill national needs in areas such as communications, power, energy storage, propulsion, safety, and security
- "Out-of-the-box" approaches to performing existing operations or research activities
- Novel concepts to enable new capabilities or revolutionary improvement in terms of performance, weight, cost, reliability, operational simplicity, or other figures of merit associated with aerospace endeavors that support NASA's goals
- Architectures, concepts, or processes related to NASA strategic goals that also address national and global challenges

Various studies in recent years have addressed NASA's vision, mission, and goals and have identified key technology advances that would benefit potential future missions. Recent examples include

- **The NASA Strategic Plan**
(www.nasa.gov/pdf/516579main_NASA2011StrategicPlan.pdf)
- **NASA's Space Technology Roadmaps**
(<http://www.nasa.gov/offices/oct/home/roadmaps/index.html>)
- **The National Aeronautics Research and Development Plan – Biennial Update 2010**
(<http://www.whitehouse.gov/sites/default/files/microsites/ostp/aero-rdplan-2010.pdf>)
- **National Research Council (NRC) Review of the Space Technology Roadmap**
(http://www.nap.edu/catalog.php?record_id=13354)
- **NASA's Strategic Space Technology Investment Plan (Draft)**
(http://www.nasa.gov/pdf/674740main_07-17_12DRAFT_Strategic_Space_Tech_plan.pdf)

These references are provided for guidance and inspiration, but are not intended to be comprehensive or to limit the topics for consideration. Note that the fourteen discipline-specific Technology Roadmaps frequently provide information about the current state of the art of existing technologies, and reasonable expectations of how these technologies are expected to mature over the next twenty years. Where appropriate, you can assume these expectations to represent the technology baseline, and your proposed concepts should substantially exceed them or be alternatives to them.

(e) Availability of Funds for Awards

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 selects for award under this NRA.

II. SCHEDULE AND DELIVERABLES

(a) Schedule

Phase I efforts typically will be up to nine months. The period of performance will commence upon award.

It is expected that continuation to Phase II study will be possible for a few of the most promising NIAC concepts. There will be a separate solicitation for Phase II awards, which will fund efforts typically for up to two years (after Phase I). Only proposals based on successful NIAC Phase I studies will be considered for Phase II. NASA will publish a separate NRA for the NIAC Phase II opportunity. It is expected that Phase II proposals based on any successful NIAC Phase I study will be eligible, whether just completed in the last set of Phase I studies, or any time previously for either the current NIAC or the original *NASA Institute for Advanced Concepts*.

(b) Phase I Deliverables

The Phase I award recipients will be expected to deliver the following during the Phase I performance period:

- Brief written status reports to NASA Headquarters by the 15th day of the second month after award, and bimonthly thereafter:
 - Project title
 - Name of Fellow
 - Date of status report
 - Paragraph on recent accomplishments, to include short bullet summaries of technical progress against the work plan as well as a listing of completed travel, presentations, papers, significant press coverage
 - Paragraph on expected activities for the pending performance period
 - Issues or concerns (if any)
 - Additional supporting data can also be submitted following the basic reporting information listed above, to include any significant successes you may want to share, as well as links to or copies of papers, presentations, videos, press releases, etc.
- A final written technical report at the conclusion of the effort, *suitable for public release*, to include:
 - Detailed description of the concept and the benefits it offers
 - One or more detailed example applications in a NASA mission context
 - The approach used to evaluate the concept
 - Technical details supporting the findings with regard to the concept's technical feasibility
 - Technical challenges that remain to be addressed

- NIAC Fellow (i.e., Principal Investigator) attendance at two program meetings. The first will be to present an overview poster of the concept at a two to three-day NIAC Fall Symposium and the second will be to present status and preliminary findings at a two to three-day NIAC Spring Symposium. Both will be in the continental United States with specific dates and location to be determined.

All reports must be submitted as Portable Document Files (.pdf) attached to an electronic mail message to hq-niac@mail.nasa.gov. The final report (minus limited proprietary annexes) and the Fellows Symposium presentations **will be suitable for public release** (see III (b) and III (c) below).

III. AWARD INFORMATION

(a) Award Information

NIAC Phase I awards will be up to \$100K, for a typical duration up to nine months. Smaller amounts may be proposed, and all amounts must be justified. For proposals with NASA civil servant participation, the award amount plus civil servant labor costs (per standard NASA accounting practices for the work-years proposed) will be used for evaluation purposes. This total should also be used by the offeror for comparison to the typical award value (Since the cost of civil servant time must be included in the total cost of the effort, and that total cost must not exceed \$100K, then, for example, an \$80K award before civil servant cost plus one civil servant work-year is substantially more than \$100K alone, and would be out of scope).

In all cases, NASA's goal is to initiate new awards within 1 to 2 months after the selection of proposals is announced. However, this time period may be longer based on the number of proposals received, 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 required to submit full and detailed explanations of its requested budget 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, intra-agency transfers, inter-agency transfers, or contracts depending on the nature of the submitting organization and the nature of the proposed effort. It is expected that most Phase I awards will be grants and inter- or intra-agency transfers. (Most NIAC Phase II awards are also expected to be grants and inter- or intra-agency transfers.) 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 *Grants Handbook*¹ 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 (see http://prod.nais.nasa.gov/cgi-bin/nais/nasa_ref.cgi).

¹ The *NASA Grants and Cooperative Agreement Handbook* (hereafter referred to as the *Grants Handbook*) is at http://prod.nais.nasa.gov/pub/pub_library/grcover.htm.

Concepts that were submitted in earlier proposals but not selected for a previous NASA award may be re-proposed, as long as they meet eligibility requirements of this solicitation, and are prepared consistent with the guidelines of this NRA. Such submissions will be subjected to the full NIAC review process along with all new proposals, and considered with neither advantage nor disadvantage.

(b) Use and Disclosure of Research Resulting From Awards

As a Federal Agency, NASA requires prompt public disclosure of the results of its sponsored research 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. Proposals shall include a clear statement of how the proposer intends to publicly disseminate results. Any restrictions to public availability of results must be discussed with NASA officials, and may affect funding decisions (see Deliverables, Section II (b)).

NASA recognizes that there are cases when data cannot be disclosed in the public domain (e.g., export controlled data). 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. A publicly releasable version of the final report shall be otherwise complete and comprehensive as far as is feasible.

(c) 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 *Grants Handbook*. When the award recipient is a college, university or nonprofit organization, sections 1260.4, 1260.28, 1260.30, and 1260.136 will apply. When the award recipient is a commercial firm, sections 1274.208, 1274.905, 1274.906 and 1274.911 through 1274.915 will apply.

IV. ELIGIBILITY INFORMATION

(a) Eligibility of Applicants

This is an open announcement; anyone is welcome to respond to this solicitation. Affiliation with any educational institution, commercial or not-for-profit organization, research laboratory, agency, or NASA Center (including the Jet Propulsion Laboratory) is permitted. Individuals may submit, as long as they meet the registration requirements for NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES) (<http://nspires.nasaprs.com>). Submitters do not need to have extensive aerospace technology experience; those with limited experience are encouraged to familiarize themselves with the documents listed in Section I (d) but note these references are provided for guidance and inspiration, but are not intended to be comprehensive or to limit the topics for consideration.

(b) Cost Sharing or Matching

Cost sharing is not required on a grant or cooperative agreement, although NASA can accept cost sharing if it is voluntarily offered (see the *Grant and Cooperative Agreement Handbook*, Section B, §1260.123, “Cost Sharing or Matching”).

(c) Foreign Participation

Teaming by non-U.S. organizations in proposed efforts is permitted but subject to NASA’s policy on foreign participation. The NFS clause 1835.016-70, Foreign participation under broad agency announcements (BAAs), provides policy and guidelines for foreign participation in this activity. NASA seeks the broadest participation in response to broad agency announcements, including foreign proposals or proposals including foreign participation. NASA’s policy is to conduct research with foreign entities on a cooperative, no-exchange-of-funds basis (see NPD 1360.2, Initiation and Development of International Cooperation in Space and Aeronautics Programs). NASA does not normally fund foreign research proposals or foreign research efforts that are part of U.S. research proposals and will not do so pursuant to this announcement (further information on foreign participation is provided in Section 1.6 of the *NASA Guidebook for Proposers*).

Should a foreign proposal or a U.S. proposal with foreign participation be selected, NASA’s Office of International and Interagency Relations will arrange with the sponsoring foreign agency or funding/sponsoring institution for the proposed participation on a no-exchange-of-funds basis, in which NASA and the non-U.S. sponsoring agency or funding/sponsoring institution will each bear the cost of discharging their respective responsibilities.

(d) China funding restrictions

- The proposer must certify compliance with 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: 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.
- 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.
- The restrictions in the Acts do not apply to commercial items of supply needed to perform a grant or cooperative agreement.
- 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.

V. PROPOSAL AND SUBMISSION INFORMATION

(a) Summary

The NIAC call for proposals will be a two-step process. Phase I, Step A solicits a three-page white paper and a separate one-page summary chart. These will be reviewed against the Phase I, Step A evaluation criteria in the NASA Research Announcement (NRA), and successful proposers will be invited to submit a full proposal in Phase I, Step B. These proposals will be given a full technical peer review according to the Step B evaluation criteria in the NRA.

(b) Proposal Instructions and Requirements

All information needed to apply to this solicitation is contained in this NIAC NRA, Appendix B and C, and in the companion document, the *Guidebook for Proposers Responding to a NASA Research Announcement (NRA) or Cooperative Agreements Notice (CAN)* (hereafter referred to as the *NASA Guidebook for Proposers*), located at <http://www.hq.nasa.gov/office/procurement/nraguidebook>. 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 found noncompliant and rejected without review. **Where this Call and the Guidebook differ, this Call takes precedence.**

For Phase I, Step A, proposers may opt to submit proposals in response to this NIAC NRA via either of two different electronic proposal submission systems: the NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES) (<http://nspires.nasaprs.com>; see Appendix C) or Grants.gov (<http://www.grants.gov>; see Appendix D). All proposers, team members, and agency officials must be registered before proposal submission with NSPIRES regardless of the electronic system used to submit proposals. NSPIRES remains the only system through which a Phase I, Step A proposal can be continued as a Phase I, Step B proposal. Proposers submitting a Phase I, Step A proposal who receive an invitation to submit a Phase I, Step B proposal will have the option of building on a stored Phase I, Step A proposal within the NSPIRES database. **Grants.gov will not be available for invited Phase I, Step B submissions. All invited proposers must use NSPIRES for Phase I, Step B proposal submissions.**

Organizations that would like to register with NSPIRES are required to have a valid registration with the System for Award Management (SAM) at www.sam.gov. If you had an active record in CCR, you have an active record in SAM. You still must create a user account in SAM. If you want to use the same username and password that you used in CCR, you may. Once the organization is registered in SAM, the listed Electronic Business Point of Contact (EBPOC) must register as a user with NSPIRES, log on, then begin the organization registration process in NSPIRES. ***If your organization is not already registered in SAM, please allow adequate time (perhaps a week or more) to complete the SAM registration process.***

Questions regarding this NRA should be directed, in writing, to the Point of Contact identified in Section VIII below. Clarifications or questions and answers will be posted on this solicitation's NSPIRES web page as part of a group of Frequently Asked Questions.

The introductory material and 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. A group of *Frequently Asked Questions* (FAQs) provides additional miscellaneous information about a variety of the NASA proposal and award processes, policies, and procedures.

Each proposal should feature a brief, scientifically valid, project title that is intelligible to a scientifically literate reader and suitable for public release.

(c) Content and Form of the Proposal Submission

(i) Electronic Proposal Submission

All proposals submitted in response to Phase I, Step A and those invited for Phase I, Step B of this NIAC NRA must be submitted in a fully electronic form. No hard copy of the proposal is required or permitted. Submission of Phase I, Step A White Papers and invited Phase I, Step B proposals is a two-step process. When the PI has completed entry of the data requested in the required electronic forms and attachment of the allowed PDF attachments, an official at the PI's organization who is authorized to make such a submission, referred to as the **Authorized Organizational Representative (AOR)**, must submit the electronic proposal (forms plus attachments). *Please work with your AOR early in the proposal preparation process, and allow for up to two days for the coordination between the PI and your AOR on the final editing and submission of the proposal materials.* This process is facilitated through your respective accounts in NSPIRES and/or Grants.gov.

(ii) Phase I, Step A Process

Note carefully the following requirements for submission of a Phase I, Step A electronic proposal, regardless of the intent to submit via NSPIRES or Grants.gov.

- The primary organization requesting NASA funds through the proposed investigation must be listed on the Proposal Cover Page. Individuals may submit as long as they are registered as an Authorized Organizational Representative (AOR), within NSPIRES.
- The PI and a valid AOR must be registered in NSPIRES. This applies equally for proposals submitted via Grants.gov, as well as for proposals submitted via NSPIRES.

Generically, an electronic proposal consists of electronic forms and one or more attachments. The electronic forms contain data that will appear on the proposal cover pages and will be stored with the proposal in the NSPIRES database. Phase I, Step A submissions in response to this NRA must have only a single attachment. The single attachment contains the three-page White Paper, prepared according to the instructions provided in section V (c) (iv).

(iii) Phase I, Step B Process

Note carefully the following requirements for submission of a Phase I, Step B electronic proposal.

- Only PIs that receive an invitation based on a successful Phase I, Step A White Paper may submit a Phase I, Step B Proposal.
- Phase I, Step B proposals must be submitted through NSPIRES. Phase I, Step B proposals may not be submitted through Grants.gov.
- Any organization requesting NASA funds through the proposed investigation must be listed on the Proposal Cover Page.
- The PI and key team members, named on the proposal's electronic cover page must be individually registered in NSPIRES.
- All personnel named on the proposal's electronic cover page must confirm their participation on that proposal (indicating team member role) and specify an organizational affiliation in NSPIRES (see Appendix B). The organizational affiliation specified on the cover page must be the organization through which the team member would work and receive funding while 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. Team members are asked to ensure that their contact information is up-to-date. Changes can be made using the "Account Management" link on the "NSPIRES Options" page.

Generically, an electronic proposal consists of electronic forms and one or more attachments. The electronic forms contain data that will appear on the proposal cover pages and will be stored with the proposal in the NSPIRES database. Phase I, Step B proposals submitted in response to this NRA must have only a single attachment. The single attachment contains all sections of the proposal, including the science/technical/management section, the budget narrative, and all required and allowed appendices; see Section V (c) (iv) below for further requirements.

Submission of Phase I, Step B proposals via NSPIRES is a two-step process. 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 Organizational 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.

(iv) Proposal Format and Contents

All Phase I, Step A proposals submitted in response to this NRA must include any specified required electronic forms available through either of two proposal submission systems, NSPIRES or Grants.gov. All Phase I, Step B proposals submitted in response to this NRA must include any specified required electronic forms available through the NSPIRES proposal submission system. Submission via NSPIRES will also require

responding to Program-Specific questions on the NSPIRES submission page. Sections VI (iv) (a) and (b) give detailed descriptions of the required proposal contents. Table 1 is a summary of Step A and Step B proposal component requirements.

Section	Notes	Maximum Page Length
Step A		
Summary Chart	Format provided in Figure 1	1
White Paper	See V (c) (iv) (a) for details	3
Step B (if invited)		
Table of Contents		1
Summary Chart	From Step A submission	1
Repeat Step A White Paper	From Step A submission	3
Approach and Benefits	See V (c) (iv) (b) for details	5
References and Citations	Note the text must stand alone independent of supplied references; reviewers are not required to read references and citations	As needed
Biographical Sketches	Of PI and key team members	Optional, limit of 2 pages per person
Statements of Commitment and Letters of Support	For key resources, potential users, or relevant individuals not listed on the cover page	As needed
Budget Justification	See V (c) (v) for details	As needed

Table 1: Summary of Proposal Step A and Step B Component Requirements

a) Phase I, Step A Instructions

The purpose of the White Paper is to describe the essential elements of the proposed concept: what is it, why is it exciting, what will it enable, and why is it credible. While recognizing that no one format is necessarily appropriate to the wide range of concepts eligible for NIAC funding, proposers are encouraged to meet the following guidance:

- “Wow us, and give your concept a chance to wow the world!”
- Title — short, descriptive, easily understood. (Aim closer to a newspaper headline than a scholarly journal article title. Reviewers may evaluate numerous concepts, and they need a good way to remember and refer to yours.)
- What is the proposed concept? Clearly articulate the essential elements and describe at least one mission that addresses NASA goals or wider aeronautic or space benefit.
- What makes it exciting? Does it enable an entirely new mission or provide a great leap in capabilities? Why is it worth studying now even if it is perhaps high risk or far term?
- Is the concept unexplored? In what ways are the concept’s feasibility or properties not known, not readily determined, or not adequately addressed in prior studies? Will your study of the concept break new ground, change the conversation about future possibilities, or significantly contribute to a fundamentally new understanding of the approach?

- Why is the concept credible and technically sound? Is there at least one plausible implementation path? What justification (at the “back of the envelope” level) supports the concept’s plausibility and feasibility? If there are significant technological or programmatic hurdles, explain why this concept should be considered.
- Page and font format is up to the proposer, but font size must be legible (typically 12-pt font), margins should be reasonable, and the length cannot exceed three standard 8.5x11 pages plus the one-page overview chart (i.e., four pages total). Pages beyond the limit will not be considered.
- A detailed work plan, team composition, or budget is not required for Phase I, Step A White Papers. (However, please note that these will be required for invited Phase I, Step B proposals)
- In addition to the three-page technical description, provide a single 8.5 x 11 page summary chart. This summary chart will be used to represent your concept during the review process. Please follow the template in Figure 1, and include the following components:
 - Concept Image (size may be varied to best illustrate/explain)
 - Concept Description
 - Benefits (of the concept and of the Phase I study)
 - Study Approach: what are the key objectives of the study
 - Blank Quadrant for Reviewer comments

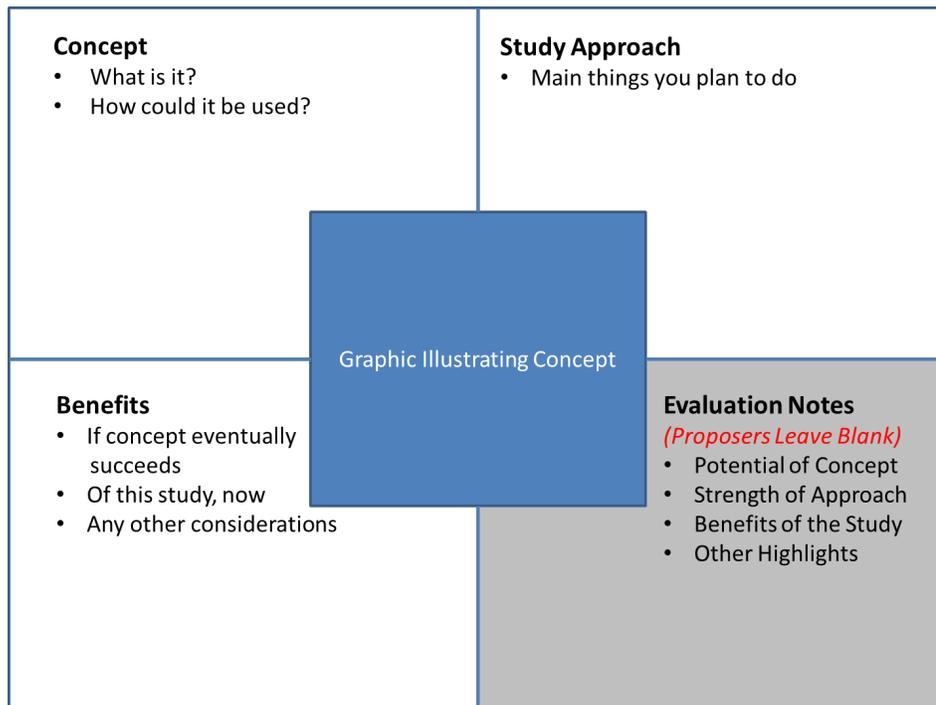


Figure 1: Required Template for Summary Chart

b) Phase I, Step B Instructions (See Appendix B for additional information)

The NSPIRES system will guide proposers through submission of all required proposal information. Select **prior-phase proposal** when creating an invited Phase I, Step B

proposal. The Phase I, Step B proposal must be consistent with the concept selected when submitting the Phase I, Step A proposal. Please note that the Proposal Summary, Business Data, Budget, and Proposal Team and Program Specific Questions are required Cover Page Elements for all Phase I, Step B proposals. The proposal summary in the cover page should be between 100-300 words (4000 characters maximum) and understandable by the layman reader.

If invited to submit a Phase I, Step B proposal, the proposer will be asked to identify the technology area(s) most closely associated with (or requiring the most technological advancement for) the NIAC concept being proposed. The Technology Area Breakdown Structure (TABS) may be found under “Other Documents” on NSPIRES (TABS_NIAC_FY12.pdf). At least one TABS element is required. More than one selection is permitted, since some concepts may address multiple major technology areas. The proposer has flexibility in selecting the level of the work breakdown structure (first, second, third, etc.); various levels are shown in order to provide as much insight as possible into the technology areas.

The combined technical/management component of the Phase I, Step B proposal is limited to eight pages plus a single page overview chart (see Table One). We expect the overview chart will be essentially identical to the one submitted for Phase I, Step A. The eight page proposal should incorporate the three-page Phase I, Step A White Paper plus five pages to address the following:

- What is your approach to execute the study? Clearly identify the proposed study objectives. Demonstrate an understanding of the major issues and describe how your work plan addresses significant obstacles and objections to the concept. Identify the members of the team and their contributions. Ensure that your approach is feasible within the proposed cost and schedule.
- What are the benefits of the study? How will your study advance our understanding of the feasibility and benefit of the concept, particularly if there have been prior studies of similar or related concepts? Is the study likely to have wider benefits such as engaging the public, making a contribution to the economy, or producing potential non-aerospace spin-offs? Are there likely intermediate contributions from the study that could have immediate (period of the study) benefits to science, to technology, or in other ways?

For proposals with NASA civil servant team members: Proposers are required to enter the NASA civil servant team member name and fraction of full-time equivalent (FTE) involvement in the same field under the Item column in section F “Other Direct Costs” of the online budget. The funds requested should be entered as the Total Requested Funds for the NASA civil servant, including salary, fringe, materials, travel, etc. This budget entry should be made for each NASA civil servant involvement, and is in addition to the agency identification under the team member section and the NASA civil servant FTE designation under the business data section.

The technical/management section and other required sections of the Phase I, Step B proposal must be submitted as a single, searchable, unlocked PDF file that is attached to the electronic submission in NSPIRES. Proposers must comply with all 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 that are specifically requested in this NRA will be permitted; proposals containing unsolicited appendices may be declared noncompliant.

While again recognizing that no one format is necessarily appropriate to the wide range of concepts eligible for NIAC funding, proposers are encouraged to stay close to the following instructions.

The full Phase I, Step B Proposal shall not exceed 10MB in pdf format and will consist of the one-page overview chart plus up to 8 pages for technical content, team, and work plan. Pages beyond the limit will not be considered. A budget justification will be included in the proposal but will not count against the 8-page limit.

The following items are to be included in the Phase I, Step B proposal but do not count against the 8-page limit:

- Biographical Sketches for the PI and all Co-Is not to exceed two pages per team member (see Guidebook for Proposers for more information)
- Technical References (optional) - References, if any (for example to show relevance to other work or differentiation from it), do not count toward the project description page limit, and are to be included following all other sections of the proposal (**NOTE: reviewers are not required to consider information presented in references**).
- Statements of Commitment...if needed
- A budget justification with details adequate to substantiate the requested funding. The budget justification should be included at the end of the uploaded file, but does not count against the 8-page limit. (see details in V (c) (v) below).

The proposal must have clearly legible body text, figures, and figure captions, as described in the instructions for Step A. Text within figures and tables may be smaller but must still be judged by the reviewers to be readable.

Differentiation: If the proposed effort builds directly upon previous or current government-funded research, proposers should include a short background summary and clearly describe how the proposed effort is novel and different. Proposers should also note any similar proposals they have submitted for consideration in other solicitations.

Important note on creating PDF files for upload (for Phase I Step A or Step B submissions): 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. 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. 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.

In order to meet the 10 MB file size limit, you should crop and compress any embedded photos and graphic files to an appropriate size and resolution. Most electronically submitted proposals will be less than 2 MB in size.

(v) NIAC Budget Format

In the evaluation of Phase I, Step B proposals submitted under the NIAC NRA, STP will be providing all of the budget data in the NSPIRES budget forms to peer reviewers (i.e., STP is *not* redacting budgets). Proposers should include all relevant details in the budget justification section as part of the uploaded pdf attachment. Proposals submitted in response to this NIAC NRA should follow the directions for the budget section of the proposal given in Section 2.3.10 of the *NASA Guidebook for Proposers*. There are no additional requirements for NIAC proposals from non-NASA proposers.

Since NASA funding sent to NASA Centers must be obligated in the same fiscal year (FY) in which they are received, proposals submitted by NASA Centers (but not including JPL) should begin the budget section of the proposal with a breakdown of funding by NASA Center and by fiscal year.

(vi) Notice of Intent to Propose

There will be no Notices of Intent for this solicitation.

(d) Phase I, Step A and Phase I, Step B Due Dates and Deadlines

Phase I, Step A White Papers must be submitted in entirety by an Authorized Organizational Representative (AOR) no later than 5:00 PM Eastern Standard Time on **February 14, 2013**. Invitations for Phase I, Step B are anticipated to be sent by **March 20, 2013**. Invited Phase I, Step B Proposals are anticipated to be required in entirety from an Authorized Organizational Representative (AOR) no later than 5:00 PM Eastern Standard Time on **April 18, 2013**.

Phase I, Step A White Papers and Invited Phase I, Step B Proposals submitted later than the proposal due date and deadline will be considered late, and will be rejected without review. If a late proposal is rejected, it is entirely at the discretion of the proposer whether or not to resubmit it in response to a subsequent appropriate solicitation.

(e) Proposal Funding Restrictions

For invited Step B Proposals, proposers must clearly identify all resources required for the completion of the proposed effort, including workforce, procurements, facility costs, travel and any other direct and indirect costs. This information will be used to evaluate the feasibility of the technical effort against the total resources requested. 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 NIAC NRA.

- The estimated funding and number of proposals anticipated to be funded, as described in this call, 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 under this NRA. For further information on what costs are permissible, refer to the cost principles cited in the *Grants Handbook*, Section B, §1260.127, “Allowable Costs.”
- 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. Proposers from NASA Centers should consult the latest NASA policy document.
- 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, 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*; see also Appendix C, part (c)(8)(iv)).
- The instructions in the following paragraph clarify and supersede the *NASA Guidebook for Proposers*, Section 2.3.10(c)(iv).

Proposals submitted in response to this solicitation must specify the quantity of NASA civil servant workyears required. NASA civil servant labor cost should be included as other direct costs, per section V(c)(iv)(a). Civil servant labor costs should also not be included on the NSPIRES cover page.

- Non-NASA U.S. Government organizations proposing as team members should propose based on full-cost accounting unless no such standards are in effect; in that case such proposers should follow the *Managerial Cost Accounting Standards for the Federal Government* as recommended by the Federal Accounting Standards Advisory Board (for further information, see <http://www.hq.nasa.gov/fullcost>). Proposal budgets must include all costs that will be paid out of the resulting award.

(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 are modified for this NRA as described in Section VI. In addition, this NRA describes how NIAC is relevant to the NASA Strategic Plan. Therefore, 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 this specific call.

(g) Use and Disclosure of Proposal Information

Except as provided in the paragraph below, information contained in proposals is used for evaluation purposes only. In order to maximize protection of trade secrets or other information that is confidential or privileged, proposers should identify such information in their proposals using restrictive notices (see Appendix B, paragraph (a)(2) of the *NASA Guidebook for Proposers*). In any event, information contained in proposals will be protected to the extent permitted by law.

For selected proposals, NASA considers the Proposal Title, the Principal Investigator's name and organization, and the Proposal Summary to be in the public domain and will post that information on an appropriate publicly accessible location. Proposers should draft their Proposal Summaries in anticipation of public disclosure. Selected Proposers are free, but not required by NASA, to release any additional information about their proposals that they may choose. However, NASA considers other portions of proposals to be proprietary and, therefore, does not release these sections of successful proposals to the public without prior consultation with the Proposer.

VI. PROPOSAL REVIEW

(a) Phase I, Step A and Phase I, Step B rationale

The two step process ensures that PIs (and subsequently, technical reviewers) will focus their valuable time and effort preparing (or evaluating) proposals that are in scope and have a reasonable chance of success. All Phase I, Step A white papers will be evaluated only using the Step A evaluation criteria. However Step A should be prepared with consideration of the Step B evaluation criteria as well, because invited Step B full proposals contain the Step A submissions as well as the additional Step B information.

(b) Phase I, Step A Evaluation Criteria

Each of the proposals will be reviewed by technical experts to determine which should be invited to submit Phase I, Step B full proposals. These will be assessed for:

- Compliance with the NRA instructions (the proposer meets the proposal preparation instructions)
- Scope (meets the NIAC criteria: an Aerospace concept, exciting, unexplored, and credible and is not an excluded case (see below))

All proposals passing the above screen will receive a competitiveness evaluation, which is based on the proposed concept's potential impact if fully successful and the clarity with which the proposal describes the essential elements of the concept and addresses the concept's plausibility and feasibility.

Invitations to submit a Phase I, Step B proposal will only be extended to proposers with Phase I, Step A submissions that are compliant, in scope, and competitive.

Note the following ***Excluded Cases*** specific points, any one of which is sufficient to decide not to invite a Phase I, Step B proposal. In line with the NIAC goal to foster truly revolutionary concepts, this effort is explicitly ***NOT*** soliciting proposals that:

- Is not an Aerospace concept. It must address NASA goals or wider benefits with space or aeronautics applications.

- Are unclear about the concept being proposed or its potential mission application. A NIAC proposal must identify the specific aerospace concept, and how it might one day be used to enable or radically improve at least one candidate mission. It is not sufficient to identify only a relevant problem and/or a tool, process, or approach to find a solution or determine further steps.
- Revisit concepts that, while not implemented, have been studied in detail in the past, without proposing an essentially new factor that substantially differentiates the proposal from prior efforts.
- Are incremental. There are many other programs that foster continuing research, evolutionary technology development, or “next-generation” systems with modest improvements. NIAC seeks breakthrough concepts that could redefine the future possibilities for NASA.
- Are not technically credible. NIAC deliberately seeks unorthodox, high risk, and revolutionary concepts, but proposals that appear to be in conflict with the known laws of physics or basic engineering principles must offer a sufficiently credible defense or will be dismissed as unworthy of serious consideration.
- Are not programmatically credible. NIAC deliberately seeks unorthodox, high risk, and revolutionary concepts, but proposals that appear to have no practical implementation path (apparently insurmountable cost or other barriers) must offer a sufficiently credible defense or they will be dismissed as unworthy of serious consideration.
- Are narrowly focused on technology, subsystems, or investigations of smaller scope (e.g., components, instruments, materials). While some degree of focused analysis may be necessary to establish the credibility of the underlying innovation, it should not be to such a degree that it interferes with a study goal to establishing the concept feasibility in an appropriate mission context.
- Primarily perform experiments, analysis, or theoretical derivations; Characterization of material properties, studies of advanced artificial intelligence algorithms, or tests of physical theories, any of which may lead to breakthroughs, are of value, but not within the NIAC scope. NIAC studies must focus on mission concepts.
- Primarily develop tools or processes to improve design, development, decisions, etc. These might one day lead to great concepts, but the focus of NIAC is development and assessment of the concepts themselves.

(c) Phase I, Step B Evaluation Criteria

The evaluation criteria Appendix C.2 of the *NASA Guidebook for Proposers* – relevance, intrinsic merit and cost - have been regrouped and expanded for this solicitation. All proposals submitted in response to this NRA will be evaluated against the following criteria (listed in descending order of importance for the major criteria).

- **Potential of the Concept**
 - Is the proposed aerospace concept exciting, unexplored, and credible? Does the proposal include at least one mission application that addresses NASA’s goals or the needs of wider space or aeronautics enterprise? Does the concept enable an entirely new mission or great leap in capabilities (often high risk or far term, but worth studying now)? Are the concept’s

feasibility or properties not known, not readily determined, nor adequately addressed in prior studies? Is the concept technically sound with at least one plausible implementation path? Does the proposal include a justification (at the “back of the envelope” level) to support the concept’s credibility and feasibility?

- **Strength of the Approach**

- Does the proposal present a sound technical approach to accomplish the proposed research objectives? Does the proposal demonstrate an understanding of the major issues? Does the study approach identify and address any significant obstacles or objections to the concept? Is the proposed team qualified to complete the proposed Phase I study? Is the proposed study effort feasible within the proposed cost and planned with an appropriate schedule?

- **Benefits of the Study:**

- To what extent is the proposed study likely to significantly advance our understanding of the feasibility and benefit of the concept? (This is particularly important if related concepts have been studied before.) Is the study likely to have any wider benefits? (Some examples include engaging the public, making a contribution to the national economy, or producing potential non-aerospace spin-offs.) Are there likely intermediate contributions from the study, offering immediate scientific or engineering benefit, regardless of the success of the underlying concept? Is this inspiring or pioneering – a truly new approach, an early attempt to apply approaches from other domains to aerospace, or otherwise different thinking that might lead to new opportunities?

(d) Review and Selection Processes

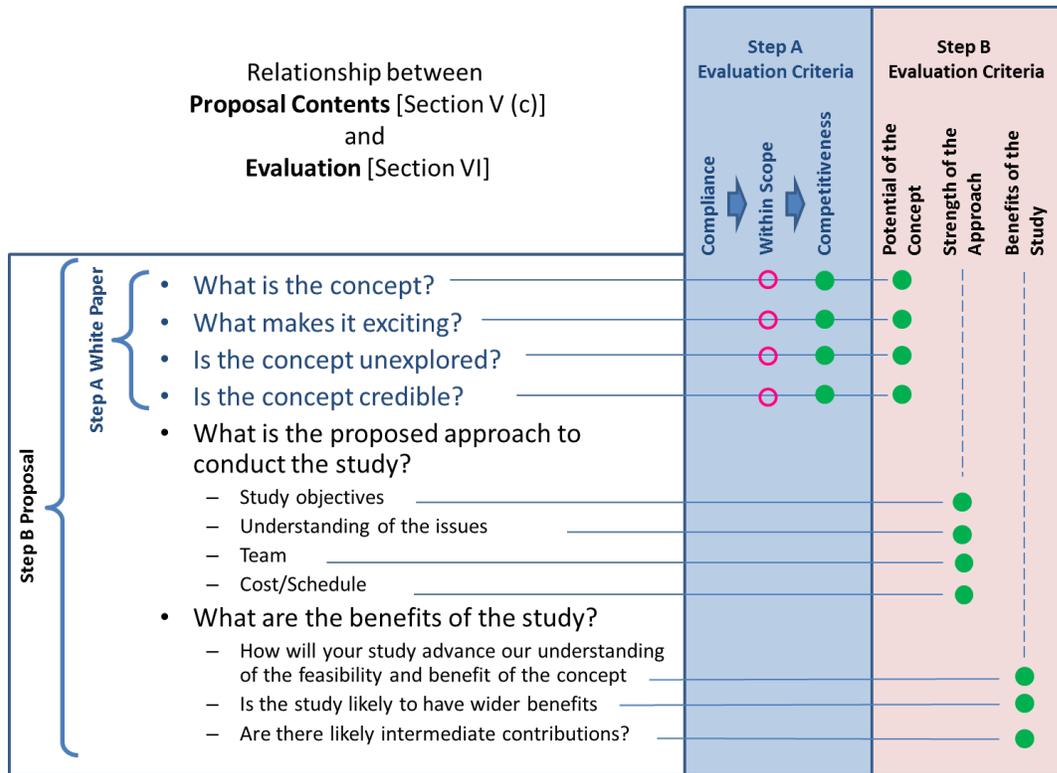


Figure 2 Relationship between proposal contents and proposal review.

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.

The NASA Space Technology Program Director or designee will be the final Selecting Official.

Every effort will be made to ensure that independent reviewers have no connection to the proposing organizations, to avoid any possibility of organizational conflict of interest. Accordingly, any NASA personnel either proposing a NIAC study or anticipating participation in NIAC proposal reviews must contact their Center Chief Technologist (CCT). The CCTs must notify STP immediately if they anticipate any possibility of a conflict of interest. STP will work with each CCT to ensure that rigorous safeguards are in place to prevent any conflicts and ensure fair peer review.

The review process will be in accordance with the OCT/STP Organizational Conflict of Interest (OCI) Mitigation Plan. The review process consists of four principal steps:

1. **Step A White Paper Review.** Phase I, Step A White Papers that are within scope and technically compliant and credible will be considered for invitation to a Phase I, Step B proposal. If there is a very large number of eligible Phase I, Step A proposals, only the most competitive will be invited to submit a Phase I, Step B full proposal (See IV (b) Phase I, Step A Evaluation Criteria).

2. **Technical Panel Peer Review.** Phase I, Step B full proposals will be assigned to one of several technical review panels. These panels will evaluate the proposals against the evaluation criteria delineated in this NIAC NRA.
3. **Prioritized Recommendation.** The results of the Technical Review Panels will be integrated and reviewed by the responsible NASA officials for prioritization.
4. **Selection.** The Source Selection Official makes the final selection of proposals to be invited to submit Phase I, Step B proposals, and those Step B proposals that will be negotiated for award, based on the technical reviews and the prioritized recommendations

(e) 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 Point of Contact listed at the conclusion of this solicitation.

Those proposers not selected will be notified by postal or electronic communication.

(f) Processes 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 Poussard
Director, Contract Management Division
Office of Procurement
NASA Headquarters
Washington, DC 20546-0001
Telephone: 202-358-0445

(ii) Protests

Only contract awards are subject to bid 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 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

Assistant Administrator for Procurement
Office of Procurement
NASA Headquarters
Washington, DC 20546-0001
Telephone: 202-358-2090

VII. AWARD ADMINISTRATION INFORMATION

(a) Notice of Award

For selected proposers, the proposer's business office will be contacted by a NASA Awards Officer, who is the only official authorized to obligate the Government. Any costs incurred by the proposer in anticipation of an award will be subject to the policies and regulations of the *Grants Handbook* (see Section B, §1260.125(e), "Revision of Budget and Program Plans").

(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*.

VIII. POINTS OF CONTACT FOR FURTHER INFORMATION

Procurement questions and comments about this NRA may be directed to:

Jonathon Wingerberg
NIAC Procurement Official
Office of Headquarters Procurement, NASA GSFC
Jonathon.D.Wingerberg@nasa.gov

Technical questions and comments about this NRA may be directed to:

John M Falker, PhD
NIAC Program Executive
Office of the Chief Technologist, NASA Headquarters
hq-niac@mail.nasa.gov

Questions of a general nature will be added to a NIAC FAQ. This FAQ will be located under "Other Documents" on the NSPIRES page for this solicitation.

Note: Proposals must not be submitted to this address. Proposals must be submitted electronically as described in Section V above and in Appendices C and D.

Inquiries about accessing or using the NASA proposal data base located at <http://nspires.nasaprs.com> should be directed by an email 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 email 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.

IX. ANCILLARY INFORMATION

(a) Announcement of Updates/Amendments to Solicitation

It is possible that additional programmatic information may develop before the proposal due date. 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.

Any clarifications or questions and answers that are published will be posted on either the OCT website or under NIAC summary information at <http://nspires.nasaprs.com>.

(b) Electronic Submission of Proposal Information

On-time electronic submission over the Internet is required for every proposal. While every effort is made to ensure the reliability and accessibility of the electronic proposal submission systems (NSPIRES and Grants.gov) and to maintain help centers via email and telephone, difficulty may arise at any point, including the user's own equipment. Therefore, prospective proposers are urged to familiarize themselves with the submission system(s), ensure they are registered in NSPIRES, and submit the required proposal materials well in advance of the deadline. Difficulty in registering with or using a proposal submission system 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 V(d) above). After submission via NSPIRES, proposers can verify proposal delivery by logging into NSPIRES and selecting "proposals" and "Submitted Proposals/NOIs."

APPENDIX A: TECHNOLOGY READINESS LEVEL (TRL) DESCRIPTIONS

The Technology Readiness Level (TRL) describes the stage of maturity in the development process from observation of basic principles through final product operation. The exit criteria for each level documents that principles, concepts, applications or performance have been satisfactorily demonstrated in the appropriate environment required for that level. A relevant environment is a subset of the operational environment that is expected to have a dominant impact on operational performance. Thus, reduced-gravity may be only one of the operational environments in which the technology must be demonstrated or validated in order to advance to the next TRL.

TRL	Definition	Hardware Description	Software Description	Exit Criteria
1	Basic principles observed and reported.	Scientific knowledge generated underpinning hardware technology concepts/applications.	Scientific knowledge generated underpinning basic properties of software architecture and mathematical formulation.	Peer reviewed publication of research underlying the proposed concept/application.
2	Technology concept and/or application formulated.	Invention begins, practical application is identified but is speculative, no experimental proof or detailed analysis is available to support the conjecture.	Practical application is identified but is speculative, no experimental proof or detailed analysis is available to support the conjecture. Basic properties of algorithms, representations and concepts defined. Basic principles coded. Experiments performed with synthetic data.	Documented description of the application/concept that addresses feasibility and benefit.
3	Analytical and experimental critical function and/or characteristic proof of concept.	Analytical studies place the technology in an appropriate context and laboratory demonstrations, modeling and simulation validate analytical prediction.	Development of limited functionality to validate critical properties and predictions using non-integrated software components.	Documented analytical/experimental results validating predictions of key parameters.
4	Component and/or breadboard validation in laboratory environment.	A low fidelity system/component breadboard is built and operated to demonstrate basic functionality and critical test environments, and associated performance predictions are defined relative to the final operating environment.	Key, functionally critical, software components are integrated, and functionally validated, to establish interoperability and begin architecture development. Relevant Environments defined and performance in this environment predicted.	Documented test performance demonstrating agreement with analytical predictions. Documented definition of relevant environment.

5	Component and/or brassboard validation in relevant environment.	A medium fidelity system/component brassboard is built and operated to demonstrate overall performance in a simulated operational environment with realistic support elements that demonstrates overall performance in critical areas. Performance predictions are made for subsequent development phases.	End-to-end software elements implemented and interfaced with existing systems/simulations conforming to target environment. End-to-end software system, tested in relevant environment, meeting predicted performance. Operational environment performance predicted. Prototype implementations developed.	Documented test performance demonstrating agreement with analytical predictions. Documented definition of scaling requirements.
6	System/sub-system model or prototype demonstration in a relevant environment.	A high fidelity system/component prototype that adequately addresses all critical scaling issues is built and operated in a relevant environment to demonstrate operations under critical environmental conditions.	Prototype implementations of the software demonstrated on full-scale realistic problems. Partially integrate with existing hardware/software systems. Limited documentation available. Engineering feasibility fully demonstrated.	Documented test performance demonstrating agreement with analytical predictions.
7	System prototype demonstration in an operational environment.	A high fidelity engineering unit that adequately addresses all critical scaling issues is built and operated in a relevant environment to demonstrate performance in the actual operational environment and platform (ground, airborne, or space).	Prototype software exists having all key functionality available for demonstration and test. Well integrated with operational hardware/software systems demonstrating operational feasibility. Most software bugs removed. Limited documentation available.	Documented test performance demonstrating agreement with analytical predictions.

8	Actual system completed and "flight qualified" through test and demonstration.	The final product in its final configuration is successfully demonstrated through test and analysis for its intended operational environment and platform (ground, airborne, or space).	All software has been thoroughly debugged and fully integrated with all operational hardware and software systems. All user documentation, training documentation, and maintenance documentation completed. All functionality successfully demonstrated in simulated operational scenarios. Verification and Validation (V&V) completed.	Documented test performance verifying analytical predictions.
9	Actual system flight proven through successful mission operations.	The final product is successfully operated in an actual mission.	All software has been thoroughly debugged and fully integrated with all operational hardware/software systems. All documentation has been completed. Sustaining software engineering support is in place. System has been successfully operated in the operational environment.	Documented mission operational results.

Definitions

Proof of Concept: Analytical and experimental demonstration of hardware/software concepts that may or may not be incorporated into subsequent development and/or operational units.

Breadboard: A low fidelity unit that demonstrates function only, without respect to form or fit in the case of hardware, or platform in the case of software. It often uses commercial and/or ad hoc components and is not intended to provide definitive information regarding operational performance.

Brassboard: A medium fidelity functional unit that typically tries to make use of as much operational hardware/software as possible and begins to address scaling issues associated with the operational system. It does not have the engineering pedigree in all aspects, but is structured

to be able to operate in simulated operational environments in order to assess performance of critical functions.

Prototype Unit: The prototype unit demonstrates form, fit, and function at a scale deemed to be representative of the final product operating in its operational environment. A subscale test article provides fidelity sufficient to permit validation of analytical models capable of predicting the behavior of full-scale systems in an operational environment

Engineering Unit: A high fidelity unit that demonstrates critical aspects of the engineering processes involved in the development of the operational unit. Engineering test units are intended to closely resemble the final product (hardware/software) to the maximum extent possible and are built and tested so as to establish confidence that the design will function in the expected environments. In some cases, the engineering unit will become the final product, assuming proper traceability has been exercised over the components and hardware handling.

Mission Configuration: The final architecture/system design of the product that will be used in the operational environment. If the product is a subsystem/component, then it is embedded in the actual system in the actual configuration used in operation.

Laboratory Environment: An environment that does not address in any manner the environment to be encountered by the system, subsystem, or component (hardware or software) during its intended operation. Tests in a laboratory environment are solely for the purpose of demonstrating the underlying principles of technical performance (functions), without respect to the impact of environment.

Relevant Environment: Not all systems, subsystems, and/or components need to be operated in the operational environment in order to satisfactorily address performance margin requirements. Consequently, the relevant environment is the specific subset of the operational environment that is required to demonstrate critical "at risk" aspects of the final product performance in an operational environment. It is an environment that focuses specifically on "stressing" the technology advance in question.

Operational Environment: The environment in which the final product will be operated. In the case of space flight hardware/software, it is space. In the case of ground-based or airborne systems that are not directed toward space flight, it will be the environments defined by the scope of operations. For software, the environment will be defined by the operational platform.

Reference: NPR 7120.8 - February 05, 2008

APPENDIX B: SUBMISSION OF PROPOSALS VIA NSPIRES

Phase I, Step A White Papers may be submitted electronically via NASA's master proposal data base system, the NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES) or via Grants.gov (see Appendix C). Invited Phase I, Step B Proposals must be submitted via NSPIRES. In order to submit a proposal via NSPIRES, this NRA requires that the proposer register key data concerning the intended submission with NSPIRES at <http://nspires.nasaprs.com>. Potential applicants are urged to access this site well in advance of the NOI and proposal due dates 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 individually registered in NSPIRES and that such individuals must perform this registration themselves; no one may register a second party, even the PI of a proposal in which that person is committed to participate. It is also important to note that every named individual must be identified with the organization through which they are participating in the proposal, regardless of their place of permanent employment or preferred mailing address. This data site is secure and all information entered is strictly for NASA's use only.

Every individual identified on the NSPIRES proposal cover page as a team member must indicate their commitment to the proposed investigation through NSPIRES prior to proposal cover page submission. Team members must additionally confirm the organization through which they are participating on this proposal. A 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 <role> confirmation for proposal <title> for Solicitation <<solicitation number>>." On the "Team Member Participation Confirmation" page, the proposal team member should read language about the Organizational Relationship, then click the "Continue" button.
- If the contact information then displayed on the "Team Member Profile" screen is out of date, the proposal team member should update this information later using the "Account Mgmt" link in the NSPIRES navigation bar across the top. Prior to making that update, however, the team member should follow the on-screen prompts to identify the organization through which he/she is participating on this proposal. Click the "Link Relationship" button to the right side of the "Organizational Relationship" banner. Select the organization from the "Link Proposal to an Association" part of the page. If the correct organization is not displayed here, try using the "Add Association" button to add the organization to this list. Then click the "Save" button at the bottom of the page. If the team member cannot find the organization when searching in the "Add Association" area (*i.e.*, the organization is not registered), type in the formal name in the space provided (or select "Self" if appropriate). Once the organization is selected and the "Save" button is clicked, there is a confirmation page that allows the team member to edit that relationship if it was chosen incorrectly. Click "Continue".
- Note that the organization through which the proposal team member is participating in the proposal might not be the proposal team member's primary employer or primary

mailing address. If the address information is accurate (or once it has been edited to be accurate), the proposal team member may log out of NSPIRES.

- NSPIRES will send an email to both the team member and the PI confirming that the commitment was made and the organization was identified. The PI may additionally monitor the status of proposal team member commitments by examining the “Relationship Confirmed” column on the Team Member page of the NSPIRES proposal cover page record. Note that the proposal cover page cannot be submitted until all identified team members have confirmed their participating organizations.

All Invited Phase I, Step B 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; *Business Data* that provides the proposed start and end dates, as well as other proposal characteristics; a *Budget* form that contains a budget summary of the proposed research effort; *Program Specific Data* that includes required questions specific to NIAC; and *Proposal Team* that provides the co-investigators and other participants in the proposal. This *Cover Page* form is available for access and submission starting about 90 days in advance of the proposal due dates and remains open until the proposal due date. No other forms are required for submission via NSPIRES. See the *NASA Guidebook for Proposers*, Sections 2 and 3, for further details.

Although NSPIRES has the ability to accept many separate proposal documents, the required elements of any proposal submitted in response to this NRA must be submitted as a single, searchable, unlocked PDF document that contains the complete proposal, including the science/technical/management section and budget justification, assembled in the order provided in the *NASA Guidebook for Proposers* (see Section 2.3) and uploaded as a single attachment using the tools in NSPIRES. The proposer is responsible for assembling the complete proposal document for peer review. All required and permitted appendices must be included in the PDF file and should not be uploaded as separate attachments. Including any part of the proposal twice creates an additional burden on the peer reviewers. Documents such as team member biographical sketches, letters of commitment, and current and pending support should not be uploaded to NSPIRES as separate files.

NSPIRES generates error and warning messages as part of the element check concerning possibly missing data. An error (designated by a red X) will preclude proposal submission to NASA by the AOR. A warning (indicated by an ! on a yellow field) is an indication that data may be missing; a warning can be ignored after verifying that the material is included in the single attachment containing the complete proposal. Any actions taken because of warnings are at the PI's discretion.

It is unnecessary to download the Proposal Cover Page and incorporate it into the Proposal Document. NSPIRES will automatically route the two parts of the proposal (*Cover Page* form, proposal document) to the appropriate peer or NASA reviewers.

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 online help menus, requests for assistance may be directed by email 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.

APPENDIX C: SUBMISSION OF PHASE I, STEP A PROPOSALS VIA GRANTS.GOV

Invited Step B proposals may not be submitted via Grants.gov.

NASA offers proposers the option to use Grants.gov to prepare and submit Only Phase I, Step A proposals in response to this NIAC NRA. Invited Phase I, Step B proposals must be submitted via NSPIRES (See Appendix C). 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 PI download an application package from Grants.gov. Identifying the appropriate application package requires the funding opportunity number for that program element; the funding opportunity number may be found in the *Summary of Key Information* subsection that concludes each program element description in the appendices of this NRA. Proposals submitted via Grants.gov must be submitted by the AOR.

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

- Grant researchers (PIs) do NOT need to register with Grants.gov. However, every individual named in the proposal as a proposing team member in any role, including PI, co-investigators, and collaborators, must be registered in NSPIRES (<http://nspires.nasaprs.com>) and such individuals must perform this registration themselves; no one may register a second party, even the PI 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.
- Follow Grants.gov instructions provided at the website to download any software tools or applications required to submit via Grants.gov.
- Download the application package from Grants.gov by selecting "Download grant application packages" under "Apply for Grants" at <http://www.grants.gov>. The Funding Opportunity Number may be found in the title page of this solicitation. Enter the appropriate Funding Opportunity Number to retrieve the desired application package. All NASA/OCT application packages may be found by searching on CFDA Number 43.009.
- Complete the required Grants.gov forms including the SF424 Application for Federal Assistance, research and research-related (R&R) Other Project Information, R&R Senior/Key Person Profile, and R&R Budget. Every named individual must be identified with the organization through which they are participating in the proposal, regardless of their place of permanent employment or preferred mailing address.
- Complete the required NASA specific forms including NASA Other Project Information, NASA PI and Authorized Representative Supplemental Data Sheet, and NASA Senior/Key Person Supplemental Data Sheet (this form is only required if there are Senior/Key Persons other than the PI).

- Complete any NASA program-specific form that is required for the specific program element. This form, which is usually required for all program element submissions, 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 proposal sections (see Section 2 of the *NASA Guidebook for Proposers*). Upload sections as separate PDF documents as prompted by Grants.gov.
- Because Grants.gov does not support the electronic commitment of team members, statements of commitment from all team members must be provided as letters attached to the proposal application at the place(s) specified by Grants.gov. This statement must include confirmation of both the team member role in the proposed effort (e.g., Co-Investigator, collaborator) and the identification of the organization through which the team member will be participating. Here is an example statement of commitment: "I acknowledge that I am identified by name as <<role>> to the investigation, entitled <<name of proposal>>, that is submitted by <<name of Principal Investigator>> to the NASA Research Announcement <<alpha-numeric identifier>>, and that I intend to carry out all responsibilities identified for me in this proposal. I understand that the extent and justification of my participation as stated in this proposal will be considered during peer review in determining in part the merits of this proposal. I have read the entire proposal, including the management plan and budget, and I agree that the proposal correctly describes my commitment to the proposed investigation. For the purposes of conducting work for this investigation, my participating organization is <<insert name of organization>>"
- 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/CustomerSupport>. Instructions for NASA-specific forms and NASA program-specific forms may be found in the application. For any questions that cannot be resolved with the available online help menus and documentation, requests for assistance may be directed by email to support@grants.gov or by telephone to (800) 518-4726.