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NASA Headquarters
Space Operations Mission Directorate/Exploration Systems Mission Directorate
Washington, DC 20546-0001**

Research Opportunities in Fundamental Physics

NASA Research Announcement

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Research Opportunities in Fundamental Physics

Proposals solicited through this NASA Research Announcement (NRA) will use a two-step proposal process. Step-1 proposals are required and must be submitted by September 7, 2011. Step-1 proposals will be reviewed at NASA for relevance to the Research Emphases outlined in Section I.B. of this NRA. Proposers, whose proposals are evaluated to be relevant, will be permitted to submit full Step-2 proposals. Step-2 proposal evaluations will be conducted by a science peer review panel.

Proposals that do not conform to the standards outlined in this solicitation will be declared non-compliant and declined without review. You are encouraged to read the solicitation in its entirety to prepare a competitive proposal. Key requirements are identified here:

- For Step-1 and Step-2 proposals: You and your organization must be registered with NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES). Your proposal must be submitted by an authorized representative of your organization. All team members listed on the proposal must be registered with NSPIRES (See Section IV.B.1).
- **Step-1 proposals are required** and shall not exceed 5 pages single-spaced in length and must be in conformance with the style formats in the Guidebook for Proposers Section 2.2. Step-1 proposals must be electronically submitted by September 7, 2011 (See Section IV.B.2).
- For Step-1 and Step-2 proposals: Your hypothesis and specific aims must address the research emphases in this solicitation, and must be clearly outlined in the project description of your proposal (See Section I.B).
- For Step-2 proposals: The length of the project description of the proposal shall not exceed 20 pages single-spaced in length and must be in conformance with the style formats in the Guidebook for Proposers Section 2.2.using standard 12-point type (See Section IV.B.3).
- For Step-2 proposals: If your proposal is a continuation of current NASA-supported research, you must provide specifics (2 pages maximum) to the productivity of your NASA-funded research in a section separate from the project description (See Section IV.B.3). These two pages are not considered part of the 20-page project description.
- For Step-2 proposals: Your proposal must meet requirements of the Compliance Review section of this solicitation and must be submitted by November 4, 2011 (See Section V.B).

I. Funding Opportunity Description

A. Introduction

This NRA solicits fundamental physics research proposals from U.S. investigators to participate in planned European Space Agency (ESA) research activities on the International Space Station (ISS). These ESA activities are the Space Optical Clock (SOC) project, the Quantum Weak Equivalence Principle (QWEP) project, and the Atomic Clock Ensemble in Space (ACES) project. The details of the planned ESA projects are described in Section I.C.

NASA's physical sciences research activities have been guided by recommendations from the National Research Council (NRC). The 2003 report, "Assessment of Directions in Microgravity and Physical Sciences Research at NASA" and the 2011 report "Recapturing a Future for Space Exploration: Life and Physical Sciences Research for a New Era" recommended a set of high priority areas in Fundamental Physics. The research activities defined in Section I.B supporting ESAs SOC, QWEP, and ACES projects are consistent with recommendations in the NRC reports, representing a subset of the overall recommendations of high priority research areas that should be pursued. Proposals submitted in response to this NRA must be limited to addressing one or more of the research emphases in Section I.B.

Participation is open to all categories of U.S. institutions, including educational institutions, industry, nonprofit organizations, NASA Centers and other Government agencies. Principal Investigators (PIs) may collaborate with investigators from universities, Federal Government laboratories, the private sector, state and local government laboratories and other countries. Additional information concerning international participation in this NRA can be found in Section III.B.

B. Research Emphases Specific to this Solicitation

Fundamental physics is standing at the precipice of dramatic discoveries. Last century's major scientific insights represented by the theories of general relativity and quantum mechanics are known to be mutually incompatible. The lack of a theory to unify all natural forces including gravity indicates the incompleteness of the Standard Model and General Relativity. In addition, there is clear evidence for dark energy and dark matter from astrophysical observations. While NASA's Science Mission Directorate plans to study dark matter and dark energy through observational means, and to seek clues to when General Relativity might fail through studies of physics in the strong gravity environment near black holes, the establishment of new physical understanding beyond current known theories remains elusive. Nonetheless, the new physics is expected to lead to breakdowns of the well-established theories with verifiable experimental consequences. Recent technology advancement in optical clocks, atom interferometers and Bose Einstein Condensates has demonstrated a radical improvement in measurement precision, putting experimentalists within striking range of reaching the experimental

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sensitivity where breakdown of these theories may occur and important new discoveries made.

It is clear that laboratory physics can contribute greatly to this quest for new physics in the 21st century by utilizing carefully conceived experiments with unprecedented resolution on the ISS, such as the planned ESA SOC, QWEP and ACES projects.

Proposers must show a clear connection between their proposed activities to the planned ESA SOC or QWEP or ACES ISS projects. Proposals, including Step-1 proposals that do not provide this clear connection will be evaluated as “not relevant.” (See Section V.A). Proposers are encouraged to refer to Section I.C to learn about ESA’s current plans for implementing the ISS projects.

Considering these points along with the considerations in Section I.A, NASA is soliciting research proposals in the following three areas consistent with ESA plans and NRC recommendations:

i. Space Optical Clocks (SOC)

ESA’s SOC project is a natural successor to the ACES mission aiming to operate a high-performance neutral atom optical clock accurate to one part in 10^{17} on the ISS for tests of fundamental physics and for providing high-accuracy comparisons of future ground-based optical clocks through an advanced space to ground link. It is planned for installation at the external payload facility of the Columbus module on the ISS before the end of this decade.

The scientific objectives of the SOC project are to utilize the ISS laboratory to:

- Demonstrate an optical clock on the ISS accurate to one part in 10^{17} , measure the Earth’s gravitational redshift to two parts in 10^7 , and test relativistic effects in the frequency comparisons of moving clocks.
- Perform a null measurement of the Sun’s gravitational redshift to two parts in 10^7 .
- Use the SOC to perform differential geopotential measurements with 1 cm height resolution on the geoid; such measurements are based on the comparison of distant clocks on ground
- Use the SOC to perform time synchronization and time transfer experiments (both space-to-ground and ground-to-ground) and to allow comparison between ground clocks to a fractional frequency resolution of 1 part in 10^{18} .

More scientific and technical details about the SOC project can be found in Section I.C.i.

It is expected that U.S. scientists funded through this solicitation will participate in meaningful ways on the international science team, such as to optimize the hardware design, to mature the technology, to develop data analysis methodology, to implement the

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project on the ISS, and to participate in operational and data analysis activities. Suitable roles of U.S. participants could include independent experimental and theoretical research in areas contributing to the overall scientific objectives; participating in time transfer and clock frequency comparison activities from the ISS clock to ground clocks, and between clocks on the ground; science mission development, science team and instrument working group participation; technology maturation activities; trade studies; and data analysis activities - including independent checks of data. It is expected that successful U.S. participants will make contact with European team members already in the proposal stage and develop a clear area of unique U.S. responsibility that strengthens the overall team and contributes directly to the scientific goals.

ii. Quantum Weak Equivalence Principle (QWEP)

ESA's QWEP project plans to perform an atom interferometry test of the Weak Equivalence Principle by measuring the differential acceleration experienced by two clouds of ultra-cold atoms composed of different atomic species. QWEP is planned for installation on the ISS Columbus module as an internal experiment or as an external payload in the 2020 timeframe.

The scientific objectives of the QWEP project are to utilize the ISS research laboratory to:

- Test the Weak Equivalence Principle using quantum particles to better than one part in 10^{15}
- Validate the technology for a matter wave sensor in space through demonstration of differential atom interferometry and gravity gradiometry measurements.
- Investigate condensate properties in microgravity
- Demonstrate atom interferometry with ultra-cold atom sources in space

More scientific and technical details about the QWEP project can be found in Section I.C.i.

It is expected that U.S. scientists funded through this solicitation will participate in meaningful ways on the international science team, such as to optimize the hardware design, to mature the technology, to develop data analysis methodology, to implement the project on the ISS, and to participate in operational and data analysis activities. Suitable roles of U.S. participants could include performing independent experimental and theoretical research in areas contributing to the overall scientific objectives; measurement principle definition and development; science instrument development, science team and instrument working group participation; technology maturation activities; trade studies; and data analysis activities - including independent checks of data. It is expected that successful U.S. participants will make contact with European team members already in the proposal stage and develop a clear area of unique U.S. responsibility that strengthens the overall team and contributes directly to the scientific goals.

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iii. Atomic Clock Ensemble in Space (ACES)

ESA's ACES project will launch and operate an atomic clock accurate to one part in 10^{16} on the ISS for tests of fundamental physics and for providing high-accuracy comparisons of ground-based optical clocks through a microwave space to ground link. It is planned for installation at the external payload facility of the Columbus module on the ISS by the 2014 timeframe.

The scientific objectives of the ACES project are to utilize the ISS laboratory to:

- Demonstrate an atomic clock on the ISS accurate to one part in 10^{16} , measure the Earth's gravitational redshift to two parts in 10^6 , and test relativistic effects in the frequency comparisons of moving clocks.
- Search for a time variation of the fine structure constant to better than one part in 10^{17} over one year of integration time.
- Search for Lorentz transformation violations to the one part in 10^{10} level.
- Use ACES to perform time synchronization and time transfer experiments (both space-to-ground and ground-to-ground) and to allow comparison between ground clocks to a fractional frequency resolution of 1 part in 10^{17} in a few days of integration time.

More scientific and technical details about the ACES project can be found in Section I.C.i.

It is expected that U.S. scientists funded through this solicitation will participate in meaningful ways on the international science team, such as to develop data analysis methodology and to participate in operational and data analysis activities. Suitable roles of U.S. participants could include independent experimental and theoretical research in areas contributing to the overall scientific objectives; participating in time transfer and clock comparison activities from the ISS clock to ground clocks, and between clocks on the ground; science team and instrument working group participation; trade studies; and data analysis activities - including independent checks of data. It is expected that successful U.S. participants will make contact with European team members already in the hardware development stage and develop a clear area of unique U.S. responsibility that strengthens the overall team and contributes directly to the scientific goals.

C. Additional General Information

This section contains relevant reference information on ground-based and spaceflight facilities to assist proposers in developing their proposals. As stated elsewhere in this solicitation, this solicitation is for participation of U.S. scientists in ESA's SOC, QWEP and ACES projects. In addition to information on these ESA projects, information on potentially available ground facilities is also included.

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i. ESA Project Descriptions:

a. Space Optical Clock (SOC)

ESA's SOC project plans to operate a high-performance neutral atom optical clock accurate to one part in 10^{17} on the ISS for tests of fundamental physics and for providing high-accuracy comparisons of future ground-based optical clocks through an advanced space-to-ground link. It is planned for installation at the external payload facility of the Columbus module on the ISS before the end of this decade. European researchers are assessing clock implementations based on both Strontium and Ytterbium technologies currently. The final selection of one or the other clock for flight implementation will occur at the end of the on-going study phase, however, at present a Strontium clock is favored. Details about the current status and technical plans of the ESA project can be found at:

http://www.esa.int/SPECIALS/HSF_Research/SEMKJ57CTWF_0.html

b. Quantum Weak Equivalence Principle (QWEP)

ESA's QWEP project plans to perform an atom interferometry test of the Weak Equivalence Principle by measuring the differential acceleration experienced by two distinct clouds composed of different atomic species. It is planned for installation internally or externally to the Columbus module on the ISS in the 2020 timeframe. The project is currently being formulated by ESA. The atomic species presently under investigation for this test include the two Rubidium isotopes (^{85}Rb and ^{87}Rb) and ^{39}K . Some details about the current status and technical plans of the ESA project can be found at:

http://www.esa.int/SPECIALS/HSF_Research/SEMKJ57CTWF_0.html

c. Atomic Clock Ensemble in Space

ESA is developing the Atomic Clock Ensemble in Space (ACES) project for ISS implementation in the 2014 time frame. ACES is a mission based on a new generation of atomic clocks to be installed on the International Space Station, at the external payload facility of the Columbus module. The on-board clock signal is generated by an active hydrogen maser (SHM) and a primary standard based on samples of laser cooled Cs atoms (PHARAO). Fractional frequency instability and inaccuracy of one part in 10^{16} will be reached by the ACES frequency reference under microgravity conditions. A high-performance link in the microwave domain will distribute on ground the ACES signal allowing clock comparisons to a frequency resolution of one part in 10^{17} . ACES will connect ground clocks based on different atoms and atomic transitions in a worldwide network that will probe fundamental laws of physics to high accuracy. Space to ground and ground-to-ground comparisons of atomic frequency standards will be used to perform tests of Einstein's theory of general relativity including a precision measurement of the gravitational red shift, a search for time variations of fundamental constants, and Lorentz Invariance tests.

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Additional information about ACES can be found at:

http://www.esa.int/SPECIALS/HSF_Research/SEMJSK0YDUF_0.html

ii. International Space Station (ISS)

The ISS partnership led by the United States includes Russia, Japan, Canada, and Europe. The space station, including its large solar arrays, spans the area of a U.S. football field, including the end zones, and weighs 827,794 pounds. The complex has more livable room than a conventional five-bedroom house, and has two bathrooms and a gymnasium. ESA plans to implement the projects described in this announcement as either attached external payloads to the ESA Columbus laboratory module, or as internal payloads.

General information about the International Space Station is available at:

http://www.nasa.gov/mission_pages/station/science/iss_factsheets.html, and
http://www.nasa.gov/mission_pages/station/main

Information about ESA's Columbus module is available at:

http://www.esa.int/esaHS/ESAFRG0VMOC_iss_0.html

iii. Ground-based facilities potentially available to European partners of successful U.S. proposers

ESA's drop tower in Bremen, Germany is capable of providing up to 9 seconds of reduced gravity. In collaboration with European partners, this facility may be used to verify or mature potential flight technology approaches. Details can be found at:

http://www.esa.int/SPECIALS/HSF_Research/SEMDQZSTGOF_0.html

iv. Fundamental Physics ISS Workshop Report

An ISS Fundamental Physics Workshop was held October 13–15, 2010 at the Laguna Cliffs Resort in Dana Point California. The Workshop was structured as a set of technical sessions followed by discussions and breakout sessions. The following research topics were covered at the workshop: Clocks, Atom Interferometers, Bose Einstein Condensates, Condensed Matter Physics, General Relativity and Physics beyond the Standard Model. The workshop report is available on the NSPIRES webpage where this solicitation is located (<http://nspires.nasaprs.com>).

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.

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NASA's safety priority is to protect the following: (1) the public, (2) astronauts and pilots, (3) the NASA workforce (including employees working under NASA award instruments), and (4) high-value equipment and property.

E. Availability of NASA Funds for Award

The Government's obligation to make award(s) is contingent upon the availability of the appropriated funds from which payment can be made and the receipt of proposals that are determined meritorious for NASA award under this NRA.

F. Additional Funding Restrictions

A contract, grant, cooperative agreement, or other agreement may be used to accomplish an effort funded in response to an NRA. NASA will determine the appropriate award instrument. Contracts resulting from NRAs are subject to the FAR and the NASA FAR Supplement. Any resultant grants or cooperative agreements will be awarded and administered in accordance with the NASA Grant and Cooperative Agreement Handbook (NPR 5800.1).

Regardless of whether functioning as a PI or as a team member, personnel from NASA Centers must propose budgets based on Full Cost Accounting (FCA). Non-NASA U.S. Government organizations should propose based on FCA 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 the Guidebook For Proposers Responding To A NASA Research Announcement (NRA) Or Cooperative Agreement Notice (CAN), January 2011 Edition (<http://www.hq.nasa.gov/office/procurement/nraguidebook/>)

II. Award Information

The selected proposals are expected to be funded for activities lasting up to five years. The mechanism for funding each successful proposal will be a single grant or contract, with funding allocations to participating investigators based on the submitted budget, available funds and overall project review. The funding duration will depend on proposal requirements, peer review panel recommendations, and continuing progress of the activity. Proposals will be evaluated as described in Section V. Proposals to continue or supplement existing grants, if selected, will result in a new grant.

Depending on available funding, the award for each selected proposal will be up to \$200,000 per year for a total award amount up to \$1 Million for the five year period. It is anticipated that approximately five investigations will be selected from this NRA. NASA does not provide separate funding for direct and indirect costs; thus, the amount of the award requested is the total of all costs submitted in the proposed budget. Selection of

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proposals are planned to be announced in December, 2011, and will be awarded in a reasonable timeframe thereafter.

III. Eligibility Information

A. Eligibility of Applicants

Selection under this NRA will be to Principal Investigators from U.S. institutions only. No international proposals are allowed but U.S. Principal Investigators may invite non-U.S. collaborators to be part of their proposal. The primary goal of this NRA is to select scientists from U.S. institutions to participate in ESA's Space Optical Clock ISS experiment, ESA's Weak Equivalence Principle ISS experiment and the Atomic Clock Ensemble in Space experiment. Participation is open to all categories of U.S. institutions, including educational institutions, industry, nonprofit organizations, NASA Centers and other Government agencies. Principal Investigators (PIs) may collaborate with investigators from universities, Federal Government laboratories, the private sector, state and local government laboratories and other countries. It is NASA policy that research with foreign organizations will be accomplished on a no-exchange-of-funds basis. For further information, please see Section III.B for Guidelines for International Participation. In all such arrangements, the applying entity is expected to be responsible for administering the project according to the management approach presented in the proposal. The applying entity must have in place a documented base of ongoing high quality research in science and technology, or in those areas of science and engineering clearly relevant to the specific programmatic objectives and research emphases indicated in this NRA. Present or prior NASA support of research or training in any institution or for any investigator is not a prerequisite for submission of a proposal.

B. Guidelines for International Participation

Proposals submitted by non-U.S. institutions are not eligible. NASA welcomes collaborative proposals from U.S. institutions that include international participation. However, foreign entities are generally not eligible for funding from NASA. If the proposal involves collaboration with a non-U.S. institution, a cost plan for only the participation of the U.S. entity must be included. Proposals from U.S. entities that include foreign participation must be endorsed by the respective government agency or funding/sponsoring institution in the country from which the foreign collaborator is proposing. Such endorsement should indicate that the proposal component with non-U.S. participation merits careful consideration by NASA, and if the proposal is selected, sufficient funds will be made available to undertake the activity as proposed. All proposal components must be received on or before the established closing date. Those received after the closing date will be treated in accordance with Appendix A, paragraph (G). Sponsoring foreign government agencies or funding institutions may, in exceptional situations, request an extension if endorsement is not possible before the announced closing date. In such cases, the NASA sponsoring office should be advised when a

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decision on endorsement can be expected. Should a U.S. proposal with foreign participation be selected, NASA's Office of International and Interagency Relations (OIIR) will arrange with the foreign sponsor for the proposed participation on a no-exchange-of-funds basis, in which NASA and the non-U.S. sponsoring agency or funding institution will each bear the cost of discharging their respective responsibilities. Depending on the nature and extent of the proposed cooperation, these arrangements may entail:

- (i) An exchange of letters between NASA and the foreign sponsor; or
- (ii) A formal Agency-to-Agency Memorandum of Understanding (MOU).

NASA's policy is to conduct research with non-U.S. organizations on a cooperative, no exchange-of-funds basis. Although Co-Investigators or collaborators employed by non-U.S. organizations may be identified as part of a proposal submitted by a U.S. organization, NASA funding through this NRA may not be used to support research efforts by non-U.S. organizations at any level. See NASA FAR Supplement Part 1835.016-70 for additional information on international participation, which can be referenced at http://www.hq.nasa.gov/office/procurement/regs/1835.htm#35_016-70. Also see NASA Policy Directive 1360.2 Initiation and Development of International Cooperation in Space and Aeronautics Programs, which is located at http://nodis3.gsfc.nasa.gov/displayDir.cfm?Internal_ID=N_PD_1360_002A_&page_name=main

C. Export Control Guidelines Applicable to Proposals Including Foreign Participation

Proposals including foreign participation must include a section discussing compliance with U.S. export laws and regulations, e.g., 22 CFR Parts 120-130 and 15 CFR Parts 730-774, as applicable to the circumstances surrounding the particular foreign participation. The discussion must describe in detail the proposed foreign participation and is to include, but not be limited to, whether or not the foreign participation may require the prospective Proposer to obtain the prior approval of the Department of State or the Department of Commerce via a technical assistance agreement or an export license, or whether a license exemption/exception may apply. If prior approvals via licenses are necessary, discuss whether the license has been applied for or if not, the projected timing of the application and any implications for the schedule. Information regarding U.S. export regulations is available at the Bureau of Industry and Security website <http://www.bis.doc.gov/>, or the Directorate for Defense Trade Controls website: <http://www.pmdtdc.state.gov>.

Proposers are advised that under U.S. law and regulations, spacecraft and their specifically designed, modified, or configured systems, components, and parts are generally considered "Defense Articles" on the United States Munitions List and subject to the provisions of the International Traffic in Arms Regulations (ITAR), 22 CFR Parts 120-130.

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Because of these legal provisions and requirements, proposers and institutions whose proposals involve non-U.S. participants should be aware that such participation can add to management complexity and risk, and, therefore, Proposers should limit such cooperative arrangements to those offering significant benefits while maintaining the clearest and simplest possible technical and management interfaces.

Export-Controlled Material in Proposals

While explicit inclusion of export-controlled material in proposals is not prohibited, NASA is advising proposers that, under U.S. law and regulations, spacecraft and their specifically designed, modified, or configured systems, components, and parts are generally considered "Defense Articles" on the United States Munitions List and subject to the provisions of the International Traffic in Arms Regulations (ITAR), 22 CFR Parts 120-130. Other items or information may be subject to the Export Administration Regulations (EAR), 15 CFR Parts 730 – 774. This may, in some circumstances, complicate NASA's ability to evaluate the proposal, since occasionally NASA may use the services of foreign nationals who are neither U.S. citizens nor lawful permanent residents of the U.S. to review proposals submitted in response to this NRA.

Proposers to NRAs are strongly encouraged not to include export-controlled material in their proposals, although the effort being proposed may itself be export controlled (ref. Web sites noted above in 1.6.2(a)). If it is essential to include any export-controlled information in a proposal, a notice to that effect must be prominently displayed on the first pages of the proposal and shall state:

“The information (data) contained in [insert page numbers or other identification] of this proposal is (are) subject to U.S. export control laws and regulations. It is furnished to the Government with the understanding that it will not be exported without the prior approval of the Proposer under the terms of an applicable export license or technical assistance agreement.”

Reference the following URL for guidance on NASA's Export Control Program and NASA Center Points of Contact:

<http://www.hq.nasa.gov/office/oer/nasaecp/contacts.html>

For the purposes of proposals submitted via NSPIRES, these first pages listing export-controlled information should precede the table of contents, do not count against the page limits, and may also be used to provide the proprietary notification, if applicable. Note that it is the responsibility of the Proposer to determine whether any proposal information is subject to export-control regulations.

D. Cost Sharing or Matching

Cost sharing is not required for contract awards except as provided in NASA FAR Supplement (NFS) 1816.303-70 for awards resulting from

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unsolicited proposals for research submitted by commercial organizations. NFS 1816.303-70 is located at http://www.hq.nasa.gov/office/procurement/regs/1816.htm#16_303-70.

For a NASA Center, an institution of higher education, hospital, or other non-profit organization seeking to receive a grant or cooperative agreement, cost sharing is not required; however, NASA can accept cost sharing if it is voluntarily offered. For these recipients, Section B, Provision &sec;1260.123, "Cost sharing or matching," located at <http://ec.msfc.nasa.gov/hq/grantb.html#1260.123>, describes the acceptable forms of cost sharing.

For a commercial organization seeking to receive a grant or cooperative agreement, cost sharing is required, unless the commercial organization can demonstrate that they will not receive substantial compensating benefits for performance of the work. If no substantial compensating benefits will be received, then cost sharing is not required, but can be accepted. Section B, Provision 1260.123, "Cost sharing or matching," and the special conditions at section A, subpart 1260.4(b) describes cost sharing and allowability for awards with commercial firms that do not require cost sharing. Section D, Provision &sec;1274.204, "Costs and payments," located at <http://ec.msfc.nasa.gov/hq/grantd.html#1274204> of the NASA Grant and Cooperative Agreement Handbook describes the acceptable forms of cost sharing for commercial organizations."

IV. Proposal and Submission Information

Proposals solicited through this NASA Research Announcement (NRA) will use a two-step proposal process. In Step-1 proposers are required to submit a 5-page overview that will be reviewed at NASA for relevance to the Research Emphases outlined in Section I.B. of this NRA. Step-1 proposals are required and must be submitted by September 7, 2011. Only proposers, whose Step-1 proposals are determined to be relevant to the research emphases in Section I.B, will be permitted to submit full Step-2 proposals. **A finding of relevance in Step I is a prerequisite for advancing to Step 2.** Proposers are encouraged to read Section IV in its entirety before starting the application process.

For Step-2, proposers are required to submit the complete proposal by November 4, 2011. Step-2 proposals must be compliant with Section V.B. of this NRA or they will be declined without review.

Proposals must be submitted electronically. Step-1 Proposers can use either NSPIRES (<http://nspires.nasaprs.com>) or Grants.gov (<http://www.grants.gov/>) for proposal submission. All proposers, team members, and agency officials must be registered before proposal submission with NSPIRES as described under Section IV.B.1 regardless of the electronic submission system used. NSPIRES remains the only system through which a

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Step-1 proposal can be continued as a Step-2 proposal. Step-2 proposals must be submitted through NSPIRES.

Step-1 proposals will be accepted between July 29, 2011 and September 7, 2011. Step-1 proposals will not be accepted after 11:59 PM Eastern, September 7, 2011. All submitters of Step-1 proposals will be informed electronically through NSPIRES by September 21, 2011 that they are, or are not, permitted to submit a full Step-2 proposal through NSPIRES. **Submitters who do not receive notification as to their Step-2 invitation status by September 23, 2011 should contact NASA (Section VII).** Step-2 proposals will be accepted between September 23, 2011 and November 4, 2011. Step-2 proposals will not be accepted after 11:59 PM Eastern, November 4, 2011.

A. Source of Application Materials

Except where specifically stated otherwise in this NRA, applicants must prepare proposals in accordance with the “Instructions for Responding to NASA Research Announcements” NASA Federal Acquisition Regulations (FAR) Supplement (NFS), Part 1852.235-72 (http://www.hq.nasa.gov/office/procurement/regs/5228-41.htm#52_235-72). These instructions hereafter referred to as the *NASA FAR Supplement Provision*, can be referenced in its entirety in Appendix A of this document.

All information needed to submit an electronic proposal in response to this solicitation is contained in this NRA and in the 2010 version of the companion document entitled “Guidebook for Proposers Responding to a NASA Research Announcement (NRA) or Cooperative Agreement Notice (CAN)” (hereafter referred to as the *Guidebook for Proposers*) that is located at <http://www.hq.nasa.gov/office/procurement/nraguidebook/>.

At NASA’s discretion, proposals that do not conform to these standards and directions given in this NRA may be declared noncompliant and declined without review.

Proposal submission questions will be answered and published in a Frequently Asked Questions (FAQ) document. This FAQ will be posted on the NSPIRES solicitation download site alongside this NRA, and will be updated periodically between submission release and the proposal due date.

B. Content and Form of Proposal Submission

i. NASA’s Proposal Data System

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NSPIRES Registration

This NRA requires that the proposer register key data concerning their intended submission with the NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES) located 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 Cover Page (see further below) must be registered in NSPIRES and that such individuals must perform this registration themselves;** that is, no one may register a second party, even the Principal Investigator (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.

Every organization that intends to submit a proposal to NASA in response to this NRA, including educational institutions, industry, nonprofit institutions, NASA Centers, the Jet Propulsion Laboratory, and other U.S. Government agencies, **must be registered in NSPIRES**, regardless of the electronic system used to submit proposals. Such registration must be performed by an organization's electronic business point-of-contact (EBPOC) in the Central Contractor Registry (CCR).

Electronic Submission

Step-1 and Step-2 proposals must be submitted electronically by one of the officials at the PI's organization who is authorized to make such a submission. All team members must be registered in NSPIRES and confirm their organizational affiliation when added to a proposal before the PI organization official can submit. It is strongly recommended that the PI work closely with his/her team members and organization official to ensure the proposal is submitted by the due date and time listed in this solicitation. **Proposals will not be accepted after the listed due dates and times.**

Proposers can use either Grants.gov. (<http://www.grants.gov/>) or NSPIRES (<http://nspires.nasaprs.com>) for Step-1 proposal submission. All proposers, team members, and agency officials must be registered before proposal submission with NSPIRES. NSPIRES remains the only system through which a Step-1 proposal can be continued as a Step-2 proposal. Proposers submitting a Step-1 proposal who receive an invitation to submit a Step-2 proposal must submit their Step-2 proposal through NSPIRES. Proposers who elect to use Grants.gov for Step-1 proposals who receive an invitation to submit a full Step-2 proposal must use NSPIRES for their Step-2 submission.

NSPIRES accepts fully electronic proposals through a combination of data-based information (e.g., the electronic *Cover Page* and its associated forms) and uploaded PDF file(s) that contain the body of the proposal. The system will conduct an element check to identify any item(s) that is (are) apparently missing or incomplete. Proposers are particularly encouraged to begin their submission process early.

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Requests for assistance in accessing and/or using this Web site may be directed by E-mail to nspires-help@nasaprs.com or by telephone to (202) 479-9376 Monday through Friday, 8:00 AM – 5:00 PM Eastern Time. Frequently Asked Questions (FAQs) may be accessed through the Proposal Online Help site at <http://nspires.nasaprs.com/external/help.do>. Tutorials of NSPIRES are available at <http://nspires.nasaprs.com/tutorials/index.html>.

ii. Intent to Propose and Step-1 Proposals

The following information **supersedes** that provided in the *Guidebook for Proposers* and provides additional direction consistent with the *NASA FAR Supplement Provision*. Proposals solicited through this NRA will use a two-step proposal process in which a Notice of Intent (NOI) is replaced by a **required** Step-1 proposal. The Step-1 proposal shall include an extended synopsis of the intended research. The **length of the Step-1 proposal (excluding the Cover Page Elements) is not to exceed 5 pages** and must use a standard 12-point type and the following margins: left = 1.5”; Right, top, bottom = 1.0”.

Step-1 proposals shall be electronically submitted by September 7, 2011. Electronic submission of Step-1 proposals will be open between July 29, 2011 and September 7, 2011. By September 21, 2011, all submitters of Step-1 proposals will be informed via e-mail (as provided on the Step-1 proposal cover page) that they are, or are not, permitted to submit a full Step-2 proposal. **Submitters who do not receive notification as to their invitation status by September 23, 2011 should contact NASA (Section VII).**

The NSPIRES system will guide proposers through submission of all required proposal information. Please note that the **Proposal Summary, Business Data, and Proposal Team are required** Cover Page Elements for a Step-1 proposal. The proposal summary should be between 100-300 words and understandable by the layman reader. These cover page elements may be modified in a Step-2 proposal. Budget should not be included with the Step-1 proposal.

Step-1 proposals must address these components:

1. A clear indication of the relevance to the Research Emphases as described in Section 1.B
2. The hypotheses and specific aims of the proposal.
3. Show strong compatibility with ESA’s Space Optical Clock, Weak Equivalence Principle, or Atomic Clock Ensemble in Space Program as described in Section I.C;
4. The proposed project team. Note: The project team is not considered binding for Step-1 and can be adjusted in a Step-2 proposal.

The proposal document must be uploaded as a single .PDF file. No additional documents should be uploaded with the Step-1 proposal.

Step-1 proposals are prepared by the PI or a designated representative of the PI. Step-1 proposals are submitted by an official of the PI’s organization after the PI has released the prepared proposal to the institution official. It is strongly recommended that the PI

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work closely with his/her organization official to ensure the proposal is submitted by the due date and time listed in this solicitation. Proposals will not be accepted after the listed due dates.

Instructions for submitting proposals to NASA via Grants.gov may be found on the Grants.gov portal at <http://www.grants.gov/>.

iii. Instructions for Preparation of Step-2 Proposals

Step-2 proposals are due November 4, 2011. **Step-2 proposals will be accepted from proposers that have met the evaluation criteria for Step-1 proposals.** All Step-2 proposals must meet the requirements for responding to an NRA as outlined in the *NASA FAR Supplement Provision*. Chapter 2 of the *Guidebook for Proposers* provides detailed discussions of the content and organization of proposals for electronic submission.

The NSPIRES system will guide proposers through submission of all required proposal information. Select **prior-phase proposal** when creating a Step-2 proposal. This will automatically transfer the proposal information from the Step-1 proposal to the Step-2 proposal.

Required Step-2 Cover Page Elements are the Proposal Summary, Business Data, Budget, Program Specific Data, and Proposal Team. The proposal summary should be between 100-300 words and understandable by the layman reader. Proposal Team members carried over from a Step-1 proposal may need to login and re-confirm their affiliation and participation on the proposal.

For proposals with one or more NASA civil servant team members, the following is required. Proposers are required to enter the NASA civil servant team member name and fraction of FTE (full-time equivalent) 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 (see the FAQ posted alongside this document for additional budget instruction). This budget entry should be made for each year of 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.

In addition to the Cover Page Elements discussed above, proposers must include the following 9 sections, in the order listed below, in one .PDF document . This .PDF document is uploaded as an attachment to the NSPIRES cover page.

1. Productivity of funded NASA research, if applicable (see IV.B.3.a below)
2. Scientific / Technical Project Description (see Section IV.B.3.b below)
3. References and Citations
4. Management Approach (see *Guidebook for Proposers* and Appendix A)
5. Personnel Curriculum Vitae (see *Guidebook for Proposers* and Appendix A)

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6. Current Support (see *Guidebook for Proposers* and Appendix A)
7. Facilities and Equipment (see *Guidebook for Proposers* and Appendix A)
8. Budget Justification of Proposed Costs (see *Guidebook for Proposers* and Appendix A)
9. Appendices / Reprints (see IV.B.3.c below)

Step-2 proposals are prepared by the PI or a designated representative of the PI. Step-2 proposals are submitted by an official of the PI's organization after the PI has released the prepared proposal to the authorized organization representative (AOR). It is strongly recommended that the PI work closely with his/her organization official to ensure the proposal is submitted by the due date and time listed in this solicitation. Proposals will not be accepted after the due dates listed in Section IV.C.

While the NSPIRES system allows for the upload of curriculum vitae, letters of endorsement and other supporting documents as separate uploads, please provide the information above in only one PDF proposal document upload. It is essential that all PDF files generated and submitted meet NASA requirements. 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.

A recently identified NSPIRES “bug” may prevent you from generating a preview copy of your entire proposal prior to submission. If you encounter this issue, this in no way will prevent you from submitting your proposal. This bug is tied to proposal PDF documents generated through the Office 2007/2010 interface. You are encouraged to use a stand-alone PDF converter, such as Adobe Writer, to convert your proposal document to PDF for transmission. See http://nspires.nasaprs.com/tutorials/PDF_Guidelines.pdf for more information on creating PDF documents that are compliant with NSPIRES.

There is a recommended 10 MB size limit for proposals (Section 2.3(c) of the NASA Guidebook for Proposers). Large file sizes can impact the performance of the NSPIRES system. Most electronically submitted proposals will be less than 2 MB in size.

NSPIRES accepts electronic proposals through a combination of data-based information (e.g., the electronic Cover Page) and the uploaded PDF file that contains the proposal as outlined above. The NSPIRES proposal submission process ensures that a minimum set of required proposal cover page fields are completed. Provision of the proposal summary and business data elements of the cover page will be necessary in order for the AOR to submit the proposal to NASA. If either of these two proposal elements is incomplete, the "View Proposal/ Check Elements" function of NSPIRES will display red "error" flags

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and messages to alert the user to the information that is required but missing, and the "Submit Proposal" button will not be available. Although the PI will be able to release the proposal to the AOR, the proposal cannot be submitted by the AOR to NASA until these required fields are complete. Any additional information that is missing will be identified by yellow "warning" flags. Proposers are reminded to check the solicitation instructions to ensure compliance with all instructions, as adherence to these two element validation checks alone is insufficient to guarantee a compliant proposal. Additionally, in those cases where instruction in the NRA contradicts an NSPIRES warning, the NSPIRES yellow "warning" may be ignored. Proposers should follow the NRA instructions closely to help ensure submission of a compliant proposal.

Instructions for submitting proposals to NASA via Grants.gov may be found on the Grants.gov portal at <http://www.grants.gov/>.

The following supersedes the information provided in the *Guidebook for Proposers* and is required in addition to the *NASA FAR Supplement Provision*:

(a) Continuation of NASA-Funded Research

Proposals that are continuations of current NASA-funded research shall provide specifics to the productivity of the supported research, research publications and new findings. This explanation shall be presented preceding the research description as part of the main proposal upload and is limited to two pages. These two pages are not considered part of the 20-page project description. Related impacts to the proposed research plan shall be highlighted in the body of the project description. **Proposals that request continued NASA support that do not include this productivity section will be returned to the submitter without panel review and not considered for funding.**

(b) Scientific/Technical Section (Project Description)

The length of the project description of the proposal shall not exceed 20 pages using standard (12 point) type. Text shall have the following margins: left = 1.5"; Right, top, bottom = 1.0". Referenced figures must be included in the 20 pages of the project description; however figure captions can use a 10 point font. The proposal shall contain sufficient detail to enable reviewers to make informed judgments about the overall merit of the proposed research and about the probability that the investigators will be able to accomplish their stated objectives with current resources and the resources requested. The hypotheses and specific aims of the proposed research shall be clearly stated. **Proposals that exceed the 20-page limit for the project description will be declined without review. Cited literature and all other proposal sections are not considered part of the 20-page project description.** Reviewers are not required to consider information presented as appendices or to view and/or consider Web links in their evaluation of the proposal. Additional information can be referenced in Appendix A, Section (c)(4).

(c) Reprints and Appendices

Reprints and Appendices, if any, do not count toward the project description page limit, and are to be included following all other sections of the proposal (**reviewers are not required to consider information presented in appendices**).

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C. Submission Dates

For Solicitation announcement identifier NRA **NNH11ZTT001N**:

Step-1 proposals are due September 7, 2011, 11:59 PM Eastern Time

Step-2 proposals are due November 4, 2011, 11:59 PM Eastern Time.

The estimated selection announcement date is December, 2011. The NASA Selecting Official is the Deputy Associate Administrator, Exploration Systems Mission Directorate at NASA Headquarters (Washington, D.C).

V. Proposal Evaluation Process for Step-2 Proposals

A. Step-1 Proposal Relevancy Review

Each Step-1 proposal will be evaluated and determined to be “relevant” or “not relevant” based upon the research emphases outlined in Section I.B of this NRA and its strong compatibility with ESA’s Space Optical Clock, Weak Equivalence Principle or Atomic Clock Ensemble in Space Program. Proposers, whose proposals are evaluated to be relevant, will be permitted to submit full Step-2 proposals. For further information, please refer to Section IV.

B. Step-2 Proposal Compliance Review

The overall evaluation process for Step-2 proposals submitted in response to this NRA will include a Compliance Review (as described in Section V.B) and an Intrinsic Scientific /Technical Merit Review (as described in Section V.C). Proposals most highly rated in the merit review process will undergo a NASA relevance, programmatic balance and cost review (Section V.D).

All Step-2 proposals must comply with the general requirements of the NRA as described in this solicitation, the *Guidebook for Proposers*, and the *NASA FAR Supplement Provision*. In the event that the directions provided in the NRA and the Guidebook are in conflict, the instructions in the NRA shall take precedence. Upon receipt, proposals will be reviewed for compliance with these requirements including:

- 1) The proposal project description must be no more than 20 pages in length.
- 2) Submission of an appropriate budget for a funding period not exceeding that described in the NRA.
- 3) Submission of all other appropriate information as required by this NRA.
- 4) The section describing the continuation of current NASA supported research is included in the proposal and does not exceed two pages.
- 5) The project aims and objectives identified in the *Scientific/Technical Project*

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Description section of the Step-2 proposal matches the project aims and objectives approved in the Step-1 proposal.

At NASA's discretion, non-compliant proposals may be withdrawn from the review process and declined without further review. Compliant proposals submitted in response to this NRA will undergo an intrinsic scientific or technical merit review.

C. Intrinsic Scientific/ Technical Merit Review and Evaluation Criteria of Step-2 Proposals

Compliant Step-2 proposals will undergo a merit peer review by a panel of scientific and/or technical subject matter experts. This panel of experts may include non-NASA and or non-Government personnel. The number and diversity of experts required will be determined by the response to this NRA and by the variety of disciplines represented in the proposals relevant to the research emphases described in this NRA. The merit review panel will assign *a score from 0-100* based upon the intrinsic scientific or technical merit of the proposal. This score will reflect the consensus of the panel which is based on the proposal's strengths and weaknesses.

The peer review panel may include in their critique of a proposal any comments they may have concerning the proposal's budget and programmatic relevance to NASA, however, the panel's scientific or technical merit score will not be impacted by the cost of the proposal work, nor will the panel's scientific or technical merit score reflect the programmatic relevance of the proposed work to NASA.

To be responsive to this research solicitation, proposed studies should be hypothesis-driven and lead to new knowledge within accepted scientific standards. Purely phenomenological approaches with no significant mechanistic basis or likely gain in scientific knowledge are not acceptable.

All of the following criteria will be used in determining the merit score (significance and approach are the most important and weigh more than innovation, investigators, and environment):

- **Significance:** Does this study address an important problem? If the aims of the application are achieved, how will scientific knowledge or technology be advanced? What will be the effect of these studies on the concepts, methods, or products that drive this field? Is there a significant societal or economic impact?
- **Approach:** Are the conceptual framework, design, methods, and analyses adequately developed, well integrated, and appropriate to the aims of the project? Is the proposed approach likely to yield the desired results? Does the applicant acknowledge potential problem areas and consider alternative tactics?
- **Innovation:** Does the project employ appropriate novel concepts, approaches, or methods? Does the project challenge existing paradigms or develop new methodologies or technologies?
- **Investigators:** Are the proposers appropriately trained and well suited to carry

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- out this work? Is the work proposed appropriate to the experience level of the principal investigator and any co-investigators? Is the evidence of the proposers' productivity satisfactory?
- **Environment:** Does the scientific environment in which the work will be performed contribute to the probability of success? Do the proposed experiments take advantage of unique features of the scientific environment or employ useful collaborative arrangements? Is there evidence of institutional support?

D. NASA Relevance, Programmatic Balance and Cost Review

Only those Step-2 proposals most highly rated in the merit review process will undergo additional review. This review will evaluate the relevancy to NASA's SOMD/ESMD ISS Research Project, programmatic balance and cost. This review will be conducted by NASA's SOMD/ESMD ISS Research Project Scientists and Managers. Evaluation of the cost of a proposed effort includes consideration of the realism and reasonableness of the proposed cost and the relationship of the proposed cost to available funds. The NASA relevance and programmatic balance review will evaluate how these highly rated proposals address priorities identified by the SOMD/ESMD ISS Research Project. The proposals will also be evaluated for their potential compatibility to ESA's Space Optical Clock and Weak Equivalence Principle Programs.

E. Selection

The information resulting from the reviews described above will be used to prepare selection recommendations by NASA Project Scientists and Managers. Selection for funding will be made by the designated NASA Selecting Official (Deputy Associate Administrator, Exploration Systems Mission Directorate).

The most important element in this evaluation process is the Intrinsic Scientific/ Technical Merit Review as described in Section V.C. In addition, strong compatibility with ESA's Space Optical Clock and Weak Equivalence Principle Programs, programmatic relevance/balance and available funds are all taken into consideration when making final selections. Deficiencies in any one of these factors may prevent selection of a proposal. Additional information can be found in Appendix A, Section (K).

F. Ombudsman

(1) An ombudsman has been appointed to hear and facilitate the resolution of concerns from offerors, potential offerors, and contractors during the pre-award and post-award phases of this acquisition. When requested, the ombudsman will maintain strict confidentiality as to the source of the concern. The existence of the ombudsman is not to diminish the authority of the contracting officer and/or grant officer, the Proposal Evaluation Panel, or the selection official. Further, the ombudsman does not participate in the evaluation of proposals, the source selection process, or the adjudication of formal contract disputes. Therefore, before consulting with an ombudsman, interested parties

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must first address their concerns, issues, disagreements, and/or recommendations to the contracting officer and/or grant officer for resolution.

(2) If resolution cannot be made by the grants officer or contracting officer, interested parties may contact the NASA ombudsman. Concerns, issues, disagreements, and recommendations which cannot be resolved at the installation may be referred to the NASA ombudsman, Diane Thompson, at 202-358-0514, email agency.procurementombudsman@mail.nasa.gov. Please do not contact the ombudsman to request copies of the solicitation, verify due date, or clarify technical requirements. Such inquiries shall be directed to the contacts specified in Section VII of this document.

VI. Award Administration Information

A. Award Notices

At the end of the Step-2 selection process, each proposing organization will be notified of its selection or non-selection status. NASA will provide debriefings to those Step-1 and Step-2 proposers who request one. Selection notification will be made electronically through NSPIRES and by a letter signed by the selecting official. The selection letters are not an authorization to begin performance. The selected organization's business office will be contacted by a NASA Grant Officer or Contracting Officer to negotiate an award. Any costs incurred by the proposer in anticipation of an award are at their own risk until contacted by a NASA Grant Officer or Contracting Officer. The NASA Procurement Office will request further business data, and negotiate the resultant action. NASA Grant Officers/Contracting Officers are the only personnel with the authority to award NASA grants or contracts and obligate government funds. NASA reserves the right to offer selection of only a portion of a proposal. In these instances, the proposer will be given the opportunity to accept or decline the offer. Additional information can be referenced in Appendix A, Section (K)(2).

B. Administrative and National Policy Requirements

All grant awards are subject to the NASA Grant and Cooperative Agreement Handbook (NPR 5800.1). This handbook consists of four sections that prescribe the policies and procedures relating to the award and administration of NASA grants. Section A provides the text of provisions and special conditions and addresses NASA's authority, definitions, applicability, amendments, publications, deviations, pre-award requirements and post-award requirements currently covered by 14 CFR Part 1260. Section B relates to grants with institutions of higher education, hospitals, and other nonprofit organizations. Sections A and B, with the special considerations in subpart 1260.4(b), apply to awards with commercial firms that do not involve cost sharing. Section C adopts the administrative requirements of Office of Management and Budget (OMB) Circular No. A-102 and relates to administrative requirements for grants to state and local governments. Section D relates to awards with commercial firms. The Handbook is located at <http://ec.msfc.nasa.gov/hq/grcover.htm>. All contract awards are subject to the

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Federal Acquisition Regulations (FAR) and NASA FAR Supplement.

C. Program Reporting/Individual Researcher Reporting

Annual Reporting and Task Book Reporting

The PI shall provide an annual written report to NASA on or before the anniversary of the award date and each year thereafter. This information will be used to assess the degree of progress of the project. A component of this annual report will be used for the NASA Advanced Capabilities Division Research & Technology Task Book (<http://taskbook.nasaprs.com>). The Task Book includes descriptions of all peer-reviewed research activities funded by the ESMD/SOMD ISS Research and Advanced Capabilities Division disciplines such as Physical Sciences, Fundamental Space Biology and Human Research.

This information will consist primarily of:

- An abstract
- A bibliographic list of publications
- Copies of publications
- A statement of progress, including a comparison with the originally proposed work schedule

Final Report

A final report must be provided to NASA at the end of the award funding period, including a detailed listing of all peer-reviewed publications. This information will consist primarily of:

- Statement of the specific objectives
- Significance of the work
- Background
- Overall progress during the performance period
- Narrative discussion of technical approaches including problems encountered
- Accomplishments related to approach
- An appendix with bibliography and copies of all publications and reports

Any publications or other public materials containing data are particularly important to include in this section.

VII. Contacts

Additional programmatic information for the NASA Fundamental Physics NRA is available from:

Dr. Francis Chiaramonte

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Program Executive
NASA Headquarters
Email: francis.p.chiaramonte@nasa.gov
Phone: 202-358-0693

Additional technical information for the NASA Fundamental Physics NRA is available from:

Dr. Ulf Israelsson
NASA Jet Propulsion Laboratory
Email: ulf.e.israelsson@nasa.gov
Phone: 818-354-9255

Additional contracts information for this NRA is available from:

Name: Gregg DeFelicibus
Title: Contracting Officer
Phone: 228-813-6261
Email: gregg.a.defelicibus@nasa.gov

For help on NSPIRES, please contact the NSPIRES Help Desk:
Email: nspires-help@nasaprs.com
Phone: 202-479-9376

VIII. References

1. Guidebook For Proposers Responding To A NASA Research Announcement (NRA) Or Cooperative Agreement Notice (CAN), January 2011 Edition. This document is available online at the following address:
<http://www.hq.nasa.gov/office/procurement/nraguidebook/>
2. NASA Advanced Capabilities Division Research & Technology Task Book (<http://taskbook.nasaprs.com>). This document is available online at the following address: <http://taskbook.nasaprs.com/>
3. NASA Federal Acquisition Regulations Supplement. This document is available online at the following address:
<http://www.hq.nasa.gov/office/procurement/regs/nfstocA.htm>
4. NASA Grant and Cooperative Agreement Handbook. This document is available online at the following address:
http://prod.nais.nasa.gov/pub/pub_library/grcover.htm
5. [Assessment of Directions in Microgravity and Physical Sciences Research at NASA](#), National Research Council, 2003.

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6. Recapturing a Future for Space Exploration: Life and Physical Sciences Research for a New Era, NRC, 2011. Pre-publication copy available at:
http://www.nap.edu/catalog.php?record_id=13048
7. Fundamental Physics ISS Workshop Report, October 2010. Report available on the NSPIRES webpage where this solicitation is located. <http://nspires.nasaprs.com>

Appendix A: Instructions for Responding to NASA Research Announcements

(NASA FAR Supplement 1852.23-5-72, November 2004)

(A) General.

- (1) Proposals received in response to a NASA NRA will be used only for evaluation purposes. NASA does not allow a proposal, the contents of which are not available without restriction from another source, or any unique ideas submitted in response to an NRA to be used as the basis of a solicitation or in negotiation with other organizations, nor is a pre-award synopsis published for individual proposals.
- (2) A solicited proposal that results in a NASA award becomes part of the record of that transaction and may be available to the public on specific request; however, information or material that NASA and the awardee mutually agree to be of a privileged nature will be held in confidence to the extent permitted by law, including the Freedom of Information Act.
- (3) NRAs contain programmatic information and certain requirements which apply only to proposals prepared in response to that particular announcement. These instructions contain the general proposal preparation information which applies to responses to all NRAs.
- (4) A contract, grant, cooperative agreement, or other agreement may be used to accomplish an effort funded in response to an NRA. NASA will determine the appropriate award instrument. Contracts resulting from NRAs are subject to the FAR and the NASA FAR Supplement. Any resultant grants or cooperative agreements will be awarded and administered in accordance with the NASA Grant and Cooperative Agreement Handbook (NPR 5800.1).
- (5) NASA does not have mandatory forms or formats for responses to NRAs; however, it is requested that proposals conform to the guidelines in these instructions. NASA may accept proposals without discussion; hence, proposals should initially be as complete as possible and be submitted on the proposer's most favorable terms.
- (6) To be considered for award, a submission must, at a minimum, present a specific project within the areas delineated by the NRA; contain sufficient technical and cost information to permit a meaningful evaluation; be signed by an official authorized to legally bind the submitting organization; not merely offer to perform standard services or to just provide computer facilities or services; and not significantly duplicate a more specific current or pending NASA solicitation.

- (B) NRA-Specific Items.** Several proposal submission items appear in the NRA itself: the unique NRA identifier; when to submit proposals; where to send proposals; number of copies required; and sources for more

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information. Items included in these instructions may be supplemented by the NRA.

- (C) The following information is needed to permit consideration in an objective manner. NRAs will generally specify topics for which additional information or greater detail is desirable. Each proposal copy shall contain all submitted material, including a copy of the transmittal letter if it contains substantive information.

(1) **Transmittal Letter or Prefatory Material.**

- (i) The legal name and address of the organization and specific division or campus identification if part of a larger organization;
- (ii) A brief, scientifically valid project title intelligible to a scientifically literate reader and suitable for use in the public press;
- (iii) Type of organization: e.g., profit, nonprofit, educational, small business, minority, women-owned, etc.;
- (iv) Name and telephone number of the principal investigator and business personnel who may be contacted during evaluation or negotiation;
- (v) Identification of other organizations that are currently evaluating a proposal for the same efforts;
- (vi) Identification of the NRA, by number and title, to which the proposal is responding;
- (vii) Dollar amount requested, desired starting date, and duration of project;
- (viii) Date of submission; and
- (ix) Signature of a responsible official or authorized representative of the organization, or any other person authorized to legally bind the organization (unless the signature appears on the proposal itself).

(2) **Restriction on Use and Disclosure of Proposal Information.**

Information contained in proposals is used for evaluation purposes only. Offerors or quoters should, in order to maximize protection of trade secrets or other information that is confidential or privileged, place the following notice on the title page of the proposal and specify the information subject to the notice by inserting an appropriate identification in the notice. In any event, information contained in proposals will be protected to the extent permitted by law, but NASA assumes no liability for use and disclosure of information not made subject to the notice.

Notice

Restriction on Use and Disclosure of Proposal Information

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The information (data) contained in [insert page numbers or other identification] of this proposal constitutes a trade secret and/or information that is commercial or financial and confidential or privileged. It is furnished to the Government in confidence with the understanding that it will not, without permission of the offeror, be used or disclosed other than for evaluation purposes; provided, however, that in the event a contract (or other agreement) is awarded on the basis of this proposal the Government shall have the right to use and disclose this information (data) to the extent provided in the contract (or other agreement). This restriction does not limit the Government's right to use or disclose this information (data) if obtained from another source without restriction.

- (3) **Abstract.** Include a concise (200-300 word if not otherwise specified in the NRA) abstract describing the objective and the method of approach.
- (4) **Project Description.**
 - (i) The main body of the proposal shall be a detailed statement of the work to be undertaken and should include objectives and expected significance; relation to the present state of knowledge; and relation to previous work done on the project and to related work in progress elsewhere. The statement should outline the plan of work, including the broad design of experiments to be undertaken and a description of experimental methods and procedures. The project description should address the evaluation factors in these instructions and any specific factors in the NRA. Any substantial collaboration with individuals not referred to in the budget or use of consultants should be described. Subcontracting significant portions of a research project is discouraged.
 - (ii) When it is expected that the effort will require more than one year, the proposal should cover the complete project to the extent that it can be reasonably anticipated. Principal emphasis should be on the first year of work, and the description should distinguish clearly between the first year's work and work planned for subsequent years.
- (5) **Management Approach.** For large or complex efforts involving interactions among numerous individuals or other organizations, plans for distribution of responsibilities and arrangements for ensuring a coordinated effort should be described.
- (6) **Personnel.** The principal investigator is responsible for supervision of the work and participates in the conduct of the research regardless of whether or not compensated under the award. A short biographical sketch of the principal investigator, a list of principal publications and any exceptional qualifications should be included. Omit social security number and other personal items which do not merit consideration in evaluation of the proposal. Give similar biographical

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information on other senior professional personnel who will be directly associated with the project. Give the names and titles of any other scientists and technical personnel associated substantially with the project in an advisory capacity. Universities should list the approximate number of students or other assistants, together with information as to their level of academic attainment. Any special industry-university cooperative arrangements should be described.

(7) **Facilities and Equipment.**

- (i) Describe available facilities and major items of equipment especially adapted or suited to the proposed project, and any additional major equipment that will be required. Identify any Government-owned facilities, industrial plant equipment, or special tooling that is proposed for use. Include evidence of its availability and the cognizant Government points of contact.
- (ii) Before requesting a major item of capital equipment, the proposer should determine if sharing or loan of equipment already within the organization is a feasible alternative. Where such arrangements cannot be made, the proposal should so state. The need for items that typically can be used for research and non-research purposes should be explained.

(8) **Proposed Costs (U.S. Proposals Only).**

- (i) Proposals should contain cost and technical parts in one volume: do not use separate "confidential" salary pages. As applicable, include separate cost estimates for salaries and wages; fringe benefits; equipment; expendable materials and supplies; services; domestic and foreign travel; ADP expenses; publication or page charges; consultants; subcontracts; other miscellaneous identifiable direct costs; and indirect costs. List salaries and wages in appropriate organizational categories (e.g., principal investigator, other scientific and engineering professionals, graduate students, research assistants, and technicians and other non-professional personnel). Estimate all staffing data in terms of staff-months or fractions of full-time.
- (ii) Explanatory notes should accompany the cost proposal to provide identification and estimated cost of major capital equipment items to be acquired; purpose and estimated number and lengths of trips planned; basis for indirect cost computation (including date of most recent negotiation and cognizant agency); and clarification of other items in the cost proposal that are not self-evident. List estimated expenses as yearly requirements by major work phases.
- (iii) Allowable costs are governed by FAR Part 31 and the NASA FAR Supplement Part 1831 (and OMB Circulars A-21 for educational institutions and A-122 for nonprofit organizations).
- (iv) Use of NASA funds--NASA funding may not be used for foreign research efforts at any level, whether as a collaborator

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or a subcontract. The direct purchase of supplies and/or services, which do not constitute research, from non-U.S. sources by U.S. award recipients is permitted. Additionally, in accordance with the National Space Transportation Policy, use of a non-U.S. manufactured launch vehicle is permitted only on a no-exchange-of-funds basis.

- (9) **Security.** Proposals should not contain security classified material. If the research requires access to or may generate security classified information, the submitter will be required to comply with Government security regulations.
 - (10) **Current Support.** For other current projects being conducted by the principal investigator, provide title of project, sponsoring agency, and ending date.
 - (11) **Special Matters.**
 - (i) Include any required statements of environmental impact of the research, human subject or animal care provisions, conflict of interest, or on such other topics as may be required by the nature of the effort and current statutes, executive orders, or other current Government-wide guidelines.
 - (ii) Identify and discuss risk factors and issues throughout the proposal where they are relevant, and your approach to managing these risks.
 - (iii) Proposers should include a brief description of the organization, its facilities, and previous work experience in the field of the proposal. Identify the cognizant Government audit agency, inspection agency, and administrative contracting officer, when applicable.
- (D) **Renewal Proposals.**
- (1) Renewal proposals for existing awards will be considered in the same manner as proposals for new endeavors. A renewal proposal should not repeat all of the information that was in the original proposal. The renewal proposal should refer to its predecessor, update the parts that are no longer current, and indicate what elements of the research are expected to be covered during the period for which support is desired. A description of any significant findings since the most recent progress report should be included. The renewal proposal should treat, in reasonable detail, the plans for the next period, contain a cost estimate, and otherwise adhere to these instructions.
 - (2) NASA may renew an effort either through amendment of an existing contract or by a new award.
- (E) **Length.** Unless otherwise specified in the NRA, effort should be made to keep proposals as brief as possible, concentrating on substantive material. Few proposals need exceed 15-20 pages. Necessary detailed information, such as reprints, should be included as attachments. A complete set of attachments is necessary for each copy of the proposal. As proposals are not returned, avoid use of "one-of-a-kind" attachments.

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- (F) **Joint Proposals.**
- (1) Where multiple organizations are involved, the proposal may be submitted by only one of them. It should clearly describe the role to be played by the other organizations and indicate the legal and managerial arrangements contemplated. In other instances, simultaneous submission of related proposals from each organization might be appropriate, in which case parallel awards would be made.
 - (2) Where a project of a cooperative nature with NASA is contemplated, describe the contributions expected from any participating NASA investigator and agency facilities or equipment which may be required. The proposal must be confined only to that which the proposing organization can commit itself. "Joint" proposals which specify the internal arrangements NASA will actually make are not acceptable as a means of establishing an agency commitment.
- (G) **Late Proposals.** Proposals or proposal modifications received after the latest date specified for receipt may be considered if a significant reduction in cost to the Government is probable or if there are significant technical advantages, as compared with proposals previously received.
- (H) **Withdrawal.** Proposals may be withdrawn by the proposer at any time before award. Offerors are requested to notify NASA if the proposal is funded by another organization or of other changed circumstances which dictate termination of evaluation.
- (I) **Evaluation Factors.**
- (1) Unless otherwise specified in the NRA, the principal elements (of approximately equal weight) considered in evaluating a proposal are its relevance to NASA's objectives, intrinsic merit, and cost.
 - (2) Evaluation of a proposal's relevance to NASA's objectives includes the consideration of the potential contribution of the effort to NASA's mission.
 - (3) Evaluation of its intrinsic merit includes the consideration of the following factors of equal importance:
 - (i) Overall scientific or technical merit of the proposal or unique and innovative methods, approaches, or concepts demonstrated by the proposal.
 - (ii) Offeror's capabilities, related experience, facilities, techniques, or unique combinations of these which are integral factors for achieving the proposal objectives.
 - (iii) The qualifications, capabilities, and experience of the proposed principal investigator, team leader, or key personnel critical in achieving the proposal objectives.
 - (iv) Overall standing among similar proposals and/or evaluation against the state-of-the-art.
 - (1) Evaluation of the cost of a proposed effort may include the realism and reasonableness of the proposed cost and available funds.
- (J) **Evaluation Techniques.** Selection decisions will be made following peer and/or scientific review of the proposals. Several evaluation techniques are

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regularly used within NASA. In all cases proposals are subject to scientific review by discipline specialists in the area of the proposal. Some proposals are reviewed entirely in-house, others are evaluated by a combination of in-house and selected external reviewers, while yet others are subject to the full external peer review technique (with due regard for conflict-of-interest and protection of proposal information), such as by mail or through assembled panels. The final decisions are made by a NASA selecting official. A proposal which is scientifically and programmatically meritorious, but not selected for award during its initial review, may be included in subsequent reviews unless the proposer requests otherwise.

(K) Selection for Award.

- (1) When a proposal is not selected for award, the proposer will be notified. NASA will explain generally why the proposal was not selected. Proposers desiring additional information may contact the selecting official who will arrange a debriefing.
- (2) When a proposal is selected for award, negotiation and award will be handled by the procurement office in the funding installation. The proposal is used as the basis for negotiation. The contracting officer may request certain business data and may forward a model award instrument and other information pertinent to negotiation.

(L) Additional Guidelines Applicable to Foreign Proposals and Proposals Including Foreign Participation.

- (1) NASA welcomes proposals from outside the U.S. However, foreign entities are generally not eligible for funding from NASA. Therefore, unless otherwise noted in the NRA, proposals from foreign entities should not include a cost plan unless the proposal involves collaboration with a U.S. institution, in which case a cost plan for only the participation of the U.S. entity must be included. Proposals from foreign entities and proposals from U.S. entities that include foreign participation must be endorsed by the respective government agency or funding/sponsoring institution in the country from which the foreign entity is proposing. Such endorsement should indicate that the proposal merits careful consideration by NASA, and if the proposal is selected, sufficient funds will be made available to undertake the activity as proposed.
- (2) All foreign proposals must be typewritten in English and comply with all other submission requirements stated in the NRA. All foreign proposals will undergo the same evaluation and selection process as those originating in the U.S. All proposals must be received before the established closing date. Those received after the closing date will be treated in accordance with paragraph (g) of this provision. Sponsoring foreign government agencies or funding institutions may, in exceptional situations, forward a proposal without endorsement if endorsement is not possible before the announced closing date. In such cases, the NASA sponsoring office should be advised when a decision on endorsement can be expected.

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- (3) Successful and unsuccessful foreign entities will be contacted directly by the NASA sponsoring office. Copies of these letters will be sent to the foreign sponsor. Should a foreign proposal or a U.S. proposal with foreign participation be selected, NASA's Office of External Relations will arrange with the foreign sponsor for the proposed participation on a no-exchange-of-funds basis, in which NASA and the non-U.S. sponsoring agency or funding institution will each bear the cost of discharging their respective responsibilities.
 - (4) Depending on the nature and extent of the proposed cooperation, these arrangements may entail:
 - (i) An exchange of letters between NASA and the foreign sponsor; or
 - (ii) A formal Agency-to-Agency Memorandum of Understanding (MOU).
- (M) **Cancellation of NRA.** NASA reserves the right to make no awards under this NRA and to cancel this NRA. NASA assumes no liability for canceling the NRA or for anyone's failure to receive actual notice of cancellation.