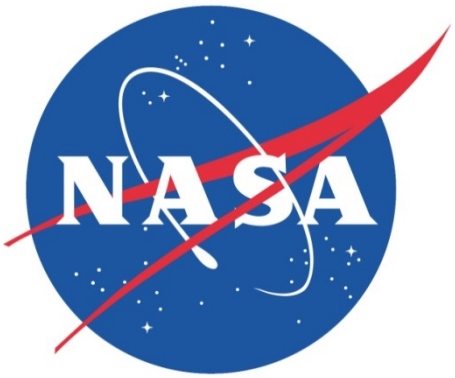
OMB Control Number 2700-0085



National Aeronautics and Space Administration
Office of Education

FY 2015 NASA Cooperative Agreement Notice (CAN)

Experimental Program to Stimulate Competitive Research (EPSCoR)

Research Announcement

Announcement Number: NNH15ZHA003C
Catalog of Federal Domestic Assistance (CFDA) Number: 43.008

Release Date:	**December 19, 2014**
Notice of Intent Due:	**February 2, 2015**
Proposals Due:	**March 19, 2015**

NASA Headquarters
Office of Education
Washington, DC 20546-0001

Summary of Key Information

Cooperative Agreement Notice (CAN)

Experimental Program to Stimulate Competitive Research (EPSCoR)

The National Aeronautics and Space Administration (NASA) Office of Education, in cooperation with NASA's Aeronautics Research Mission Directorate (ARMD), Human Exploration & Operations Mission Directorate (HEOMD), Science Mission Directorates (SMD), Space Technology Mission Directorate (STMD), and NASA's ten centers, solicits proposals for the NASA Experimental Program to Stimulate Competitive Research (EPSCoR). Each funded NASA EPSCoR proposal is expected to establish research activities that will make significant contributions to the strategic research and technology development priorities of one or more of the Mission Directorates, and contribute to the overall research infrastructure, science and technology capabilities, higher education, and economic development of the jurisdiction. Notices of Intent are due on **February 2, 2015** and proposals are due on **March 19, 2015.**

Solicitation Availability

This announcement is accessible through the NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES) and through Grants.gov.

To access through NSPIRES, go to http://nspires.nasaprs.com and click on Solicitations.

To access through Grants.gov, go to http://www.grants.gov/search/agency.do and select the link for NASA.

Selecting Official

The selecting official for this CAN is the Associate Administrator for Education at NASA Headquarters.

Funds Availability

The Government's obligation to make an award is contingent upon the availability of appropriated funds from which payment can be made.

Number and Size of Awards

It is anticipated that 3 to 5 awards of up to $750,000 each to be expended over a three-year period of performance may be made under this Notice pursuant to the authority of the *NASA Grant and Cooperative Agreement Handbook* (http://www.gpo.gov/fdsys/granule/CFR-1999-title14-vol5/CFR-1999-title14-vol5-part1260/content-detail.html), Section 1260.12(d). The exact number of awards depends on the available EPSCoR Research Budget.

NASA Safety Policy

The objectives of the NASA Safety Program are to protect the public, NASA workforce, high-value equipment and property, and the environment from potential harm as a result of NASA activities and operations by factoring safety as an integral feature of programs, projects, technologies, operations, and facilities.

Proposal Submission

All information needed to respond to this solicitation is contained in this announcement and in the companion document entitled *Guidebook for Proposers Responding to a NASA Research*

Announcement (NRA) or Cooperative Agreement Notice (CAN) May 2014 Edition (hereafter referred to as the NASA Guidebook for Proposers). The PDF version is available at: http://www.hq.nasa.gov/office/procurement/nraguidebook/proposer2014.pdf
Within the Agency, NASA Research Announcements (NRAs) and Cooperative Agreement Notices (CANs) are types of solicitations used to solicit proposals for grants and cooperative agreements. The main difference between an NRA and a CAN is that a CAN is used when the decision has been made in advance that cooperative agreements, rather than grants, will be awarded for a given research opportunity. Proposers follow the same procedures and processes when responding to CANs and/or NRAs.

Inquiries

Technical and scientific questions about programs in this CAN may be directed to:

Jeppie R. Compton
Project Manager, NASA EPSCoR
Office of Education
NASA Kennedy Space Center, HQ EX-E
Kennedy Space Center, FL 32899-0001
E-mail: jeppie.r.compton@nasa.gov
Telephone: (321) 867-6988

Inquiries regarding the submission of proposal materials may be addressed to:

Althia Harris
NASA Research and Education Support Services (NRESS)
2345 Crystal Drive, Suite 500
Arlington, VA 22202-4816
E-mail: aharris@nasaprs.com
Telephone: (202) 479-9030 x310
Fax: (202) 479-0511

Release Date:	**December 19, 2014**
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1.0 Description of Opportunity

1.1 Technical Description

The National Aeronautics and Space Administration (NASA) Office of Education, in cooperation with NASA's Aeronautics Research Mission Directorate (ARMD), Human Exploration & Operations Mission Directorate (HEOMD), Science Mission Directorates (SMD), the Space Technology Mission Directorate (STMD), and NASA's ten centers, solicits proposals for the NASA Experimental Program to Stimulate Competitive Research (EPSCoR). Each funded NASA EPSCoR proposal is expected to establish research activities that will make significant contributions to NASA's strategic research and technology development priorities and contribute to the overall research infrastructure, science and technology capabilities, higher education, and economic development of the jurisdiction.

The program parameters are:

- NASA EPSCoR Jurisdictions responding to this Cooperative Agreement Notice (CAN) may submit one proposal per paragraph 1.3 below (EPSCoR Eligibility and Proposal Acceptance).
- The maximum funding request per proposal is $750,000. This amount is to be expended over a three-year period.
- All NASA EPSCoR monies must be cost-shared at a level of at least 50% with non-federal monies. In-kind cost-sharing is allowable.

This CAN is available in electronic form through the NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES) and Grants.gov.

To access the CAN through NSPIRES, go to http://nspires.nasaprs.com and click on Solicitations.

To access the CAN through Grants.gov, go to http://www.grants.gov/search/agency.do and select the link for NASA.

1.2 EPSCoR Background

Public Law 102-588, passed in 1992, authorized NASA to initiate NASA EPSCoR to strengthen the research capability of jurisdictions that have not in the past participated equably in competitive aerospace research activities. The goal of NASA EPSCoR is to provide seed funding that will enable jurisdictions to develop an academic research enterprise directed toward long-term, self-sustaining, nationally-competitive capabilities in aerospace and aerospace-related research. This capability will, in turn, contribute to the jurisdiction's economic viability and expand the nation's base for aerospace research and development.

Based on the availability of funding, NASA will continue to help jurisdictions achieve these goals through NASA EPSCoR. Funded jurisdictions will be selected through a merit-based, peer-review competition.

The following are the specific objectives of NASA EPSCoR:

- Contribute to and promote the development of research capability in NASA EPSCoR jurisdictions in areas of strategic importance to the NASA mission;
- Improve the capabilities of the NASA EPSCoR jurisdictions to gain support from sources outside the NASA EPSCoR program;
- Develop partnerships among NASA research assets, academic institutions, and industry;

- Contribute to the overall research infrastructure, science and technology capabilities, higher education, and economic development of the jurisdiction; and
- Work in close coordination with the Space Grant consortium in the jurisdiction to improve the environment for science, technology, engineering and mathematics (STEM) education.

1.3 EPSCoR Eligibility and Proposal Acceptance

While proposals can be accepted only from institutions for which the NASA EPSCoR Directors are currently serving, all institutions of higher education within the jurisdiction must be given the opportunity and be made aware of the FY 2015 NASA EPSCoR CAN.

The National Science Foundation (NSF) eligibility tables are used to determine overall jurisdiction eligibility for NASA EPSCoR. Details regarding general eligibility are available at: http://www.nsf.gov/od/iia/programs/epscor/Eligibility_Tables/FY2014_Eligibility.pdf.

The following jurisdictions are eligible to submit one proposal to this NASA EPSCoR solicitation: Alabama, Alaska, Arkansas, Delaware, Idaho, Kansas, Kentucky, Louisiana, Maine, Mississippi, Missouri, Montana, Nebraska, Nevada, New Hampshire, New Mexico, North Dakota, Oklahoma, Puerto Rico, Rhode Island, South Dakota, Vermont, West Virginia, and Wyoming.

South Carolina may submit up to two proposals, provided at least one of the proposals represents a project from the U.S. Virgin Islands (which currently falls under South Carolina's jurisdiction).

Hawaii may submit up to two proposals, provided at least one of the proposals represents a project from Guam (which currently falls under Hawaii's jurisdiction).

The estimated funding and number of proposals anticipated to be funded, as shown in this CAN under the section entitled "Summary of Key Information," are subject to the availability of appropriated funds, as well as the submission of a sufficient number of proposals of adequate merit.

1.4 Period of Performance

NASA EPSCoR awards will support a three-year cooperative agreement. It is anticipated that this period of performance will enable the researchers to achieve the performance task objectives stated in the original proposal and/or any amendments submitted with annual progress reports and accepted by the NASA EPSCoR project office.

1.5 Connections between the NASA's EPSCoR and National Space Grant College and Fellowship Programs

Cooperative Agreements will be awarded to the institution of the NASA EPSCoR Director. The NASA EPSCoR Director must therefore serve as the Principal Investigator (PI) for and manage the jurisdiction's NASA EPSCoR project (see Section 3.0, Program Management, Subsection 3.2. Jurisdiction Level for a discussion of management responsibilities). Although the EPSCoR Director and the Space Grant (SG) Director are the same person and therefore a member of the SG consortium, individuals and institutions participating in a jurisdiction's NASA EPSCoR project need not be members of the jurisdiction's SG Consortium.

1.6 Notice of Intent

Institutions planning to prepare a proposal package for NASA EPSCoR are requested to submit a Notice of Intent (NOI) to propose. To be useful to NASA EPSCoR Management, NOIs must be submitted by the NASA EPSCoR Director through NSPIRES at http://nspires.nasaprs.com by

11:59 p.m. Eastern Time**, February 2, 2015**. NOIs must be submitted via NSPIRES regardless of whether the proposal will be submitted via NSPIRES or Grants.Gov. NASA will use the information provided in the NOI to identify research areas of interests, Center and Mission Directorate alignment, to determine the expertise required of NASA and external merit reviewers. See Appendix E, Section 3 of this announcement for additional details regarding NOIs.

2.0 Project Overview and Guidelines

2.1 General

Each NASA EPSCoR project must perform scientific and/or technical research in areas that support NASA's strategic research and technology development priorities. Proposals should emphasize developing capabilities to compete for funds from NASA and non-NASA sources outside of EPSCoR. The projects should move increasingly towards gaining support from sources outside NASA EPSCoR by aggressively pursuing additional funding opportunities offered by NASA, industry, other federal agencies, and elsewhere.

2.2 Funding and Cost-Sharing

The maximum funding that a jurisdiction can request from NASA is $750,000 per proposal. This amount is to be expended over three years in accordance with the budget details and budget narrative in the approved proposal.

Cost-sharing is required at a level of at least 50% of the requested NASA funds. Although the method of cost-sharing is flexible, NASA encourages the EPSCoR jurisdiction committees to consider methods that would add value to the jurisdiction's existing research capabilities. All contributions, including cash or in-kind, shall meet the criteria contained in the *NASA Grant and Cooperative Agreement Handbook*, 14 Code of Federal Regulations (CFR) §1260.123.

2.3 Restrictions

In addition to the funding guidelines and requirements in the *NASA Guidebook for Proposers* and the *Grant and Cooperative Agreement Handbook*, the following restrictions govern the use of the federally-provided and cost-share NASA EPSCoR funds and are applicable to this CAN:

- Funds may not be used to fund research carried out by non-U.S. institutions. U.S. research award recipients may, however, directly purchase supplies and/or services that do not constitute research from non-U.S. sources. However, subject to export control restrictions, a foreign national may receive remuneration through a NASA award for the conduct of research while employed either full or part time by a U.S. institution. For additional guidance on foreign participation, see Section 1.6 of the *NASA Guidebook for Proposers*, the NASA FAR Supplement (NFS) Part 1835.016-70 and this document's Appendix E, Section E.6.1 Assurance of Compliance – China Funding Restriction.
- Travel, including foreign travel, is allowed for the meaningful completion of the proposed investigation, as well as for reporting results at appropriate professional meetings. Foreign travel to meetings and conferences in support of the jurisdiction's NASA EPSCoR research project is an acceptable use of NASA EPSCoR funds, with an upper limit of $3,000 per trip for up to two separate years of a jurisdiction's proposal (i.e., the maximum amount the jurisdiction can request for foreign travel is $3,000 total in any one year and a limit of $6,000 total for each research proposal). EPSCoR support should be acknowledged by the EPSCoR research project number in written reports and publications. Note that domestic travel does not have a limit. Domestic travel, defined as

that travel which does not require a passport, should be appropriate and reasonable to conduct the proposed research.

- The construction of facilities is not an allowable cost in any of the programs solicited in this CAN. For further information on allowable costs, refer to the cost principles cited in the *Grant and Cooperative Agreement Handbook*, 14 CFR §1260.127.
- NASA EPSCoR funding cannot be used to purchase general purpose equipment, e.g., desktop workstations, office furnishings, reproduction and printing equipment, etc. as a direct charge. Special purpose equipment purchases (i.e., equipment that is used only for research, scientific, and technical activities directly related to the proposed research activities) are allowed and can be reflected as a direct charge as per NASA *Grants and Cooperative Agreement Handbook*, 14 CFR § 1260.27.
- NASA EPSCoR funding may not be used to support NASA civil service participation (FTE) in a research project unless that funding is provided through a funding vehicle between the jurisdiction and NASA center, such as a Space Act Agreement or other reimbursable agreement. NASA EPSCoR cannot withhold funding from an award to send to a center for FTE support (including travel).

2.4 NASA Research Areas of Interest

NASA EPSCoR research priorities are defined by the Mission Directorates (Aeronautics Research, Human Exploration & Operations, Science, and Space Technology), and NASA's ten Centers. Each Mission Directorate and Center covers a major area of the Agency's research and technology development efforts.

Information about current NASA research solicitations can be found on NSPIRES at http://nspires.nasaprs.com (select "Solicitations" and then "Open Solicitations").

Research priorities for each of the Mission Directorates (includes Centers) are summarized below; please see Appendix D for contact information for the NASA Point of Contact (POC) for each.

Aeronautics Research Mission Directorate (ARMD), POC: Tony Springer, tony.springer@nasa.gov

Researchers responding to the ARMD should propose research that is aligned with one or more of the ARMD programs. Proposers are directed to the following:

- ARMD Programs: http://www.aeronautics.nasa.gov/programs.htm
- The National Aeronautics and Space Administration (NASA), Headquarters, Aeronautics Research Mission Directorate (ARMD) Current Year version of the NASA Research Announcement (NRA) entitled, "Research Opportunities in Aeronautics (ROA)" has been posted on the NSPIRES web site at http://nspires.nasaprs.com (select "Solicitations" and then "Open Solicitations").

Detailed requirements, including proposal due dates are stated in appendices that address individual thrust areas. These appendices will be posted as amendments to the ROA NRA and will be published as requirements materialize throughout the year.

Human Exploration & Operations Mission Directorate (HEOMD), POC: Bradley Carpenter, bcarpenter@nasa.gov

Human Research Program

The Human Research Program (HRP) is focused on investigating and mitigating the highest risks to human health and performance in order to enable safe, reliable, and productive human space

exploration. The HRP budget enables NASA to resolve health risks in order for humans to safely live and work on missions in the inner solar system. HRP conducts research, develops countermeasures, and undertakes technology development to address human health risks in space and ensure compliance with NASA's health, medical, human performance, and environmental standards.

Space Life Sciences

The Space Life Sciences, Space Biology Program has three primary goals:

- To effectively use microgravity and the other characteristics of the space environment to enhance our understanding of fundamental biological processes;
- To develop the scientific and technological foundations for a safe, productive human presence in space for extended periods and in preparation for exploration;
- To apply this knowledge and technology to improve our nation's competitiveness, education, and the quality of life on Earth.

These goals will be achieved by soliciting research using its three program elements:

- Cell and Molecular Biology and Microbial Biology - studies of the effect of gravity and the space environment on cellular, microbial and molecular processes;
- Organismal & Comparative Biology - studies and comparisons of responses of whole organisms and their systems; and
- Developmental Biology – studies of how spaceflight affects reproduction, development, maturation and aging of multi-cellular organisms, as described in NASA's Fundamental Space Biology Science Plan (PDF, 7.4 MB).

Further details about ongoing activities specific to Space Biology are available at:
Space Biosciences website

Physical Science Research

The Physical Science Research Program, along with its predecessors, has conducted significant fundamental and applied research, both which have led to improved space systems and produced new products offering benefits on Earth. NASA's experiments in various disciplines of physical science reveal how physical systems respond to the near absence of gravity. They also reveal how other forces that on Earth are small compared to gravity, can dominate system behavior in space.

The Physical Science Research Program also benefits from collaborations with several of the International Space Station international partners—Europe, Russia, Japan, and Canada—and foreign governments with space programs, such as France, Germany and Italy. The scale of this research enterprise promises new possibilities in the physical sciences, some of which are already being realized both in the form of innovations for space exploration and in new ways to improve the quality of life on Earth.

Research in physical sciences spans from basic and applied research in the areas of:

- Fluid physics: two-phase flow, phase change, boiling, condensation and capillary and interfacial phenomena;
- Combustion science: spacecraft fire safety, solids, liquids and gasses, supercritical reacting fluids, and soot formation;
- Materials science: solidification in metal and alloys, crystal growth, electronic materials, glasses and ceramics;
- Complex Fluids: colloidal systems, liquid crystals, polymer flows, foams and granular flows;

- Fundamental Physics: critical point phenomena, atom interferometry and atomic clocks in space

Implementing Centers: NASA's Physical Sciences Research Program is carried out at the Glenn Research Center (GRC), Jet Propulsion Laboratory (JPL) and Marshall Space Flight Center (MSFC). Further information on physical sciences research is available at http://issresearchproject.nasa.gov/

Engineering Research

- Spacecraft: Guidance, navigation and control; thermal; electrical; structures; software; avionics; displays; high speed re-entry; modeling; power systems; interoperability/commonality; advanced spacecraft materials; crew/vehicle health monitoring; life support.
- Propulsion: Propulsion methods that will utilize materials found on the moon or Mars, "green" propellants, on-orbit propellant storage, motors, testing, fuels, manufacturing, soft landing, throttle-able propellants, high performance, and descent.
- Robotic Systems for Precursor Near Earth Asteroid (NEA) Missions: Navigation and proximity operations systems; hazard detection; techniques for interacting and anchoring with Near Earth Asteroids; methods of remote and interactive characterization of Near Earth Asteroid (NEA) environments, composition and structural properties; robotics (specifically environmental scouting prior to human arrival and later to assist astronauts with NEA exploration); environmental analysis; radiation protection; spacecraft autonomy, enhanced methods of NEA characterization from earth-based observation.
- Robotic Systems for Lunar Precursor Missions: Precision landing and hazard avoidance hardware and software; high-bandwidth communication; in-situ resource utilization (ISRU) and prospecting; navigation systems; robotics (specifically environmental scouting prior to human arrival, and to assist astronaut with surface exploration); environmental analysis, radiation protection.
- Data and Visualization Systems for Exploration: Area focus on turning precursor mission data into meaningful engineering knowledge for system design and mission planning of lunar surface and NEAs. Visualization and data display; interactive data manipulation and sharing; mapping and data layering including coordinate transformations for irregular shaped NEAs; modeling of lighting and thermal environments; simulation of environmental interactions including proximity operations in irregular micro-G gravity fields and physical stability of weakly bound NEAs.
- Research and technology development areas in HEOMD support launch vehicles, space communications, and the International Space Station. Examples of research and technology development areas (and the associated lead NASA Center) with great potential include:
    - *Processing and Operations*
        - Crew Health and Safety Including Medical Operations (Johnson Space Center (JSC))
        - In-helmet Speech Audio Systems and Technologies (Glenn Research Center (GRC))
        - Vehicle Integration and Ground Processing (Kennedy Space Center (KSC))
        - Mission Operations (Ames Research Center (ARC))
        - Portable Life Support Systems (JSC)
        - Pressure Garments and Gloves (JSC)
        - Air Revitalization Technologies (ARC)
        - In-Space Waste Processing Technologies (JSC)

- Cryogenic Fluids Management Systems (GRC)

- *Space Communications and Navigation*
  - Coding, Modulation, and Compression (Goddard Spaceflight Center (GSFC))
  - Precision Spacecraft and Lunar/Planetary Surface Navigation and Tracking (GSFC)
  - Communication for Space-Based Range (GSFC)
  - Antenna Technology (Glenn Research Center (GRC))
  - Reconfigurable/Reprogrammable Communication Systems (GRC)
  - Miniaturized Digital EVA Radio (Johnson Space Center (JSC))
  - Transformational Communications Technology (GRC)
  - Long Range Optical Telecommunications (Jet Propulsion Laboratory (JPL))
  - Long Range Space RF Telecommunications (JPL)
  - Surface Networks and Orbit Access Links (GRC)
  - Software for Space Communications Infrastructure Operations (JPL)
  - TDRS transponders for launch vehicle applications that support space communication and launch services (GRC)

- *Space Transportation*
  - Optical Tracking and Image Analysis (KSC)
  - Space Transportation Propulsion System and Test Facility Requirements and Instrumentation (Stennis Space Center (SSC)
  - Automated Collection and Transfer of Launch Range Surveillance/Intrusion Data (KSC)
  - Technology tools to assess secondary payload capability with launch vehicles (KSC)
  - Spacecraft Charging/Plasma Interactions (Environment definition & arcing mitigation) (Marshall Space Flight Center (MSFC))

Science Mission Directorate (SMD), POC: Stephanie Stockman, stephanie.a.stockman@nasa.gov

Detailed information on SMD research priorities is available at the following URLs:

- NASA Science: http://science.nasa.gov
- NASA Science Plan 2010: http://science.hq.nasa.gov/strategy/ and http://science.nasa.gov/media/medialibrary/2010/08/10/2010SciencePlan.pdf.
- NASA's Plan for a Climate-Centric Architecture for Earth Observations and Applications from Space: http://science.nasa.gov/media/medialibrary/2010/07/01/Climate_Architecture_Final.pdf.
- Research Opportunities in Space and Earth Science (ROSES):
- http://nspires.nasaprs.com/external/. Select “Solicitations”, “Open Solicitations”, and then “Research Opportunities in Space and Earth Sciences (ROSES) – 2010”.
- In addition, proposers can visit the following URLs:
- http://nasascience.nasa.gov/big-questions which summarizes the research questions across all four SMD divisions and links to their respective 2007-2016 science strategy.

- http://science.nasa.gov/researchers/sara/advisory-committees/ which provides information on a new planetary decadal survey that was released in the spring of 2011.

Space Technology Mission Directorate (STMD), POC: Joseph Grant joseph.grant-1@nasa.gov

In addition to the key areas of: 1) ISS utilization, 2) MGI, 3) Advanced Manufacturing and 4) Robotics, the Space Technology Mission Directorate (STMD) is responsible for developing crosscutting, pioneering, and transformational new technologies and capabilities, needed by the Agency to achieve its current and future missions. STMD is divided into the following nine programs, representing all levels of technology readiness (TRL) from early stage innovations to mission-ready projects:

- NASA Innovative Advanced Concepts focuses on visionary aeronautics and space system concepts. TRL Range: 1-3
- Space Technology Research Grants focus on innovative research in advanced space technology via range of university grants involving senior researchers, early career faculty and graduate students. TRL Range: 1-3
- Center Innovation Fund stimulates creativity and innovation at the NASA field centers. TRL Range: 1-3
- Centennial Challenges offers incentive prizes to stimulate innovative solutions by citizen inventors and independent teams outside of the traditional aerospace community. TRL Range: 5-9
- Small Business Innovative Research (SBIR)/Small Business Technology Transfer (STTR) engage small businesses in aerospace research and development for infusion into NASA missions and the nation's economy. TRL Range: 2-5
- Game Changing Development focuses on maturing advanced space technologies that may lead to entirely new approaches for the Agency's future space missions. TRL Range: 3-5
- Small Spacecraft Technology develops and demonstrates subsystem technologies and new mission capabilities for small spacecraft. TRL Range: 3-7
- Flight Opportunities facilitates low-cost access to suborbital environments for a broad range of innovators as a means of advancing space technology development and supporting the evolving entrepreneurial commercial space industry. TRL Range: 5-7
- Technology Demonstration Missions seeks to mature laboratory-proven technologies to flight-ready status. TRL Range: 5-7

In addition, Space Technology supports NASA's participation in the following cross-agency partnerships and National initiatives:

- The National Network for Manufacturing Innovation brings together government agencies to collaborate toward modernization of manufacturing, and supports direct investments in small businesses and training for the high-skilled manufacturing workforce. (http://manufacturing.gov/welcome.html)
- The National Nanotechnology Initiative brings government agencies together with a collective interest in understanding and controlling matter at the nanoscale, leading to a revolution in technology and industry that benefits society. (http://www.nano.gov/)
- The National Robotics Initiative brings together government agencies with interest in accelerating the development and use of robots in the United States that work beside, or cooperatively with, people and funds innovative robotics research and applications emphasizing the realization of such co-robots acting in direct support of and in a symbiotic relationship with human partners. (http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503641&org=CISE)

- Materials Genome Initiative is a multi-agency initiative designed to create a new era of policy, resources, and infrastructure that support U.S. institutions in the effort to discover, manufacture, and deploy advanced materials twice as fast, at a fraction of the cost.

Additional information about STMD programs is available at http://www.nasa.gov/directorates/spacetech/home/index.html.

By investing in high payoff, crosscutting and transformational technologies the broad space enterprise cannot tackle today, STMD matures these technologies required for NASA's future missions in science and exploration, while proving the capabilities and lowering the cost for other government agencies and commercial space activities. By pushing the boundaries of aerospace technology and seizing opportunities, investing in space technology allows NASA and our Nation to remain at the cutting edge. NASA's STMD:

- Advances technologies that are broadly applicable to multiple stakeholders
- Employs a portfolio approach to capture the entire spectrum of technology readiness
- Competitively selects research by academia, industry, NASA Centers, and other government organizations based on technical merit
- Coordinates with internal and external stakeholders and leverages the technology investments of our international, other government agency, academic and industrial partners
- Results in new inventions, new capabilities and the creation of a pipeline of innovators aimed at serving future NASA needs and National needs
- Grows the Nation's innovation economy and creates high-technology jobs

STMD programs intentionally push the boundaries of what is possible with a strong focus on innovation. No single effort is guaranteed to succeed and some will fail as novel approaches are attempted. While appropriate safety, design, and verification practices are followed, STMD programs employ a graduated technical risk tolerance approach. More resources, rigor, and greater risk avoidance apply to higher cost and higher technology readiness level (TRL) efforts, such as test articles destined for complex ground tests and/or space flight demonstrations. In all cases, a transparent, informed risk acceptance approach applies.

STMD programs described above fund projects aligned with the Agency's Space Technology Roadmaps (http://www.nasa.gov/offices/oct/home/roadmaps/index.html), which reflect the National Research Council's (NRC's) review and prioritization http://www.nap.edu/catalog.php?record_id=13354) of these roadmaps.

NASA developed the Space Technology Roadmaps in order to facilitate the development and demonstration of space technologies that address the needs of NASA's exploration systems, earth and space science, and space operations mission areas, as well as those that contribute to critical national and commercial needs in advanced space technologies. Each of the 14 roadmaps focuses on a Technology Area (TA). The roadmaps were initially drafted by NASA and subsequently independently reviewed by the NRC. The NRC's review (link provided above) resulted in findings, recommendations, and priorities – within and across the technology areas – intended to inform NASA's space technology investments. The NRC's final report (http://www.nap.edu/catalog.php?record_id=13354) was released early in 2012.

Applicants proposing Space Technology related content are strongly encouraged to familiarize themselves with the roadmap document most closely aligned with their space technology

interests. Links to the individual roadmap documents are provided below along with the NRC's top 16 priorities within their corresponding technology area:

Technology Areas	NRC Priorities within Technology Areas
TA01 Launch Propulsion Systems http://www.nasa.gov/pdf/500393main_TA01-ID_rev6-NRC-wTASR.pdf	
TA02 In-Space Propulsion Technologies http://www.nasa.gov/pdf/501329main_TA02-ID_rev3-NRC-wTASR.pdf	(Nuclear) Thermal Propulsion Electric Propulsion (2.2.1)
TA03 Space Power and Energy Storage http://www.nasa.gov/pdf/501328main_TA03-ID_rev7_NRC_wTASR.pdf	Solar Power Generation (Photovoltaic and Thermal) (3.1.3) Fission Power Generation (3.1.5)
TA04 Robotics, Tele-Robotics, and Autonomous Systems http://www.nasa.gov/pdf/501622main_TA04-ID_rev6b_NRC_wTASR.pdf	Extreme Terrain Mobility (4.2.1)
TA05 Communication and Navigation http://www.nasa.gov/pdf/501623main_TA05-ID_rev6_NRC_wTASR.pdf	Guidance Navigation &Control
TA06 Human Health, Life Support, and Habitation Systems http://www.nasa.gov/pdf/500436main_TA06-ID_rev6a_NRC_wTASR.pdf	Radiation Mitigation for Human Spaceflight Long-Duration Crew Health Environmental Control and Life Support Systems
TA07 Human Exploration Destination Systems http://www.nasa.gov/pdf/501327main_TA07-ID_rev7_NRC-wTASR.pdf	
TA08 Science Instruments, Observatories, and Sensor Systems http://www.nasa.gov/pdf/501624main_TA08-ID_rev5_NRC_wTASR.pdf	In-Situ Instruments and Sensors (8.3.3) Optical Systems (Instruments and Sensors) (8.1.3)High Contrast Imaging and Spectroscopy Technologies (8.2.4) Detectors and Focal Planes (8.1.1)
TA09 Entry, Descent, and Landing Systems http://www.nasa.gov/pdf/501326main_TA09-ID_rev5_NRC_wTASR.pdf	Entry Descent and Landing and TPS (see also (TA14)
TA10 Nanotechnology http://www.nasa.gov/pdf/501325main_TA10-ID_rev8_NRC-wTASR.pdf	
TA11 Modeling, Simulation, Information Technology and Processing http://www.nasa.gov/pdf/501321main_TA11-ID_rev4_NRC-wTASR.pdf	
TA12 Materials, Structures, Mechanical Systems, and Manufacturing http://www.nasa.gov/pdf/501625main_TA12-ID_rev6_NRC-wTASR.pdf	Lightweight and Multifunctional Materials and Structures
TA13 Ground and Launch Systems Processing http://www.nasa.gov/pdf/501626main_TA13-ID_rev4_NRC-wTASR.pdf	
TA14 Thermal Management Systems http://www.nasa.gov/pdf/501320main_TA14-ID_rev6a-NRC-wTASR.pdf	EDL and Thermal Protection Systems (see also TA09) Active Thermal Control of Cryogenic Systems

NASA will balance investments across all levels of technology readiness. By investing in all TRLs for pioneering, crosscutting and transformational technologies, the Agency ensures a robust pipeline of new capabilities for future space exploration missions.

NASA Centers

Examples of Center research interest areas include these specific areas from the following Centers. If no POC is listed or contact information is needed, please contact the POC using contact information listed in Appendix D.

Goddard Space Flight Center (GSFC), POC: David J. Rosage**,** david.j.rosage@nasa.gov

- Advanced Manufacturing - facilitates the development, evaluation, and deployment of efficient and flexible additive manufacturing technologies. (ref: NAMII.org)
- Advanced Multi-functional Systems and Structures - novel approaches to increase spacecraft systems resource utilization
- Micro - and Nanotechnology - Based Detector Systems - research and application of these technologies to increase the efficiency of detector and optical systems
- Ultra-miniature Spaceflight Systems - miniaturization approaches from multiple disciplines - materials, mechanical, electrical, software, and optical - to achieve substantial resource reductions
- Systems Robust to Extreme Environments - materials and design approaches that will preserve designed system properties and operational parameters (e.g. mechanical, electrical, thermal), and enable reliable systems operations in hostile space environments.
- Spacecraft Navigation Technologies
    - Spacecraft GNSS receivers, ranging crosslink transceivers, and relative navigation sensors
    - Optical navigation and satellite laser ranging
    - Deep-space autonomous navigation techniques
    - Software tools for spacecraft navigation ground operations and navigation analysis
- Mission and Trajectory Design Technologies
    - Mission design tools that will enable new mission classes (e.g., low thrust planetary missions, precision formation flying missions)
    - Mission design tools that reduce the costs and risks of current mission design methodologies
    - Trajectory design techniques that enable integrated optimal designs across multiple orbital dynamic regimes (i.e. earth orbiting, earth-moon libration point, sun-earth libration point, interplanetary)
- Spacecraft Attitude Determination and Control Technologies
    - Modeling, simulation, and advanced estimation algorithms
    - Advanced spacecraft attitude sensor technologies (e.g., MEMS IMU's, precision optical trackers)
    - Advanced spacecraft actuator technologies (e.g. modular and scalable momentum control devices, 'green' propulsion, micropropulsion, low power electric propulsion)
- CubeSats - Participating institutions will develop CubeSat components, technologies and systems to support NASA technology demonstration and risk reduction efforts. Student teams will develop miniature CubeSat power, pointing, communication, command/telemetry, structure, deployable (etc.) sub-systems and/or integrate such components into complete off-the-shelf "CubeSat bus" systems, with a goal of minimizing "bus" weight/power/volume/cost and maximizing available "payload" weight/power/volume. NASA technologists will then use these components/systems to develop payloads that demonstrate key technologies to prove concepts and/or reduce risks for future Earth Science, Space Science and Exploration/Robotic Servicing missions. POC: Thomas P. Flatley

- On-Orbit Multicore Computing - High performance multicore processing for advanced automation and science data processing on spacecraft. There are multiple multicore processing platforms in development that are being targeted for the next generation of science and exploration missions, but there is little work in the area of software frameworks and architectures to utilize these platforms. It is proposed that research in the areas of efficient inter-core communications, software partitioning, fault detection, isolation & recovery, memory management, core power management, scheduling algorithms, and software frameworks be done to enable a transition to these newer platforms. Participating institutions can select areas to research and work with NASA technologists to develop and prototype the resulting concepts. POC: Charles P Wildermann.

Ames Research Center (ARC), POC: Elizabeth Cartier, Elizabeth.A.Cartier@nasa.gov
Ames research Center enables exploration through selected development, innovative technologies, and interdisciplinary scientific discovery. Ames provides leadership in the following areas: Astrobiology; small satellites; supercomputing; robotic lunar exploration; and technologies for exploration. Additional Center core competencies include:

- Space Sciences
- Applied Aerospace and Information Technology
- Biotechnology
- Intelligent Systems
- Biological Sciences
- Earth Sciences
- High Performance Computing
- Advanced Aerospace Materials and Devices
- Space Transportation Technology/Thermal Protection Systems
- Human Systems Integration
- Small Spacecraft
- Airspace Systems

Glenn Research Center (GRC), POC: Mark David Kankam, mark.d.kankam@nasa.gov
Research and technology, and engineering engagements comprise including:

- Acoustics
- Advanced Energy (Renewable Wind and Solar, Coal Energy and Alternative Energy)
- Advanced Microwave Communications
- Aeronautical and Space Systems Analysis
- Computer Systems and Networks
- Electric (Ion) Propulsion
- Icing and Cryogenic Systems
- Instrumentation, Controls and Electronics
- Fluids, Computational Fluid Dynamics (CFD) and Turbomachinery
- Materials and Structures, including Mechanical Components and Lubrication
- Microgravity Fluid Physics, Combustion Phenomena and Bioengineering
- Nanotechnology
- Photovoltaics, Electrochemistry-Physics, and Thermal Energy Conversion
- Propulsion System Aerodynamics
- Space Power Generation, Storage, Distribution and Management
- Systems Engineering

The above engagement areas relate to the following key GRC competencies:

- Air-Breathing Propulsion
- Communications Technology and Development
- In-Space Propulsion & Cryogenic Fluids Management
- Power, Energy Storage and Conversion
- Materials and Structures for Extreme Environment
- Physical Sciences and Biomedical Technologies in Space

Armstrong Flight Research Center, (AFRC) POC: Oscar Murillo, Oscar.J.Murillo@nasa.gov

- Autonomy (Collision Avoidance, Separation assurance, formation flight, peak seeking control)
  (POC: Jack Ryan, AFRC-RC)
- Adaptive Control
  (POC: Curt Hanson, AFRC-RC)
- Hybrid Electric Propulsion
  (POC: Starr Ginn, AFRC-R)
- Control of Flexible Structures using distributed sensor feedback
  (POC: Marty Brenner, AFRC-RS; Peter Suh, AFRC-RC)
- Supersonic Research (Boom mitigation and measurement)
  (POC: Ed Haering, AFRC-RA)
- Supersonic Research (Laminar Flow)
  (POC: Dan Banks, AFRC-RA)
- Environmental Responsive Aviation
  (POC: Mark Mangelsdorf, AFRC-RS)
- Hypersonic Structures & Sensors
  (POC: Larry Hudson, AFRC-RS)
- Large Scale Technology Flight Demonstrations (Towed Glider)
  (POC: Steve Jacobson, AFRC-RC)
- Aerodynamics and Lift Distribution Optimization to Reduce Induced Drag
  (POC: Al Bowers, AFRC-R)

Marshall Space Flight Center (MSFC), POC: Frank Six, frank.six@nasa.gov

Propulsion Systems

- Launch Propulsion Systems
- In-Space Propulsion (Cryogenics, Green Propellants, High Pulse Power, Electric, Nuclear - Thermal, Solar Thermal, Solar Sails, Tethers
- Propulsion Test beds and Demonstrators
- Cryogenic Fluid Management
- Rapid Affordable Manufacturing of Propulsion Components
- Composite Structures
- Materials Research

Space Systems

- Fission Surface Power
- In-Space Habitation with Emphasis on Life Support Systems and Nodes/Elements
- In Situ Resource Utilization
- Mechanical Design & Fabrication
- Small Affordable ISS Payloads

- Robotics Platforms
- In-Space Asset Management (Automated Rendezvous & Capture, De-Orbit, Orbital Debris Mitigation)

Space Transportation

- Advanced Manufacturing with Emphasis on In-Space Fabrication & Repair
- Space Environmental Effects and Space Weather
- Lander Systems and Technologies
- Small Spacecraft and Enabling Technologies (Nanolaunch Systems)
- 3D Printing / Additive Manufacturing
- Meteoroid Environment

Science

- Replicated Optics
- High Energy Astrophysics (X-ray, gamma ray, cosmic ray)
- Heliophysics
- Interstellar & Planetary Dust
- Radiation Mitigation
- Next Generation Observatories
- Earth / Atmospheric Science
- Severe Storms Research
- Climate Dynamics
- Lightning Research
- Remote Sensing
- Planetary Geophysics/Atmospheres

Kennedy Space Center, POC Michael Lester, gregory.m.lester@nasa.gov

- TA 4.0 Robotics and Autonomous Systems, **Robert Mueller**, rob.mueller@nasa.gov, ph: 321-867-2557
    - 4.1 Sensing and Perception
    - 4.1.4 Natural, Man-Made Object, and Event Recognition
    - 4.3 Manipulation
    - 4.3.6 Sample Acquisition and Handling
    - 4.5 System-Level Autonomy
    - 4.5.3 Autonomous Guidance and Control
- TA 6.0 Human Health, Life Support, and Habitation Systems, **Raymond Wheeler**, Raymond.m.wheeler@nasa.gov, ph: 321-861-2950
    - 6.1 Environmental Control and Life Support Systems and Habitation Systems
    - 6.1.1 Air Revitalization
    - 6.1.2 Water Recovery and Management
    - 6.1.3 Waste Management
- TA 7.0 Human Exploration Destination Systems, **Tracy Gill**, tracy.r.gill@nasa.gov, ph: 321-867-5824
    - 7.1 In-Situ Resource Utilization
    - 7.1.1 Destination Reconnaissance, Prospecting, and Mapping
    - 7.1.2 Resource Acquisition
    - 7.1.3 Processing and Production
    - 7.1.4 Manufacturing Products and Infrastructure Emplacement

    - 7.2 Sustainability and Supportability
    - 7.2.4 Food Production, Processing, and Preservation
- TA 13.0 Ground and Launch Systems, **Jack Fox,** jack.j.fox@nasa.gov, ph: 321-867-4413
    - 13.2 Environmental Protection and Green Technologies
    - 13.2.5 Curatorial Facilities, Planetary Protection, and Clean Rooms
    - 13.3 Reliability and Maintainability
    - 13.3.3 On-Site Inspection and Anomaly Detection and Identification
    - 13.3.6 Repair, Mitigation, and Recovery Technologies
- KSC SBIR, Mr. **Mike Vinje**, PH# 321-861-3874, michael.e.vinje@nasa.gov):
    - Standardized Interfaces (a USB port for space)
    - A substantial portion of pre-launch processing involves the integration of spacecraft assemblies to each other or to the ground systems that supply the commodities, power or data. Each stage or payload requires an interface that connects it to the adjacent hardware which includes flight critical seals or connectors and other components. Development and adoption of simplified, standardized interfaces holds the potential of reducing the cost and complexity of future space systems, which increases the funding available for flight hardware and drives down the cost of access to space for everyone.
- Ammonia Recovery System for Wastewater:
http://technology.ksc.nasa.gov/documents/Tops/TOPS_13681_Ammonia_Recovery_System_Wastewater.pdf
- High Performance Polyimide Powder Co*atings:*
http://technology.ksc.nasa.gov/documents/Tops/TOPS_12777_Polyimide_Powder_Coatings.pdf
- Wire Damage Detection and Rerouting System:
http://technology.ksc.nasa.gov/documents/Tops/TOPS_12866_13285_InSituWireDamage.pdf

- **Jet Propulsion Laboratory (JPL),** POC: Linda Rodgers, linda.l.rodgers@jpl.nasa.gov
- Solar System Science
Planetary Atmospheres and Geology; Solar System characteristics and origin of life; Primitive solar systems bodies; Lunar science; Preparing for returned sample investigations
- Earth Science
Atmospheric composition and dynamics; Land and solid earth processes; Water and carbon cycles; Ocean and ice; Earth analogs to planets; Climate Science
- Astronomy and Fundamental Physics
Origin, evolution, and structure of the universe; Gravitational astrophysics and fundamental physics; Extra-solar planets and star and planetary formation; Solar and Space Physics; Formation and evolution of galaxies
- In-Space Propulsion Technologies
Chemical propulsion; Non-chemical propulsion; Advanced propulsion technologies; Supporting technologies
- Space Power and Energy Storage
Power generation; Energy storage; Power management & distribution; Cross-cutting technologies
- Robotics, Tele-Robotics and Autonomous Systems
Sensing; Mobility; Manipulation technology; Human-systems interfaces; Autonomy; Autonomous rendezvous & docking; Systems engineering
- Communication and Navigation
Optical communications & navigation technology; Radio frequency communications; Internetworking; Position, navigation and timing; Integrated technologies; Revolutionary concepts

- Human Exploration Destination Systems
  In-situ resource utilization and Cross-cutting systems
- Science Instruments, Observatories and Sensor Systems
  Science Mission Directorate Technology Needs; Remote Sensing instruments/sensors; Observatory technology; In-situ instruments/sensor technologies
- Entry, Descent and Landing Systems
  Aerobraking, aerocapture and entry systems; Descent; Landing; Vehicle system technology
- Nanotechnology
  Engineered materials; Energy generation and storage; Propulsion; Electronics, devices and sensors
- Modeling, Simulation, Information Technology and Processing
  Flight and ground computing; Modeling; Simulation; Information processing
- Materials, Structures, Mechanical Systems and Manufacturing
  Materials; Structures; Mechanical systems; Cross cutting
- Thermal Management Systems
  Cryogenic systems; Thermal control systems (near room temperature); Thermal protection systems

Johnson Space Center (JSC), POC: Kamlesh Lulla, kamlesh.p.lulla@nasa.gov

- Propulsion systems and Technologies
- In-space propulsion technologies
- Energy Storage technologies-Batteries, Regenerative Fuel cells
- Robotics and TeleRobotics
- Crew decision support systems
- Immersive Visualization
- Human Robotic interface
- Flight and Ground communication systems
- Advanced habitat systems
- GN&C for descent systems
- Large body GN&C
- Human system performance modeling
- Imaging and information processing
- Semantic Technologies
- Simulation and modeling
- Materials and structures
- Lightweight structure
- Smallsat and antennas

Stennis Space Center, POC: Nathan Sovik, nathan.a.sovik@nasa.gov

- Active and Passive Nonintrusive Remote Sensing of Propulsion Test Parameters
- Intelligent Integrated System Health Management (ISHM) in Rocket Test-Stands
- Advanced Non-Destructive Evaluation Technologies
- Advanced Propulsion Systems Testing
- Cryogenic Instrumentation and Cryogenic, High Pressure, and Ultrahigh Pressure Fluid Systems
- Ground Test Facilities Technology
- Propulsion System Exhaust Plume Flow Field Definition and Associated Plume Induced Acoustic & Thermal Environments
- Vehicle Health Management/Rocket Exhaust Plume Diagnostics

PROPULSION TESTING

Active and Passive Nonintrusive Remote Sensing of Propulsion Test Parameters

The vast amount of propulsion system test data is collected via single channel, contact, intrusive sensors and instrumentation. Future propulsion system test techniques could employ passive nonintrusive remote sensors and active nonintrusive remote sensing test measurements over wide areas instead of at a few discrete points. Opportunities exist in temperature, pressure, stress, strain, position, vibration, shock, impact, and many other measured test parameters. The use of thermal infrared, ultraviolet, and multispectral sensors, imagers, and instruments is possible through the SSC sensor laboratory.

Intelligent Integrated System Health Management (ISHM) in Rocket Test-Stands

SHM is a capability to determine the condition of every element of a system continuously. ISHM includes detection of anomalies, diagnosis of causes, and prognosis of future anomalies; as well as making available (to elements of the system and the operator) data, information, and knowledge (DIaK) to achieve optimum operation. In this context, we are interested in methodologies to embed intelligence into the various elements of rocket engine test-stands, e.g., sensors, valves, pumps, tanks, etc. Of particular interest is the extraction of qualitative interpretations from sensor data in order to develop a qualitative assessment of the operation of the various components and processes in the system. The desired outcomes of the research are: (1) to develop intelligent sensor models that are self-calibrating, self- configuring, self-diagnosing, and self- evolving (2) to develop intelligent components such as valves, tanks, etc., (3) to implement intelligent sensor fusion schemes that allow assessment, at the qualitative level, of the condition of the components and processes, (4) to develop a monitoring and diagnostic system that uses the intelligent sensor models and fusion schemes to predict future events, to document the operation of the system, and to diagnose any malfunction quickly, (5) to develop architectures/taxonomies/ontologies for integrated system health management using distributed intelligent elements, and (6) to develop visualization and operator interfaces to effectively use the ISHM capability.

Advanced Non-Destructive Technologies

Advances in non-destructive evaluation (NDE) technologies are needed for fitness-for-service evaluation of pressure vessels used in rocket propulsion systems and test facilities. NDE of ultra-high pressure vessels with wall thicknesses exceeding 10 inches require advanced techniques for the detection of flaws that may affect the safe use of the vessels.

Advanced Propulsion Systems Testing

Innovative techniques will be required to test propulsion systems such as advanced chemical engines, single- stage-to-orbit rocket plane components, nuclear thermal, nuclear electric, and hybrids rockets. New and more cost- effective approaches must be developed to test future propulsion systems. The solution may be some combination of computational- analytical technique, advanced sensors and instrumentation, predictive methodologies, and possibly subscale tests of aspects of the proposed technology.

Cryogenic Instrumentation and Cryogenic, High Pressure, and Ultrahigh Pressure Fluid Systems

Over 40 tons of liquefied gases are used annually in the conduct of propulsion system testing at the Center. Instrumentation is needed to precisely measure mass flow of cryogens starting with very low flow rates and ranging to very high flow rates under pressures up to 15,000 psi.

Research, technology, and development opportunities exist in developing instruments to measure fluid properties at cryogenic conditions during ground testing of space propulsion systems. Both intrusive and nonintrusive sensors, but especially nonintrusive sensors, are desired.

Ground Test Facilities Technology

SSC is interested in new, innovative ground-test techniques to conduct a variety of required developmental and certification tests for space systems, stages/vehicles, subsystems, and components. Examples include better coupling and integration of computational fluid dynamics and heat transfer modeling tools focused on cryogenic fluids for extreme conditions of pressure and flow; advanced control strategies for non- linear multi-variable systems; structural modeling tools for ground-test programs; low-cost, variable altitude simulation techniques; and uncertainty analysis modeling of test systems.

Propulsion System Exhaust Plume Flow Field Definition and Associated Plume Induced Acoustic & Thermal Environments

Background: An accurate definition of a propulsion system exhaust plume flow field and its associated plume induced environments (PIE) are required to support the design efforts necessary to safely and optimally accomplish many phases of any space flight mission from sea level or simulated altitude testing of a propulsion system to landing on and returning from the Moon or Mars. Accurately defined PIE result in increased safety, optimized design and minimized costs associated with: 1. propulsion system and/or component testing of both the test article and test facility; 2. any launch vehicle and associated launch facility during liftoff from the Earth, Moon or Mars; 3. any launch vehicle during the ascent portion of flight including staging, effects of separation motors and associated pitch maneuvers; 4. effects of orbital maneuverings systems (including contamination) on associated vehicles and/or payloads and their contribution to space environments; 5. Any vehicle intended to land on and return from the surface of the Moon or Mars; and finally 6. The effects of a vehicle propulsion system on the surfaces of the Moon and Mars including the contaminations of those surfaces by plume constituents and associated propulsion system constituents. Current technology status and requirements to optimally accomplish NASA s mission: In general, the current plume technology used to define a propulsion system exhaust plume flow field and its associated plume induced environments is far superior to that used in support of the original Space Shuttle design. However, further improvements of this technology are required: 1. in an effort to reduce conservatism in the current technology allowing greater optimization of any vehicle and/or payload design keeping in mind crew safety through all mission phases; and 2. to support the efforts to fill current critical technology gaps discussed below. PIE areas of particular interest include: single engine and multi-engine plume flow field definition for all phases of any space flight mission, plume induced acoustic environments, plume induced radiative and convective ascent vehicle base heating, plume contamination, and direct and/or indirect plume impingement effects. Current critical technology gaps in needed PIE capabilities include: 1. An accurate analytical prediction tool to define convective ascent vehicle base heating for both single engine and multi- engine vehicle configurations. 2. An accurate analytical prediction tool to define plume induced environments associated with advanced chemical, electrical and nuclear propulsion systems. 3. A validated, user friendly free molecular flow model for defining plumes and plume induced environments for low density external environments that exist on orbit, as well as interplanetary and other planets.

Vehicle Health Management/Rocket Exhaust Plume Diagnostics

A large body of UV-Visible emission spectrometry experimentation is being performed during the 30 or more tests conducted each year on the Space Shuttle Main Engine at SSC. Research opportunities are available to quantify failure and wear mechanisms, and related plume code

validation. Related topics include combustion stability, mixture ratio, and thrust/power level. Exploratory studies have been done with emission/absorption spectroscopy, absorption resonance spectroscopy, and laser induced fluorescence. Only a relatively small portion of the electromagnetic spectrum has been investigated for use in propulsion system testing and exhaust plume diagnostics/vehicle health management.

Langley Research Center (LaRC), POC: Gamaliel (Dan) Cherry, Gamaliel.R.Cherry@nasa.gov
Intelligent Flight Systems – Revolutionary Air Vehicles
(POC: Guy Kemmerly 757-864-5070)

- Atmospheric Characterization – Active Remote Sensing
  (POC: Malcolm Ko 757-864-8892)
- Systems Analysis and Concepts - Air Transportation System Architectures & Vehicle Concepts
- (POC: Michael Marcolini 757-864-3629)
- Advanced Materials & Structural System – Advanced Manufacturing
  (POC: David Dress 757-864-5126)
- Aerosciences - Trusted Autonomy
  (POC: Sharon Graves 757-864-5018)
- Entry, Decent & Landing - Robotic Mission Entry Vehicles
  (POC: Keith Woodman 757-864-7692)
- Measurement Systems - Advanced Sensors and Optical Measurement
  (POC: Tom Jones 757-864-4903)

2.5 Research Student Support

The use of NASA EPSCoR funds for support of research students is not required but is allowable, and if used, must be detailed in the Budget Justification and described in the narrative and evaluation sections of the proposal (Section 8.0.: Proposal Evaluation Criteria and Selection Process).

2.6 Partnerships and Interactions

All institutions of higher education within an eligible jurisdiction must be made aware of the FY2015 NASA EPSCoR CAN and given the opportunity to compete. *All proposals must be submitted through the jurisdiction's NASA EPSCoR Director's office*. Jurisdictions are strongly encouraged to submit proposals that demonstrate partnerships or cooperative arrangements among academia, government agencies, business and industry, private research foundations, jurisdiction agencies, and local agencies. Inclusion of faculty and students from underrepresented/underserved groups is encouraged.

NASA-funded, in-kind services provided by NASA Centers or Mission Directorates should be identified as NASA responsibilities in the proposals and are not to be included in the 50% matching requirement.

Statements of commitment and letters of support are important components of the proposal. NASA does not, however, solicit or evaluate letters of endorsement. Review the *NASA Guidebook for Proposers* for distinctions among statements of commitment, letters of support, and letters of endorsement.

3.0 Program Management

3.1 NASA EPSCoR Program and Project Levels

The NASA EPSCoR is a component of the Aerospace Research and Career Development Program administered by the Office of Education at NASA Headquarters. NASA EPSCoR Program Management is closely coordinated with NASA Headquarters program offices (research and educational) and the Centers.

NASA EPSCoR Project Management resides at the Kennedy Space Center (KSC). NASA EPSCoR Project Management has the overall responsibility for oversight, evaluation, and reporting. Technical and scientific questions about programs in this solicitation may be directed to the NASA EPSCoR Project Manager.

The primary points of contact for the Mission Directorates and the NASA Centers are listed in Appendix D.

3.2 Jurisdiction Level

The jurisdiction's NASA EPSCoR Director will serve as the managing Principal Investigator (PI) on the award, providing leadership and direction for the team from an oversight role. The submitting and awardee institution will be that of the jurisdiction's NASA EPSCoR Director. The Director is responsible for oversight and overall management of the project to assure compliance with NASA EPSCoR. The Director is responsible for ensuring the timely reporting by the team of progress and accomplishments of its work. The investigator in charge of the scientific direction of the proposed work should be listed as the Science-I (Co-I/Science-I). If the Co-I/Science-I's institution is different from the submitting institution, awards may be made to the Co-I/Science-I's institution through a subcontract.

The Government's obligation to continue any award is based on satisfactory progress as detailed in the recipient's required annual progress reports. The research proposal can include a reasonable level of funding for management, administrative, and oversight function of the jurisdiction's NASA EPSCoR Director. This amount, if required, must be included in the $750,000 cap.

The jurisdiction's NASA EPSCoR Director should provide guidance and updates to the Co-Is regarding NASA policy and direction from both an Agency technical perspective and from a NASA EPSCoR programmatic standpoint. The Director is responsible for maintaining an awareness of NASA research and technology development priorities and jurisdiction research priorities. As the primary point of contact for NASA regarding EPSCoR in the jurisdiction, it is expected that the Director maintains connections with the jurisdiction's EPSCoR committee and (the Director) identifies and develops opportunities for collaboration within the jurisdiction with existing EPSCoR and EPSCoR-like programs from other federal agencies. It is also expected that the Director will consult with appropriate jurisdiction organizations such as the economic development commission and the jurisdiction's EPSCoR Committee in attending to jurisdiction research priorities.

3.3 Schedule

The schedule for the review and selection of proposals for this announcement is as follows:

Notices of Intent Due: **February 2, 2015**
Proposals Due: **March 19, 2015**

3.4 Cancellation of Program Announcement

NASA Office of Education reserves the right to not make awards under this CAN and to cancel this CAN. NASA assumes no liability (including bid and proposal costs) for cancelling the CAN or for any entity's failure to receive actual notice of cancellation.

3.5 Inquiries

Technical and scientific questions about this CAN may be directed to:

Jeppie R. Compton
Project Manager, NASA EPSCoR
Office of Education/EX-E
Kennedy Space Center, FL 32899-0001
E-mail: jeppie.r.compton@nasa.gov
Telephone: (321) 867-6988

Inquiries regarding the submission of proposal materials may be addressed to:

Althia Harris
NASA Research and Education Support Services (NRESS)
2345 Crystal Drive, Suite 500
Arlington, VA 22202-4816
E-mail: aharris@nasaprs.com
Telephone: (202) 479-9030 x310
Fax: (202) 479-0511

4.0 Proposal Review and Selection

4.1 Evaluation Criteria

Evaluation by peers of the proposed personnel will be used to assess each proposal's overall merit. The evaluation criteria are: Intrinsic Merit, NASA Alignment and Partnerships, Management and Evaluation, and Budget Justification: Narrative and Details. For descriptions of these, see Section 8.0, Proposal Evaluation Criteria and Selection Process.

4.2 Review and Selection Processes

Review of proposals submitted in response to this CAN will be consistent with the general policies and provisions contained in the *NASA Guidebook for Proposers*, Appendix C. The evaluation criteria described in this CAN under Section 8.0, Proposal Evaluation Criteria and Selection Process, take precedence over the evaluation criteria described in Section C.2 of the *NASA Guidebook for Proposers*. However, selection procedures will be consistent with the provisions of the *NASA Guidebook for Proposers*, Section C.5. The selecting official for this CAN is the Associate Administrator for Education at NASA Headquarters.

4.3 Selection Announcement

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 NASA's budget process may result in a delay

of the selection date(s). After 180 days past the proposal's submitted date, proposers may contact the NASA EPSCoR Project Manager for a status.

Notification of both the selected and non-selected proposals will be consistent with the policy contained in the *NASA Guidebook for Proposers*, Section C.5.3. Proposers not selected will be notified by electronic mail and offered a debriefing consistent with the policy in the *NASA Guidebook for Proposers*, Section C.6.

5.0 Award Administration Information

5.1 Notice of Award

For selected proposals, a NASA Grants Officer will contact the business office of the proposer's institution. The NASA Grants Officer is the only official authorized to obligate the Government. For a grant or cooperative agreement, any costs that the proposer incurs in anticipation of an award will be subject to the *NASA Grant and Cooperative Agreement Handbook,* 14 CFR § 1260.125(e).

5.2 Administrative and National Policy Requirements

This solicitation does not invoke any special administrative or national policy requirements, nor do the resulting awards involve any special terms and conditions that differ from NASA's terms and conditions as provided in the *Grant and Cooperative Agreement Handbook* and *the NASA Guidebook for Proposers,* with the exception that this solicitation contains a cost share requirement.

5.3 Award Reporting Requirements

The reporting requirements for awards made through this CAN will be consistent with the *Grant and Cooperative Agreement Handbook,* Exhibit G. Specific reporting requirements are described below.

Annual Progress and Final Reports

During the first two years of performance, recipients are required to submit an annual progress report at least 60 days prior to the anniversary date of the start of the project. If the recipient requests and is granted a no-cost extension (NCE), a report is also required at least 60 days prior to the anniversary date of the start of the project or with the NCE request, whichever is sooner. This progress report will document project activities during the reporting year.

A final report is required no later than 90 days after the end of the award period and will document project activities over the entire period of the award as well as overall progress towards project objectives. NASA EPSCoR staff and a NASA Technical Monitor will review these progress reports.

Research projects will be required to submit annual performance data, project information, and Program Performance Measures data through the NASA Office of Education Performance Measurement (OEPM) system. These OEPM reports may or may not coincide with the annual report dates. The OEPM reporting is managed through HQ NASA.

NASA will provide research projects with specific guidelines for the submission of OEPM data. Every effort will be made to streamline the reporting burden for these requirements, while complying with federal and education reporting requirements. NASA will provide specific formats and data entry forms to the respective jurisdictions.

Reference 14 CFR § 1260.22 Technical publications and reports

(b) Reports shall be in the English language, informal in nature, and ordinarily not exceed three pages (not counting bibliographies, abstracts, and lists of other media).

A. Cover Page – The information below is required by the NSSC and the NASA EPSCoR Project Office:

- Exact title of cooperative agreement as indicated on the original proposal and with the NSSC
- Grant (Cooperative Agreement) Number
- *Note: Check exact title, grant number and start & end dates at:* https://www.nssc.nasa.gov/grantstatus
- Type of Report
  - Annual Progress Report, indicate YR1, YR2, YR3 NCE, etc.
    - Due yearly no later than 60 days before grant start date anniversary
    - PDF emailed to Agency-EPSCoR@mail.nasa.gov and NSSC-Grant-Report@mail.nasa.gov
  - Final Performance Report (*a.k.a. NSSC's Summary of Research*)
    - Due no later than 90 days after grant end date
    - PDF emailed to Agency-EPSCoR@mail.nasa.gov and NSSC-CloseOut@mail.nasa.gov
    - When submitting a Final Performance Report *only* the NSSC will require the completion of form "Summary of Research Cover Page Template.pdf" listing new technology and federally owned property. A complete list of all required forms as requested by the NSSC is at: https://searchpub.nssc.nasa.gov/servlet/sm.web.Fetch/NSSC_G_CA_Required_Closeout_Reports.pdf?rhid=1000&did=1668119&type=released
    - When submitting final reports, remember to also go to https://invention.nasa.gov/index.php and report any new technology

2. Period Covered by Report
   - First annual progress report – first 10 months
   - Following annual progress reports – previous 12 months only
   - Final progress report – full duration of the grant
3. Date of Report
4. PI name & contact information
5. ScI name & contact information
6. Grant Institution

B. Narrative Summary – An excellent report narrative summarizes evidence of achievement measured against the proposed goals and objectives. Achievements, showing no gaps, incomplete or circumstantial documentation, are confirmed with back up attachments. It is a description of the progress of the program toward proposed objectives during the time period of the report only. It documents progress and highlights major impact accomplishments. *The narrative should contain text only and not exceed 3 pages.*

C. Attachments – Use as many pages as needed. Attachments should contain photos with captions (600 dpi, 5"x7"), official document scans, web links with summary paragraph, and scans of newspaper/journal articles, awards and agendas. The narrative should reference

attachments. Tables may be used. Supporting documentation will include, but not limited to:

1. Detail of research objectives and targets – The targets stated in the proposal should be re-stated followed by a list of achievements, including names, titles, and institutions when applicable
2. Systemic change as evidenced by:
    - Improvements in jurisdiction research and development infrastructure
    - Increased financial commitment from the jurisdiction, industry, and participating institutions
    - Response of activities to NASA and jurisdiction priorities
    - Reordered jurisdiction and/or institutional priorities
3. Examples of successful technology transfer to the private sector listed with verifiable detail
4. Extent to which individual collaborations have evolved listed in terms of researchers, collaborating entities and benefit of the collaboration based on the research priorities of the jurisdiction. Only include agencies/institutions not identified below in faculty/research participants. Identify collaborations as:
    - NASA Center
    - Other federal agency
    - Jurisdiction agency
        - Other academic institution
        - Industry
        - Others – Specify
5. Discussion of interaction between and cooperation with the jurisdiction's Space Grant Consortium
6. List with details of research success of individual investigators and project as a whole as measured by:
    - Peer reviewed publications and accreditations such as abstracts at professional meetings, book chapters, reports, manuscripts, and articles for NASA venues or in refereed journals, which have been accepted or published
    - Conference proceedings, talks, presentations at professional meetings– include topics and participation as panel member, keynote speeches, session chair, etc.
7. Patents applied for or patents pending, include:
    - Application Serial No:
    - Title:
    - Application Date:
    - Inventor(s) and institution(s):
    - Abstract: (100-150 words)
8. Patents awarded, include (scan of patent is acceptable):
    - Patent Number:
    - Title:
    - Application Date
    - Date Issued:
    - Inventor(s) and institution(s):
    - Abstract: (100-150 words)
9. Technical transfer activities and partner (for a final report, on the NSSC cover page reference "Attachment 9 Technical Transfer Activities" and page number for details)
10. List new (follow-on) grants by funding entity and value of grants awarded
11. Name and course number and Institution of new or revised courses that target STEM

Skills
12. Faculty/Research/Post Graduate participants listed by name and institution
13. List any faculty/student *recognition* awards, include verification information
14. Brief (200 word) Spin Off, success story or highlight, include a sentence long caption and photo (600 dpi, 5"x7") based on information above Project highlights suitable for presentation, i.e. newspaper articles, links to online articles, specific facility or student recognition, photos with topic line and one paragraph explanation.

An annual report should include a revised schedule and budget of project activities only if there are significant deviations from the original proposal.

Accomplishments toward project goals will be evaluated by reference to indicators such as, but not limited to, the metrics outlined above. NASA may approve no-cost extensions when requested by the recipient in accordance with the *NASA Grant and Cooperative Agreement Handbook*.

The NASA EPSCoR project office will review the annual and final reports for completeness. Failure to provide an annual project report and/or final report will delay or preclude the participation of the respective jurisdiction in other funding opportunities related to NASA EPSCoR.

6.0 Updates and Submission Information

6.1 Announcement of Updates/Amendments to Solicitation

Additional programmatic information for this CAN may develop before the proposal due date. If so, such information will be added as a formal amendment to this CAN as posted at its homepage on http://nspires.nasaprs.com.

Any clarifications or questions and answers regarding this CAN will be posted at its homepage on http://nspires.nasaprs.com.

It is the responsibility of the prospective proposer to regularly check this CAN's homepage for updates.

6.2 Electronic Submission of Proposal Information

On-time electronic submission via NSPIRES (http://nspires.nasaprs.com) or Grants.gov (http://www.grants.gov) is required for every proposal. Note carefully the following requirements for submission of an electronic proposal, regardless of the intent to submit via NSPIRES or Grants.gov.

- Every organization that intends to submit a proposal to NASA in response to this CAN must be registered in NSPIRES. This applies both to proposals submitted via Grants.gov, as well as for proposals submitted via NSPIRES. Every organization that intends to submit a proposal through Grants.gov must also be registered in Grants.gov, as well as in NSPIRES. Registration for either proposal data system must be performed by an organization's electronic business point-of-contact (EBPOC) that holds a valid registration with the System for Award Management (SAM) https://www.sam.gov/portal/public/SAM/
- Each individual team member (e.g., PI, co-investigators, etc.), including all personnel named on the proposal's electronic cover page, must be individually registered in NSPIRES. This applies both to proposals submitted via Grants.gov, as well as for proposals submitted via NSPIRES.

While every effort is made to ensure the reliability and accessibility of the web site and to maintain a help center via e-mail and telephone, difficulty may arise at any point on the internet, including with the user's own equipment. Prospective proposers are urged to familiarize themselves with the NSPIRES site and to submit the required proposal materials well in advance of the proposal submission deadline. Difficulty in registering with or using a proposal submission system (either NSPIRES or Grants.gov) is not, in and of itself, a sufficient reason for NASA to consider a proposal that is submitted after the proposal due date (see Appendix E).

6.3 Proposal Submission Date and Time

All proposals in response to this CAN must be submitted electronically via NSPIRES (http://nspires.nasaprs.com) or Grants.gov (http://www.grants.gov/search/agency.do). Hard copies of the proposal will not be accepted. Electronic proposals must be submitted in their entirety by 11:59 p.m., Eastern Time on the proposal due date of **March 19, 2015.**

Respondents without access to the Web or who experience difficulty using the NSPIRES proposal site (http://nspires.nasaprs.com) may contact the Help Desk at nspires-help@nasaprs.com or call 202-479-9376 between 8:00 a.m. and 6:00 p.m. (EDT), Monday through Friday, except Federal holidays. Proposals that are late will be handled in accordance *with NASA's policy as given in the NASA Guidebook for Proposers, Appendix B, Section (g) (also* see Sections 3.2 and F.23). Proposals received after the due date may be returned without review. If a late proposal is returned, it is entirely at the proposer's discretion whether or not to resubmit it in response to a subsequent appropriate solicitation.

7.0 Proposal Preparation

Required elements of the proposal are described below and must be submitted as one or more PDF documents that are uploaded for proposal submission. Please refer to Appendix E of this announcement for NSPIRES instructions on proposal submission procedures. Section 2.2 of the *NASA Guidebook for Proposers* provides guidelines for style formats and Section 2.3 provides guidelines for proposal content.

REQUIRED CONSTITUENT PARTS OF A PROPOSAL (in order of assembly)	PAGE LIMIT
Proposal Cover Page	No page limit when generated by electronic proposal system 4,000 characters, included in Proposal Cover Page
Proposal Summary (abstract)	
Table of Contents	1
Scientific/Technical/Management Section	15*
References and Citations	As needed
Biographical Sketches for:	
the Principal Investigator(s)	2 (per PI)
each Co-Investigator	1
Current and Pending Support	As needed
Statements of Commitment and Letters of Support	As needed
Budget Justification: Narrative and Details *(including Proposing Organization Budget, itemized lists detailing expenses within major budget categories, and detailed subcontract/subaward budgets)*	
Budget Narrative	As needed
(including Summary of Proposal Personnel	1
and Work Effort and Facilities and Equipment)	2
Budget Details	As needed
Special Notifications and/or Certifications	As needed

* *includes all illustrations, tables, and figures, where each "n-page" fold-out counts as n-pages and each side of a sheet containing text or an illustration counts as a page. Note: This page limit may be superseded by instructions in the NRA.*

8.0 Proposal Evaluation Criteria and Selection Process

Successful research proposals are likely to be those that provide sound contributions to both immediate and long-term scientific and technical needs of NASA as explicitly expressed in current NASA documents and communications, as well as contribute to the overall research infrastructure, science and technology capabilities, higher education, and economic development of the jurisdiction. Successful proposals will also include pragmatic plans for generation of sustained non-EPSCoR support.

Jurisdictions responding to this CAN may submit one proposal per paragraph 1.3 above. Proposals will be evaluated based on the following criteria: Intrinsic Merit, NASA Alignment and Partnerships, Management and Evaluation, and Budget Justification: Narrative and Details. The bulleted lists after each criterion below should not be construed as any indication of priority or relative weighting. The bullets are provided for clarity and facilitation of proposal development. **Note**: *The proposal must contain a section entitled "Relevance to NASA" and a section entitled "Relevance to Jurisdiction." Proposers should provide specific information on how they determined the relevance of the proposed effort to NASA. The relevance to NASA and the jurisdiction must be balanced.*

8.1 Intrinsic Merit (35% of score)

- **Proposed Research.** Proposals should provide a detailed narrative of the proposed research activity, including the scientific and/or technical merit of the proposed research, unique and innovative methods, approaches, concepts, or advanced technologies, and the potential impact of the proposed research on its field.
- **Existing Research** Proposals should provide baseline information about current research activities within the jurisdiction in the proposed research area, including projects currently funded under NASA EPSCoR. If relevant, the narrative should include a brief history of NASA EPSCoR Research projects in the jurisdiction and should include a discussion of how these previous NASA EPSCoR research projects or RID activities have helped prepare the institution and jurisdiction for and contributed to the proposed research activities. If the proposed research represents a new direction for the jurisdiction, the ability of the technical team to carry out the research should be explained. Other relevant research and technology development programs within the jurisdiction should be included.

8.2 NASA Alignment and Partnerships (35% of score)

Only NASA personnel will evaluate section 8.2.1:

8.2.1 Relevance to, Partnerships with, and Interactions with NASA.

- Proposals should discuss the value of the proposed research to NASA's research priorities.
- Proposals should describe the use of NASA content, people, or facilities in the execution of the research activities. They should describe current and/or previous interactions, partnerships, and meetings with NASA researchers, engineers, and scientists in the area of the proposed research, and discuss how future partnerships between the institution's researchers and personnel at the Mission Directorates and/or Centers will be fostered. The name(s) and title(s) of NASA researchers with whom the proposers will partner should be included.
- The utilization of NASA venues to publish accomplishments should be also considered. Proposals should describe the use of NASA content, people, or facilities in the execution of the research activities. The name(s) and title(s) of NASA researchers with whom the proposers will partner should be included. The utilization of NASA venues to publish accomplishments should be also considered.

8.2.2 Relevance to, Partnerships with, and Interactions with the Jurisdiction.

- Proposals should discuss the value of the proposed research to the jurisdiction's research priorities.
- Proposals should articulate clearly how the proposed research activities build capacity in the jurisdiction. In particular, proposers should explain how the current proposed research fits into the strategic plan for NASA EPSCoR-related research in the jurisdiction.
- Proposals should delineate mechanisms for building partnerships with universities, industry, and/or other government agencies to enhance the ability of the jurisdiction to achieve its objectives, to obtain and leverage sources of additional funding, and/or to obtain essential services not otherwise available.

8.2.3 Sustainability. Proposals should state how they plan to develop research competitiveness both in the jurisdiction and nationally.

8.3 Management and Evaluation (15% of score)

This section should describe the management structure for the proposed research, and coordination with the jurisdiction's NASA EPSCoR project management. The following elements should be included:

- **Results of Prior NASA EPSCoR Research Support:** If the current EPSCoR Director has administered NASA EPSCoR research awards (excluding Research Infrastructure Development (RID)) that were completed in the past five years, he or she must demonstrate accomplishments commensurate with the managerial and administrative expectations of the award. The EPSCoR Director will not be assessed on his/her expertise in the specific proposed research area (the Science-PI is tasked with managing the scientific/technical development progress). The following information must be provided: the NASA EPSCoR award number(s), amount(s) the title of the projects(s); and period(s) of support; primary outcomes resulting from the NASA EPSCoR award, including a summary discussion of accomplishments compared to the proposed outcomes from the original proposal; coordination with the research and technical development priorities of NASA, and contribution(s) to the overall research capacity of the jurisdiction.
- **Personnel:** A list of the personnel participating in this research program, including Principal Investigator and all Co-Investigators, Research Associates, Post-Doctoral Fellows, Students (projected numbers of both graduate and undergraduates), and other research participants should be included. The credentials of the researchers are important; however EPSCoR includes the concept of encouraging and helping new researchers.
- **Research Project Management:** A description of the management structure of the proposed research project, and the extent to which the project's management and research team will lead to a well-coordinated, efficiently-managed, and productive effort should be included.
- **Multi-Jurisdiction Projects:** If the proposed research is collaboration between more than one NASA EPSCoR jurisdiction, one jurisdiction must be identified as the lead while additional partners should be identified as sub-awardees. The proposal should detail the inter-jurisdiction management structure of the proposed research project, including a list of the participating jurisdictions, and the participating universities and agencies within each jurisdiction. Multi-jurisdictional proposals may not exceed the $750,000 limit.
- **Project Evaluation:** Proposals should document the intended outcomes and offer metrics to demonstrate progress toward and achievements of these outcomes. They should discuss metrics to be used for tracking and evaluating project progress. Milestones and timetables for achievement of specific objectives during the award period should be presented. The proposal should describe an appropriate evaluation plan/process to document outcomes and demonstrate progress toward achieving objectives of proposed project elements. Evaluation methodology should be based upon reputable models and techniques appropriate to the content and scale of the project. Projects should implement improvements throughout the entire period of performance based on ongoing evaluation evidence.

  Of particular interest to the NASA Office of Education is a reliable method for longitudinal tracking of student progress. If the proposal includes a plan for student support, the proposal should provide for gathering student performance data. Projects will be required to utilize the NASA Office of Education Performance Management (OEPM) system for longitudinal tracking of any student participants.

- **Tracking of Program Progress:** To the extent reasonable, proposals should discuss how the following will be assessed:
  - the progress and potential towards achieving self-sufficiency beyond the award period of the research capabilities developed under this grant; and
  - the potential for the proposed research area to continue to grow in importance in NASA-related fields in the future.
- **Continuity:** If applicable, proposals should describe the role of EPSCoR in connecting to their other NASA education or research projects. They should include methods for effecting the transition of participants to succeeding levels of involvement or facilitating career opportunities. This principle also refers to continuity in research capability. The proposal may contain project efforts directed particularly at involving young researchers in new fields of research that have promise to provide NASA with long-term quality research and development.

8.4 Budget Justification: Narrative and Details (15%)

A detailed budget, including NASA and cost-share funds, is required for the three years of performance. Preparation guidelines for the budget can be found in the *NASA Guidebook for Proposers*, Section 2.3.10 which includes a suggested format to use in preparing the proposed budget. All sources of cost-sharing shall be described and documented. The budget will be evaluated based upon the clarity and reasonableness of the funding request. A budget narrative should be included that discusses other budgetary issues such as the extent and level of jurisdiction, industrial, and institutional commitment and financial support, including resources (staff, facilities, laboratories, indirect support, waiver of indirect costs, etc.).

The proposed budget should be adequate, appropriate, reasonable, and realistic, and demonstrate the effective use of funds in alignment with the proposed project. This section should include detailed budgets for each of the three years of the funding and a summary budget for all three years. The proposed budget should reflect clear alignment with the content and text of the proposal. The budget should contain sufficient cost detail and supporting information to facilitate evaluation.

Appendix A: NASA Missions

NASA's Mission *to pioneer the future in space exploration, scientific discovery, and aeronautics research,* draws support from four Mission Directorates, each with a specific responsibility.

A.1 Aeronautics Research Mission Directorate (ARMD) works to solve the challenges that still exist in our nation's air transportation system: air traffic congestion, safety and environmental impacts. Solutions to these problems require innovative technical concepts, and dedicated research and development. NASA's ARMD pursues the development of new flight operation concepts, and new tools and technologies that can transition smoothly to industry to become products.

Through green aviation, NASA is helping create safer, greener and more effective travel for everyone. Our green aviation goals are to enable fuel-efficient flight planning, and reduce aircraft fuel consumption, emissions and noise. NASA aeronautics' four research programs conduct fundamental, cutting-edge research into new aircraft technologies, as well as systems-level research into the integration of new operations concepts and technologies into the Next Generation Air Transportation System (NextGen). A fifth program manages a portfolio of wind tunnels and other testing facilities (icing, propulsion), flight research and support aircraft, and the evolution of test technologies at NASA centers around the country. Additional information on the Aeronautics Research Mission Directorate (ARMD) can be found at: **(**http://www.aeronautics.nasa.gov**)**

A.2 Human Exploration & Operations Mission Directorate (HEOMD) provides the Agency with leadership and management of NASA space operations related to human exploration in and beyond low-Earth orbit. HEO also oversees low-level requirements development, policy, and programmatic oversight. The International Space Station, currently orbiting the Earth with a crew of six, represents the NASA exploration activities in low-Earth orbit. Exploration activities beyond low Earth orbit include the management of Commercial Space Transportation, Exploration Systems Development, Human Space Flight Capabilities, Advanced Exploration Systems, and Space Life Sciences Research & Applications. The directorate is similarly responsible for Agency leadership and management of NASA space operations related to Launch Services, Space Transportation, and Space Communications in support of both human and robotic exploration programs. Additional information on the Human Exploration & Operations Mission Directorate (HEOMD) can be found at: (http://www.nasa.gov/directorates/heo/home/index.html)

A.3 Science Mission Directorate (SMD) leads the Agency in four areas of research: Earth Science, Heliophysics, Planetary Science, and Astrophysics. SMD, using the vantage point of space to achieve with the science community and our partners a deep scientific understanding of our planet, other planets and solar system bodies, the interplanetary environment, the Sun and its effects on the solar system, and the universe beyond. In so doing, we lay the intellectual foundation for the robotic and human expeditions of the future while meeting today's needs for scientific information to address national concerns, such as climate change and space weather. At every step we share the journey of scientific exploration with the public and partner with others to substantially improve science, technology, engineering and mathematics (STEM) education nationwide. Additional information on the Science Mission Directorate (SMD) can be found at: (http://nasascience.nasa.gov)

A.4 The Space Technology Mission Directorate (STMD) is responsible for developing the crosscutting, pioneering, new technologies and capabilities needed by the agency to achieve its current and future missions.

STMD rapidly develops, demonstrates, and infuses revolutionary, high-payoff technologies through transparent, collaborative partnerships, expanding the boundaries of the aerospace enterprise. STMD employs a merit-based competition model with a portfolio approach, spanning a range of discipline areas and technology readiness levels. By investing in bold, broadly applicable, disruptive technology that industry cannot tackle today, STMD seeks to mature the technology required for NASA's future missions in science and exploration while proving the capabilities and lowering the cost for other government agencies and commercial space activities. Research and technology development takes place within NASA Centers, in academia and industry, and leverages partnerships with other government agencies and international partners. STMD engages and inspires thousands of technologists and innovators creating a community of our best and brightest working on the nation's toughest challenges. By pushing the boundaries of technology and innovation, STMD allows NASA and our nation to remain at the cutting edge. Additional information on the Space Technology Mission Directorate (STMD) can be found at: (http://www.nasa.gov/directorates/spacetech/about_us/index.html)

Appendix B: NASA Strategic Approach

B.1 NASA Strategic Plan

The NASA 2014 Strategic Plan includes the focus on the development of science, technology, engineering, and mathematics (STEM) disciplines along with the engagement of academic institutions and students in accomplishing the vision and mission of NASA. NASA contributes to national efforts for achieving excellence in STEM education through a comprehensive education portfolio implemented by the Office of Education, the Mission Directorates, and the NASA Centers. NASA will continue the Agency's tradition of investing in the Nation's education programs and supporting the country's educators who play a key role in preparing, inspiring, exciting, encouraging, and nurturing the young minds of today that will manage and lead the Nation's laboratories and research centers of tomorrow.

NASA Mission:
Drive advances in science, technology, aeronautics, and space exploration to enhance knowledge, education, innovation, economic vitality, and stewardship of Earth.

NASA Strategic Goals:

1. Expand the frontiers of knowledge, capability, and opportunity in space.
2. Advance understanding of Earth and develop technologies to improve the quality of life on our home planet.
3. Serve the American public and accomplish our Mission by effectively managing our people, technical capabilities, and infrastructure.

NASA Strategic Goals and Objectives relevant to education
Objective 1.2: *Conduct research on the International Space Station (ISS) to enable future space exploration, facilitate a commercial space economy, and advance the fundamental biological and physical sciences for the benefit of humanity.*
Objective 2.4: *Advance the Nation's STEM education and workforce pipeline by working collaboratively with other agencies to engage students, teachers, and faculty in NASA's missions and unique assets.*
Objective 3.1: *Attract and advance a highly skilled, competent, and diverse workforce, cultivate an innovative work environment, and provide the facilities, tools, and services needed to conduct NASA's missions.*

B.2 NASA Education Strategic Coordination Framework

NASA will continue the Agency's tradition of investing in the nation's education programs and supporting the country's educators who play a key role in preparing, inspiring, exciting, encouraging, and nurturing the young minds of today who will be the workforce of tomorrow.

NASA will continue to pursue three major education goals:

- Strengthening NASA and the Nation's future workforce
- Attracting and retaining students in science, technology, engineering and mathematics, or STEM, disciplines
- Engaging Americans in NASA's mission. The plan encompasses all education efforts undertaken by NASA and guides the Agency's relationships with external education partners.

Appendix C: Definitions

- Center – The ten NASA Centers including the Jet Propulsion Laboratory (JPL). For purposes of collaboration in NASA EPSCoR, JPL is considered a NASA Center.
- Cooperative Agreement – An agreement similar to a grant with the exception that NASA and the recipient are each expected to have substantial technical interaction for the performance of the project. Cooperative agreements are managed pursuant to the policies set forth in the *Grant and Cooperative Agreement Handbook.*
- Directorate – One of NASA's Mission Directorates—Aeronautics Research (ARMD), Human Exploration & Operations (HEOMD), Space Technology (STMD), and Science (SMD).
- Jurisdiction – States or commonwealths eligible to submit proposals in response to this CAN.
- NASA Research Contact – The NASA Research Contact is the primary NASA point of contact during the proposal writing stage for the proposed research area. If the proposer has contacted and received permission from a NASA scientific or technical person, that individual may be listed in the proposal as the NASA Research Contact. Otherwise the NASA Research Contact is the University Affairs Officer at the Center, or the NASA Mission Directorate contact at NASA Headquarters. (See Appendix D.)
- Partnership – A reciprocal and voluntary relationship between the project personnel and NASA, industry or other partners, to cooperatively achieve the goals of the proposed research.
- Principal Investigator (PI) – For this EPSCoR CAN, the Principal Investigator is the jurisdiction's EPSCoR director. The Principal Investigator has an appropriate level of authority and is responsible for proper conduct of the research, including appropriate use of funds and administrative requirements such as the submission of the scientific progress reports to the Agency. The PI is the administrator for the proposal.
    - Co-Investigator (Co-I) – A Co-I is a member of the proposal's investigation team who is a critical "partner" for the conduct of the investigation through the contribution of unique expertise and/or capabilities.
    - Science-PI – For this CAN, one Co-I should be designated as the Science-PI for those cases where the person leading the scientific direction of the proposed work is not the PI. The formally stated PI will still be held responsible for the overall direction of the effort and use of funds.
    - Co-I/Institutional-PI – A Co-I at an organization other than that of the PI institution who is making a major contribution to the proposal and serves as the point of contact at the Co-I's institution, may also be designated as the Co-I/Institutional-PI. For this CAN, the Science-PI may also serve as a Co-I/Institutional-PI. In these cases, the individual should be identified as the Science-PI in the proposal cover page.
- Research area – One of the areas of research interest for the NASA Mission Directorate(s).
- Research Group – A group of researchers that undertakes one of the specific research areas proposed.

- Research Student – A student (undergraduate, graduate, or postdoctoral) who receives a research appointment in direct support of the NASA EPSCoR research in the research proposals.
- Technical Monitor – A NASA scientific or technical person designated by the NASA EPSCoR office to monitor the research project.

Appendix D: NASA Points of Contact

D.1 Additional information regarding NASA EPSCoR can be obtained from the following:

Jeppie R. Compton
Project Manager, NASA EPSCoR
Office of Education
NASA Kennedy Space Center
HQ EX-E
Kennedy Space Center, FL 32899-0001
Phone: (321) 867-6988
E-mail: Jeppie.R.Compton@nasa.gov

D.2 NASA Research Contacts

Technical and scientific questions about research opportunities in this announcement may be directed to the appropriate contact below. Discussions of research with appropriate NASA Center or JPL personnel are strongly encouraged.

D. 3 NASA Mission Directorate Liaisons

Aeronautics Research Mission Directorate *Tony Springer* Lead, Communications and Education NASA Headquarters Phone: (202) 358-0848 Tony.Springer@nasa.gov	Science Mission Directorate *Stephanie Stockman* Education/Public Outreach Lead NASA Headquarters Phone: (202) 358-0039 Stephanie.A.Stockman@nasa.gov
Human Exploration & Operations Mission Directorate *Bradley Carpenter* Space Life and Physical Sciences Research and Applications Division NASA Headquarters Phone: (202) 358-0826 BCarpenter@nasa.gov	Space Technology Mission Directorate *Joseph Grant* Education Lead NASA Headquarters Phone: (202) 358-0070 Joseph.Grant@nasa.gov

D.4 NASA Center Liaisons

Ames Research Center *Elizabeth Cartier* Space Grant Coordinator, Office of Education and Public Outreach Phone: 650-604-6958 Elizabeth.A.Cartier@nasa.gov	Kennedy Space Center *Benita DeSuza* NASA Internships, Fellowships and Scholarships (NIFS) Lead Phone: (321) 867-3671 Benita.W.Desuza@nasa.gov
Armstrong Flight Research Center *Oscar Murillo* MIRO Project Manager Phone: (661) 276-6110 Oscar.J.Murillo@nasa.gov	Langley Research Center *Gamaliel (Dan) Cherry* University Affairs Officer Phone: (757) 864-6113 Gamaliel.R.Cherry@nasa.gov
Goddard Space Flight Center *David J. Rosage* Education Specialist Phone: (301) 286-0904 David.J.Rosage@nasa.gov	Glenn Research Center *Mark David Kankam, Ph.D.* University Affairs Officer Dir. of NASA Space & Aeronautics Academy at Glenn Phone: (216) 433-6143 Mark.D.Kankam@nasa.gov
Jet Propulsion Laboratory *Linda Rodgers* University Programs Administrator Phone: (818) 354-3274 Linda.L.Rodgers@jpl.nasa.gov	Marshall Space Flight Center *Norman (Frank) Six* University Affairs Officer Office of Academic Affairs (HS30) Phone: (256) 961-0678 Norman.F.Six@nasa.gov
Johnson Space Center *Kamlesh Lulla* Director, University Research Collaborations and Partnership Office Phone: (281) 483-3065 Kamlesh.P.Lulla@nasa.gov	Stennis Space Center *Nathan Sovik* University Affairs Officer Phone: (228) 688-7355 Nathan.A.Sovik@nasa.gov

Appendix E: Proposal and Submission Information

E.1 Proposal Instructions and Requirements

All information needed to respond to this solicitation is contained in this CAN and in the companion *NASA Guidebook for Proposers May 2014 Edition* located at http://www.hq.nasa.gov/office/procurement/nraguidebook/proposer2014.pdf.

Proposers are responsible for understanding and complying with its procedures for the successful, timely preparation and submission of their proposals. Proposals that do not conform to its standards may be declared noncompliant and rejected without review.

The introductory material, as well as the appendices, of the *NASA Guidebook for Proposers* provide additional information about the entire CAN 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.

E.2 Content and Form of the Proposal Submission

- **Electronic Proposal Submission**

All proposals submitted in response to this CAN must be submitted in a fully electronic form. No hard copy of the proposal will be accepted. Electronic proposals must be submitted by the authorized organization representative (AOR) at the proposal Principal Investigator's institution. Electronic submission by the AOR serves as the required original signature by an authorized official of the proposing institution.

Proposers may opt to submit proposals in response to this CAN via either of two different electronic proposal submission systems: NSPIRES, located at http://nspires.nasaprs.com (see Section iv below), or Grants.gov located at http://www.grants.gov (see Section v below). *Proposers should not submit the same proposal to both electronic submission systems.* NASA plans to use the NSPIRES system to facilitate the review process so all proposals received through Grants.gov will be transferred into NSPIRES.

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

- Every institution that intends to submit a proposal to NASA in response to this CAN must be registered in NSPIRES. This applies whether proposals are submitted via NSPIRES or Grants.gov. Every institution that intends to submit a proposal through Grants.gov must register under that system as well as NSPIRES. Registration for either proposal data system must be performed by an institution's electronic business point-of-contact (EBPOC) having a valid registration with the System for Award Management (SAM) [formerly known as the Central Contractor Registry (CCR)].

  IMPORTANT NOTE: FORMER CCR REGISTRANTS: If your entity had an active record in CCR, then it has an active record in SAM. Your entity does not need to take any action with respect to SAM, unless a change in business circumstances requires updates to your entity's record(s) in order to be paid; to receive an award; or to renew your entity(s) prior to its expiration. SAM will send notifications to the registered user via email 60, 30, and 15 days prior to the entity's expiration. To update or renew your entity's records(s) in SAM,

your entity is required to create a SAM User Account and link it to your entity's migrated records.

- Any institution requesting NASA funds through the proposed investigation must be listed on the Proposal Cover Page. NASA will not fund institutions that do not appear on the Proposal Cover Page.
- Each individual team member named on the proposal's electronic cover page must be individually registered in NSPIRES or Grants.gov.
- Each individual team member named on the proposal's electronic cover page must specify an institutional affiliation. The institutional affiliation specified must be the institution through which the team member is participating in the proposed investigation. If the individual has multiple affiliations, then this institution may be different from the individual's primary employer or preferred mailing address.

Generically, an electronic proposal consists of one or more electronic forms, including an electronic cover page and one or more attachments. The attachments contain all sections of the proposal, including the project description as well as all required and allowed appendices; see the "Proposal Format and Contents" section below for further requirements.

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

- **Proposal Format and Contents**

All proposals submitted in response to this CAN must include the appropriate required electronic forms available through NSPIRES or Grants.gov.

The project description and other required sections of the proposal must be submitted as searchable, unlocked PDF files that are attached to the electronic submission using one of the proposal submission systems. Proposers must comply with any format requirements specified in this CAN and in the *NASA Guidebook for Proposers*, Section 2. Only appendices/attachments that are specifically requested in either this CAN or in the *NASA Guidebook for Proposers* will be permitted; proposals containing additional appendices/attachments may be declared noncompliant. The *NASA Guidebook for Proposers*, Section 2, provides detailed discussions of the content of proposals applicable to this CAN. Section 7.0. Proposal Preparation of this CAN provides a listing of required content elements.

In the event the information in this CAN is different from or contradicts the information in the *NASA Guidebook for Proposers*, the information in this CAN takes precedence.

Important note on creating PDF files for upload: It is essential that all PDF files generated and submitted meet the NASA requirements below. This will ensure that the submitted files can be transferred into NSPIRES or Grants.gov. At a minimum, it is the responsibility of the proposer to: (1) ensure that all PDF files are unlocked and that edit permission is enabled – this is necessary to allow NSPIRES to concatenate submitted files into a single PDF document; and (2) ensure that all

fonts are embedded in the PDF file and that only Type 1 or TrueType fonts are used. In addition, any proposer who creates files using TeX or LaTeX is required to first create a DVI file and then convert the DVI file to Postscript and then to PDF. See http://nspires.nasaprs.com/tutorials/PDF_Guidelines.pdf for more information on creating PDF documents that are compliant with NSPIRES. PDF files that do not meet the NASA requirements may be declared noncompliant and not submitted to peer review for evaluation.

- **Additional Requirement for Budget Format**

In addition to the budget summary information provided in the NSPIRES or Grants.gov:

Cover Page forms, all proposers are required to include more detailed budgets and budget justifications, including detailed subcontract/subaward budgets, in a format of their own choosing in the *Budget Justification*. For this CAN, this additional budget must be divided into two parts, the "*Budget Justification: Narrative*" and the "*Budget Justification: Details*," both as described in the *NASA Guidebook for Proposers,* Section 2.3.10.

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

Note that failure to provide sufficient budget justification and data in the *Budget Justification: Narrative* (including the *Table of Proposed Work Effort*) and the *Budget Justification: Details* will prevent the peer review from appropriately evaluating the cost realism of the proposed effort. A finding by the peer review of "insufficient information to properly evaluate cost realism" will be considered a proposal weakness. Inconsistent information between these budget descriptions and the proposal text will also be considered a proposal weakness.

- **Submission of Proposals via NSPIRES, the NASA Proposal Data System**

In order to submit a proposal via NSPIRES, this CAN requires that the proposer register key data concerning the intended submission with NSPIRES; NSPIRES is accessed at http://nspires.nasaprs.com. Potential applicants are urged to access this site well in advance of the proposal due date(s) of interest to familiarize themselves with its structure and enter the requested identifier information.

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

All proposals submitted via NSPIRES in response to this CAN must include a required electronic *Cover Page* form that is accessed at http://nspires.nasaprs.com. This form comprises several distinct sections: a *Cover Page* that contains the identifier information for the proposing

institution and personnel; a *Proposal Summary* that provides an overview of the proposed investigation that is suitable for release through a publicly accessible archive should the proposal be selected; and a *Budget Summary* of the proposed research effort. Unless specified in the program description itself, no other forms are required for proposal submission via NSPIRES. See the *NASA Guidebook for Proposers*, Sections 2 and 3, for further details.

The required elements of the proposal, including the project description, must be submitted as one or more PDF documents that are attached to the *Cover Page* using the tools in NSPIRES. It is possible that the complete proposal is submitted as a single, searchable, unlocked PDF document that contains the complete proposal, including the project description section and budget justification, assembled in the order provided in this CAN and uploaded using the tools in NSPIRES. One advantage of submitting the proposal as one PDF document as described above is that it is easier for the proposer to create a table of contents that will be correct. If separate files are uploaded, there may be slight differences in page numbering due to the concatenation process. Any mismatch with the table of contents caused by this process does not impact the evaluation of the proposal.

NSPIRES will provide a list of all elements that make up an electronic proposal, and the system will conduct an element check to identify any item(s) that is (are) apparently missing or incomplete. The element check may produce warnings and/or identify errors. Uploading the proposal in one PDF file is likely to create warnings as part of the element check. These warnings should be ignored as warnings do not preclude proposal submission. Note, however, an error in the element check will preclude submission.

Proposers are encouraged to begin their submission process early. Tutorials and other NSPIRES help topics may be accessed through the NSPIRES online help site at http://nspires.nasaprs.com/external/help.do. For any questions that cannot be resolved with the available on-line help menus, requests for assistance may be directed by e-mail to nspires-help@nasaprs.com or by telephone to (202) 479-9376, Monday through Friday, 8:00 a.m. – 6:00 p.m. Eastern Time.

- **Submission of Proposals via Grants.gov**

NASA offers proposers the option to utilize Grants.gov to prepare and submit proposals in response to this CAN. Grants.gov allows institutions to electronically find and apply for competitive grant opportunities from all Federal grant-making agencies; it provides a single access point for over 1,000 grant programs offered by the 26 Federal grant-making agencies. The U.S. Department of Health and Human Services is the managing partner for Grants.gov.

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

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

- Follow Grants.gov instructions provided at the website to download any software tools or applications required to submit to Grants.gov.
- Download the application package from Grants.gov by selecting “Download grant application packages” under “Apply for Grants” at http://www.grants.gov.
- Complete the required Grants.gov forms including the SF424 Research and Related (R&R) Application for Federal Assistance, R&R Other Project Information, R&R

Senior/Key Person Profile, and R&R Budget. Every named individual must be identified with the institution 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: NASA Other Project Information, NASA Principal Investigator and Authorized Representative Supplemental Data Sheet, NASA Senior/Key Person Supplemental Data Sheet (this form is only required if there are Senior/Key Persons other than the Principal Investigator).
- Create a proposal in PDF including the project description and all other required proposal sections (see the *NASA Guidebook for Proposers*, Section 2). Upload sections as separate PDFs as prompted by Grants.gov.
- Submit the proposal via the authorized organization representative (AOR); the proposal Principal Investigator may not submit the application to Grants.gov unless he/she is an AOR.
- Grant researchers 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, must be registered in NSPIRES (http://nspires.nasaprs.com) and those 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.

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 the *NASA Guidebook for Proposers,* Sections 2 and 3. Instructions for the use of Grants.gov may be found in the *Grants.gov User Guide.*

Instructions for NASA-specific forms may be found in the application package. For any questions that cannot be resolved with the available on-line help menus and documentation, requests for assistance may be directed by e-mail to support@grants.gov or by telephone to (800) 518-4726.

E.3 Notice of Intent to Propose

A brief Notice of Intent (NOI) to propose is encouraged, but not required, for the submission of proposals to this solicitation. The information contained in an NOI is used to help expedite the proposal review activities and, therefore, is of considerable value to both NASA and the proposer. NOIs must be submitted by the jurisdiction NASA EPSCoR Director through NSPIRES (http://nspires.nasaprs.com). Note that NOIs may be submitted within NSPIRES directly by the proposal Principal Investigator; no action by an organization's AOR is required to submit an NOI. The NOI, at a minimum, should include a clear descriptive title and/or a scientific/technical summary of the anticipated research. If possible, the NOI should include the Mission Directorate and the NASA research area(s) of interest.

Interested proposers must register with NSPIRES before it can be accessed for use. Since NOIs submitted after the deadline may still be useful to NASA, late NOIs may be submitted by e-mail as directed in the *NASA Guidebook for Proposers*, Section 3.1.

E.4 Proposal Funding Restrictions

In addition to the funding restrictions and requirements given in the *NASA Guidebook for Proposers* and the *Grant and Cooperative Agreement Handbook*, the following restrictions exist on the use of the federally-provided NASA EPSCoR funds and proposed cost-share funds under this CAN:

- Funds may not be used to fund research carried out by non-U.S. institutions. U.S. research award recipients may, however, directly purchase supplies and/or services that do not constitute research from non-U.S. sources. However, subject to export control restrictions, a foreign national may receive remuneration through a NASA award for the conduct of research while employed either full or part time by a U.S. institution. For additional guidance on foreign participation, see Section 1.6 of the *NASA Guidebook for Proposers* and NASA FAR Supplement Part 1835.016-70.
- Travel, including foreign travel, is allowed for the meaningful completion of the proposed investigation, as well as for reporting results at appropriate professional meetings. Foreign travel to meetings and conferences in support of the jurisdiction's NASA EPSCoR research project is an acceptable use of NASA EPSCoR funds, with an upper limit of $3,000 per trip for up to two separate years of a jurisdiction's proposal (i.e., the maximum amount the jurisdiction can request for foreign travel is $3,000 total in any one year and a limit of $6,000 total for each research proposal). EPSCoR support should be acknowledged by EPSCoR research project number in written reports and publications. Note that domestic travel (defined as travel not requiring a passport) does not have a limit. Domestic travel should be appropriate and reasonable to conduct the proposed research.
- The construction of facilities is not an allowable cost any of the programs solicited in this CAN. For further information on allowable costs, refer to the cost principles cited in the *Grant and Cooperative Agreement Handbook*, 14 Code of Federal Regulations (CFR), Section 1260.127.
- NASA EPSCoR funding cannot be used to purchase general purpose equipment, e.g. desktop workstations, office furnishings, reproduction and printing equipment, etc. as a direct charge. Special purpose equipment purchases (i.e. equipment that is used only for research, scientific, and technical activities directly related to the proposed research activities) are allowed and can be reflected as a direct charge as per NASA Grants and Cooperative Agreement Handbook, Section A 1260.27.
- NASA EPSCoR funding may not be used to support NASA civil service participation (FTE) in a research project unless that funding is provided through a funding vehicle between the jurisdiction and NASA center, such as a Space Act Agreement or other reimbursable agreement. NASA EPSCoR cannot hold back funding from an award to send to a center for FTE support.

E.5 Conflict of Interest Check Information

NASA expects all peer reviewers to disclose all conflicts of interest; whether they are situations which may be actual conflicts of interest or which may give the appearance of a conflict of interest. Peer reviewers are also expected to disclose situations which may give the appearance of bias, or may cause a reasonable observer to question the ability of the reviewer to provide an unbiased evaluation of a proposal (see the *NASA Guidebook for Proposers*, Appendix E.3). Peer reviewers are required to sign a non-disclosure/conflict of interest form prior to being granted access to proposals.

E.6 Certification of Compliance

By submitting the enclosed proposal cover sheet certification form in response to this NASA research announcement, the authorizing official provides assurance that the jurisdiction is in compliance with the certifications listed. The summaries for the existing certifications state:

- **Debarment, Suspension, and Other Responsibility Matters Primary Covered Transactions**

  This certification is required by the regulations implementing Executive Order 12549, Debarment and Suspension, 34 CFR Part 85, Section 85.510, Participant's responsibilities. The regulations were published as Part VII of the May 26, 1988 Federal Register (pages 19160 - 19211). Copies of the regulation may be obtained by contacting the U.S. Department of Education, Grants and Contracts Service, 400 Maryland Avenue, S.W. (Room 3633 GSA Regional Office Building No. 3), Washington, DC. 20202-4725, telephone (202) 732-2505.

  - The prospective primary participant certifies to the best of its knowledge and belief, that it and its principals:
    - Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;
    - Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or Local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;
    - Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State, or Local) with commission of any of the offenses enumerated in paragraph (1)(b) of this certification; and
    - Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State, or Local) terminated for cause or default.
  - Where the prospective primary participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

- **Certification Regarding Lobbying for Contracts, Grants, Loans, and Cooperative Agreements**

  The undersigned certifies, to the best of his or her knowledge and belief, that:

  - No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the

extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

- If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form - LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.
- The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, sub-grants, and contracts under grants, loans, and cooperative agreements) and that all sub-recipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certificate shall be subject to a civil penalty of not less than $10,000, and not more than $100,000 for each such failure.

- **Assurance of Compliance with the National Aeronautics and Space Administration Regulations Pursuant to Nondiscrimination in Federally Assisted Programs**

  As a condition of receipt of Federal financial assistance, the Applicant Institution, acknowledges and agrees that it must comply (and require any subgrantees, contractors, successors, transferees, and assignees to comply) with applicable provisions of national laws and policies prohibiting discrimination, including but not limited to:

  - Title VI of the Civil Rights Act of 1964, as amended, which prohibits recipients of federal financial assistance from discriminating on the basis of race, color, or national origin (42 U.S.C. 2000d et seq.), as implemented by NASA Title VI regulations, 14 C.F.R. Part 1250.
  - As clarified by Executive Order 13166, Improving Access to Services for Persons with Limited English Proficiency, and resulting agency guidance, national origin discrimination includes discrimination on the basis of limited English proficiency (LEP). To ensure compliance with Title VI, the Applicant must take reasonable steps to ensure that LEP persons have meaningful access to its programs in accordance with NASA Title VI LEP Guidance to Grant Recipients (68 Fed. Reg. 70039). Meaningful access may entail providing language assistance services, including oral and written translation, where necessary. The Applicant is encouraged to consider the need for language services for LEP persons served or encountered both in developing budgets and in conducting programs and activities. Assistance and information regarding LEP obligations may be found at http://www.lep.gov.
  - Title IX of the Education Amendments of 1972, as amended, which prohibits discrimination on the basis of sex in education programs or activities (20 U.S.C. 1681 et seq.) as implemented by NASA Title IX regulations, 14 C.F.R. Part 1253. If the Applicant is an educational institution:
    - The Applicant is required to designate at least one employee to serve as its Title IX coordinator (14 C.F.R. §1253.135(a)).

- The Applicant is required to notify all of its program beneficiaries of the name, office, address, and telephone number of the employee(s) designated to serve as the Title IX coordinators. (14 C.F.R. §1253.135(a)).
- The Applicant is required to publish internal grievance procedures to promptly and equitably resolve complaints alleging illegal discrimination in its programs or activities (14 C.F.R. §1253.135(b).
- The Applicant is required to take specific steps to regularly and consistently notify program beneficiaries that the Applicant does not discriminate in the operation of its programs and activities. (14 C.F.R. §1253.140).

- Section 504 of the Rehabilitation Act of 1973, as amended, which prohibits The Applicant from discriminating on the basis of disability (29 U.S.C. 794) as implemented by NASA Section 504 regulations, 14 C.F.R. Part 1251.
  - The Applicant is required to designate at least one employee to serve as its Section 504 coordinator (14 C.F.R. §1251.106(a)).
  - The Applicant is required to notify all its program beneficiaries of the name, office, address, and telephone number of the employee(s) designated to serve as the Section 504 coordinator (14 C.F.R. §1251.106(a)).
  - The Applicant is required to publish internal grievance procedures to promptly and equitably resolve complaints alleging illegal discrimination in its programs or activities (14 C.F.R. §1251.106(b)).
  - The Applicant is required to take specific steps to regularly and consistently notify program beneficiaries that the Applicant do not discriminate in the operation of its programs and activities. (14 C.F.R. §1251.107).

- The Age Discrimination Act of 1975, as amended, which prohibits the Applicant from discriminating on the basis of age (42 U.S.C. 6101 et seq.) as implemented by NASA Age Discrimination Act regulations, 14 C.F.R. Part 1252.

  The Applicant also acknowledges and agrees that it must cooperate with any compliance review or complaint investigation conducted by NASA and comply (and require any subgrantees, contractors, successors, transferees, and assignees to comply) with applicable provisions governing NASA access to records, accounts, documents, information, facilities, and staff. The Applicant must keep such records and submit to the responsible NASA official or designee timely, complete, and accurate compliance reports at such times, and in such form and containing such information, as the responsible NASA official or his designee may determine to be necessary to ascertain whether the Applicant has complied or is complying with relevant obligations and must immediately take any measure determined necessary to effectuate this agreement. The Applicant must comply with all other reporting, data collection, and evaluation requirements, as prescribed by law or detailed in program guidance.

The below certification form must be completed and returned as part of the jurisdiction's proposal.

Proposal Cover Sheet

Title: _____

Principal Investigator: _____

Institution_____

Street/PO Box: _____

City: _____ State:_____ Zip: _____ Country: _____

Email: _____

Phone: _____ Fax: _____

Co-Investigator	Institution & Address	Phone & E-mail
_____	_____	_____
_____	_____	_____
_____	_____	_____

Certification of Compliance with Applicable Executive Orders and U.S. Code

By submitting the proposal identified in the Cover Sheet/Proposal Summary either in response to a NASA Research Announcement or as an Unsolicited Proposal, the Authorizing Official of the proposing institution (or the individual proposer if there is no proposing institution) as identified below:

- Certifies that the statements made in this proposal are true and complete to the best of his/her knowledge;
- Agrees to accept the obligations to comply with NASA award terms and conditions if an award is made as a result of this proposal; and
- Confirms compliance with all provisions, rules and stipulations set forth by these two Certifications [namely, (i) *Certification of Compliance with the NASA Regulations Pursuant to Nondiscrimination in Federally Assisted Programs*, and (ii) *Certifications, Disclosures, And Assurances Regarding Lobbying and Debarment & Suspension*].

Willful provision of false information in this proposal and/or its supporting documents, or in reports required under an ensuing award, is a criminal offense (U.S. Code, Title 18, Section 1001).

Title of Authorizing Official: _____

Signature: _____ Date: _____

Name of Proposing Institution: _____

Phone: _____ Fax: _____ E-mail: _____

Cage Code: _____ DUNS Number: _____ TIN Number: _____

E.6.1 Assurance of Compliance – China Funding Restriction (DEVIATION FEB 2012)

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.

Title of Authorizing Official: _____

Printed Name: _____ Signature: _____

Date: _____

Name of Proposing Institution: _____

Phone: _____ Fax: _____

E-mail: _____

E.6.2 Representation by prospective recipient that they are not the Association of Community Organizations for Reform now (ACORN) or a subsidiary of ACORN

In accordance with section 534 of the Consolidated and Further Continuing Appropriations Act of 2012 (Pub. L.112-55), none of the funds made available by the Act may be distributed to the Association of Community Organizations for Reform Now (ACORN) or its subsidiaries.

The prospective recipient represents, by submission of its offer, that it is not the Association of Community Organizations for Reform Now (ACORN) or a subsidiary thereof, and that no funds made available under this award will be distributed to ACORN or its subsidiaries.

Recipient _____

Signature _____

Name _____

Title _____

Date of execution _____

E.6.3 Representation by corporations regarding an unpaid delinquent tax liability or a felony conviction under any federal law

In accordance with sections 544 and 543 of the Consolidated and Further Continuing Appropriations Act of 2012 (Pub. L.112-55), none of the funds made available by that Act may be used to enter into a grant or cooperative agreement with any corporation that -

- Has any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability, where the awarding agency is aware of the unpaid tax liability, unless an agency has considered suspension or debarment of the corporation and made a determination that this action is not necessary to protect the interests of the Government; or

- Was convicted (or had an officer or agent of such corporation acting on behalf of the corporation convicted) of a felony criminal violation under any Federal law within the preceding 24 months, where the awarding agency is aware of the conviction, unless an agency has considered suspension or debarment of the corporation and made a determination that this action is not necessary to protect the interests of the Government.

The prospective recipient represents that -

- It is [ ] is not [ ] a corporation that has had any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability; and

- It is [ ] is not [ ] a corporation that was convicted, or had an officer or agent acting on behalf of the corporation convicted, of a felony criminal violation under a Federal law within the preceding 24 months.

E.6.4 Certification by prospective recipients regarding federal income tax filing and federal income tax violations

In accordance with section 527 of the Consolidated and Further Continuing Appropriations Act of 2012 (Pub. L.112-55), none of the funds made available by the Act may be used to enter into a grant or cooperative agreement in an amount greater than $5 Million unless the prospective recipient certifies in writing to NASA that, to the best of its knowledge and belief, the prospective recipient has filed all Federal tax returns required during the three years preceding the certification, has not been convicted of a criminal offense under the Internal revenue Code of 1986, and has not, more than 90 days prior to certification, been notified of any unpaid Federal tax assessment for which the liability remains unsatisfied, unless the assessment is the subject of an installment agreement or offer in compromise that has been approved by the Internal Revenue Service and is not in default, or the assessment is the subject of a non-frivolous administrative or judicial proceeding.

The prospective recipient's proposal shall include a signed written certification as follows -

> To the best of my knowledge and belief, _____(name of offeror) has filed the Federal tax returns required during the three years preceding this certification, has not been convicted of a criminal offense under the Internal revenue Code of 1986, and has not, more than 90 days prior to certification, been notified of any unpaid Federal tax assessment for which the liability remains unsatisfied, unless the assessment is the subject of an installment agreement or offer in compromise that has been approved by the Internal Revenue Service and is not in default, or the assessment is the subject of a non-frivolous administrative or judicial proceeding.

Appendix F: Useful Web Sites

- NASA
  http://www.nasa.gov

- NASA Office of Education
  http://education.nasa.gov

- Vision for Space Exploration
  http://www.nasa.gov/missions/solarsystem/explore_main.html

- NASA Grant and Cooperative Agreement Handbook
  http://www.gpo.gov/fdsys/granule/CFR-1999-title14-vol5/CFR-1999-title14-vol5-part1260/content-detail.html

- NASA Centers & Facilities
  http://www.nasa.gov/offices/education/centers/index.html

- Guidebook for Proposers Responding to a NASA Research Announcement
  http://www.hq.nasa.gov/office/procurement/nraguidebook

- NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES)
  http://nspires.nasaprs.com