



**NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)
HEADQUARTERS
OFFICE OF EDUCATION
300 E STREET, SW
WASHINGTON, DC 20546-0001**

**EDUCATION OPPORTUNITIES IN NASA STEM 2019
(EONS-2019)**

NASA RESEARCH ANNOUNCEMENT (NRA)

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TABLE OF CONTENTS

EXECUTIVE SUMMARY	5
1. FUNDING OPPORTUNITY DESCRIPTION.....	7
1.1 Background.....	7
1.2 NASA Strategic Plan and Relevance to Education.....	7
TABLE 1. Performance Goals (PGs) and Annual Performance Indicators (APIs).....	8
1.3 Guidebook for Proposers	8
1.4 NASA’s Safety Policy	9
1.5 NASA's Plan for Increasing Access to Results of Federally Funded Research.....	9
2. AWARD INFORMATION	10
2.1 Award Type and Availability of Funds for Awards	10
2.2 Award Period of Performance	10
2.3 Cancellation of NASA Research Announcement (NRA).....	11
2.4 Schedule for Awards.....	11
2.5 Successor Proposals and Resubmissions	11
2.6 Proposal Funding Restrictions	12
TABLE 2. MUREP Solicited Activities	12
2.7 Intellectual Property Developed under Awards	13
2.7.1 Data Rights	13
2.7.2 Patent Rights.....	13
3. ELIGIBILITY INFORMATION.....	13
3.1 Proposing Institutions	13
TABLE 3. Table of Eligibility for Lead Institution.....	13
3.2 Number of Proposals and Teaming Arrangements	15
3.3 Principal Investigators and Proposal Team Members	15

3.4 Cost Sharing or Matching	15
3.5 Special considerations for NASA team members.....	15
3.6 Submissions from Non-Domestic Entities.....	15
4. CERTIFICATIONS OF COMPLIANCE.....	16
5. PROPOSAL INSTRUCTIONS AND SUBMISSION INFORMATION	16
5.1 Proposal Submission Date and Time	16
5.2 Submission of Proposals.....	16
5.3 Registration.....	17
5.4 Special Advisory Regarding Grants.gov Submissions to an EONS Appendix	18
5.5 Notice of Intent to Propose	20
5.6 Team Member Confirmation	20
5.7 Withdrawal of Proposals.....	20
5.8 Questions Related to this NRA.....	21
5.9 Conflict of Interest Check Information.....	21
5.10 Other Submission Requirements	21
5.11 Content and Format of the Proposal Submission.....	21
TABLE 4. Required Proposal Elements	22
6. PROPOSAL EVALUATION AND SELECTION.....	23
6.1 Proposal Review Information	23
6.2 Review and Selection Processes	23
6.3 Review of Applicants in the Federal Awardee Performance and Integrity Information System (FAPIS)	24
7. AWARD ADMINISTRATION INFORMATION.....	24
7.1 Notice of Award.....	24
7.2 Process for Appeals Prior to Formal Requests for Reconsideration.....	25
7.3 Administrative and National Policy Requirements.....	26
7.4 Award Reporting Requirements	27

7.5 Additional Terms and Conditions	27
8. POINTS OF CONTACT FOR FURTHER INFORMATION	27
9. ANCILLARY INFORMATION	28
9.1 Announcement of Updates/Amendments to Solicitation.....	28
APPENDIX A PIV Card Issuance Procedures in accordance with FAR Clause 52.204-9, Personal Identity Verification of Contractor Personnel (Jan. 2011)	29
APPENDIX B Sample Proposal Cover Page.....	33
APPENDIX C EONS Policy on Late Proposals.....	43
APPENDIX D Glossary of Acronyms and Definitions.....	47
APPENDIX E Performance Measurement and Evaluation: Definitions and Relationships.....	51
APPENDIX F MUREP Innovations in Space Technology Curriculum (MISTC).....	53
APPENDIX G MUREP Institutional Research Opportunities (MIRO).....	65

EXECUTIVE SUMMARY

This National Aeronautics and Space Administration (NASA) Research Announcement (NRA), entitled *Education Opportunities in NASA STEM (EONS) – 2019*, solicits education opportunities in support of NASA’s Office of Education (OE) under the Minority University Research and Education Project (MUREP). NASA may elect to support some or none of the proposals submitted under this NRA through the use of non-MUREP funds if such funds are available from other NASA or Federal Government sources.

The purpose of MUREP is to increase NASA’s responsiveness to Federal mandates related to Historically Black Colleges and Universities (HBCU), Hispanic Serving Institutions (HSI), Tribal Colleges and Universities (TCU), Asian American and Native American Pacific Islanders Serving Institutions (AANAPSI) and other Minority Serving Institutions (MSI). Currently, MUREP activities address Presidential Executive Order (E.O.) No. 13779 on HBCUs; E.O. No. 13592 on American Indian and Alaska Native Education; E.O. No. 13555 on Educational Excellence for Hispanic Americans; E.O. No. 13515 on Increasing Participation of Asian American and Pacific Islanders (AAPI); and E.O. No. 13621 on Educational Excellence for African Americans in Federal Programs and Predominantly Black Institutions. The MUREP program team at NASA is responsible for developing agency-wide policies, procedures, and guidelines that enhance the involvement of all MSIs in NASA’s mission through MUREP-related activities.

Activities supported by MUREP provide underrepresented and underserved students majoring in a science, technology, engineering, or mathematics (STEM) discipline and also provide faculty at MSIs access to NASA research and education opportunities. Students and faculty supported by MUREP are provided opportunities to engage in NASA-related research and mission-specific technology development. MUREP projects are also designed to address the national challenges of attracting and retaining underrepresented and underserved undergraduate and graduate students in STEM.

The funds available for awards in each activity offered in this NRA can range from less than one million to five million dollars. This allows selection from a few to as many as several dozen proposals, depending on the proposed activity objectives and the submission of proposals of merit. Awards will be made as grants or cooperative agreements, depending on the extent of NASA’s involvement with the award recipient and activities. The typical period of performance for an award is one to three years, although some project activities may specify shorter or longer (maximum of five years) periods. Any changes or modifications to any of these guidelines will be specified in the descriptions of the relevant activities in the Appendices of this solicitation.

Details of the solicited activities are included in the Appendices of this NRA. Proposal due dates are included in Table 2, Section 2 of this NRA. Interested Proposers are responsible for

regularly monitoring the NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES) website <http://nspires.nasaprs.com/> for new activities or for any amendments to this NRA.

SUMMARY OF SOLICITATION

1. FUNDING OPPORTUNITY DESCRIPTION

1.1 Background

The NASA Minority University Research and Education Project (MUREP) is administered through NASA's Office of Education. The purpose of MUREP is to increase NASA's responsiveness to Federal mandates related to Historically Black Colleges and Universities (HBCUs), Hispanic Serving Institutions (HSIs), Tribal Colleges and Universities (TCUs), Asian American and Native American Pacific Islanders Serving Institutions (AANAPISIs) and other Minority Serving Institutions (MSIs). Currently, MUREP projects address Presidential Executive Order (E.O.) No. 13779 on HBCUs; E.O. No. 13270 on TCUs; E.O. No. 13230 on Educational Excellence for Hispanic Americans; E.O. No. 13515 on Increasing Participation of Asian American and Pacific Islanders (AAPIs); and E.O. No. 13621 on Educational Excellence for African Americans in Federal Programs and Predominantly Black Institutions.

The MUREP team at NASA is responsible for developing agency-wide policies, procedures and guidelines that enhance the involvement of all MSIs in NASA's mission through MUREP related activities. Activities supported by MUREP provide underrepresented and underserved students majoring in a STEM discipline and also provide faculty at MSIs with access to NASA research and education opportunities. Students and faculty supported by MUREP are provided opportunities to engage in NASA-related research and mission-specific technology development. MUREP projects are designed also to address the national challenges of attracting and retaining underrepresented and underserved undergraduate and graduate students in STEM.

1.2 NASA Strategic Plan and Relevance to Education

The NASA 2018 Strategic Plan includes the focus on the development of STEM disciplines along with the engagement of academic institutions and students in accomplishing NASA's vision and mission. NASA contributes to national efforts for achieving excellence in STEM education through a comprehensive education portfolio implemented by the NASA Office of Education, the NASA Mission Directorates, and the NASA Centers located across the country. 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 manage and lead the Nation's laboratories and research centers of tomorrow.

The NASA Strategic Goal and Objective relevant to education are outlined by the 2018 NASA Strategic Plan

https://www.nasa.gov/sites/default/files/atoms/files/nasa_2018_strategic_plan.pdf:

Strategic Goal 3: Address national challenges and catalyze economic growth.

Strategic Objective 3.3: Inspire, engage, educate, and employ the next generation of explorers through NASA-unique Science, Technology, Engineering and Mathematics learning opportunities.

The NASA FY2018 Performance Goals (PGs) and Annual Performance Indicators (APIs) for the Office of Education are outlined in Table 1:

TABLE 1: FY2018 Performance Goals (PGs) & Annual Performance Indicators (APIs) [1]

PG #	PG	API #	API
3.3.3	Provide opportunities for learners to engage with NASA’s aeronautics, space, and science people, content, and facilities in support of a diverse future NASA and aerospace industry workforce.	API 3.3.3: STEM-18-1	Provide significant, direct student awards in higher education to (1) students across all institutional categories and levels (as defined by the U.S. Department of Education); (2) racially or ethnically underrepresented students, (3) women, and (4) persons with disabilities at percentages that meet or exceed the national percentages for these populations, as determined by the most recent, publicly available data from the U.S. Department of Education’s National Center for Education Statistics for a minimum of two of the four categories.
3.3.4	Enhance the effectiveness of education investments using performance assessment and evaluation-driven processes.	API 3.3.4 STEM-18-2	Establish NASA’s science, technology, engineering, and mathematics (STEM) engagement function, guiding policies, and governance model for operations that will transform the Agency’s portfolio of STEM engagement opportunities.
		API 3.3.4 STEM-18-3	Develop a comprehensive performance assessment and evaluation strategy, including measures, processes, and tools that will be used as the foundation for evidence-based decision making.
		API 3.3.4 STEM-18-4	Release solicitations for all NASA Office of Education-funded programs that are in alignment with the science, technology, engineering, and mathematics (STEM) engagement model and mission directorate priorities.
PG 3.3.5	Provide opportunities for learners to contribute to NASA’s aeronautics, space, and science missions and work in exploration and discovery.	API 3.3.5 STEM-18-5	Space Grant, EPSCoR, and MUREP investments will contribute to American technical capability through at least 1,200 paper presentations and peer-reviewed research publications.

Note [1]: PGs 3.3.3 and 3.3.5 and APIs 3.3.3 and 3.3.5 will be addressed through EONS 2019 solicited activities. Proposers should consult the solicitation appendices for additional details.

1.3 Guidebook for Proposers

All policies and procedures for the preparation and submission of proposals, as well as those for NASA’s review and selection of proposals for funding, are presented in a separate document entitled *Guidebook for Proposers Responding to a NASA Funding Announcement (NFA)* (the

Guidebook for Proposers) that is located at <https://www.hq.nasa.gov/office/procurement/nraguidebook/proposer2018.pdf>. The 2018 *Guidebook for Proposers* is hereby incorporated into this NRA by reference, and proposers are responsible for understanding and complying with *Guidebook for Proposers*' procedures before preparing and submitting their proposals. Unless otherwise noted, **proposals that do not conform to the standards in the *Guidebook for Proposers* may be deemed noncompliant and rejected without peer review.** The chapters and appendices in the *Guidebook for Proposers* provide supplemental information about the entire NRA process, including NASA policies for the solicitation of proposals; guidelines for writing complete and effective proposals; NASA policies and procedures for the review and selection of proposals; as well as for issuing and managing the awards to the institutions that submitted selected proposals. Note that NASA's policy for proposals involving non-U.S. participants is provided in Appendix A of the *Guidebook for Proposers*.

1.4 NASA's Safety Policy

All proposals shall take into consideration NASA's priority emphasis on safety.

Safety is the freedom from those conditions that can cause death, injury, occupational illness, damage to or loss of equipment or property, or damage to the environment. NASA's safety priority is to protect: (1) the public, (2) astronauts and pilots, (3) the NASA workforce (including employees working under NASA award instruments), and (4) high-value equipment and property.

Proposers shall have a written safety policy. MUREP awardees shall notify the NASA Shared Services Center (NSSC) of any mishaps and close calls related to award implementation within two (2) business days of the occurrence of the close call or mishap. The following NASA procedural requirement applies to NASA entities and may be useful to non-NASA entities for benchmarking purposes:

NPR 8621.1C: NASA Procedural Requirements for Mishap and Close Call Reporting, Investigating, and Recordkeeping:
https://nodis3.gsfc.nasa.gov/npg_img/N_PR_8621_001C_/N_PR_8621_001C_.pdf

Responsible Office: Office of Safety and Mission Assurance
<http://nodis3.gsfc.nasa.gov/displayDir.cfm?t=NPR&c=8621&s=1C>

For additional information on the NASA Safety and Mission Assurance Program see:
<http://sma.nasa.gov>.

1.5 NASA's Plan for Increasing Access to Results of Federally Funded Research

In keeping with NASA's Plan for Increasing Access to the Results of Scientific Research (https://www.nasa.gov/sites/default/files/atoms/files/206985_2015_nasa_plan-for-web.pdf), new terms and conditions about making manuscripts and data publically accessible are attached to awards issued under this NRA. All proposers shall include a Data Management Plan (DMP). **During the implementation phase of this new requirement, the DMP shall be**

submitted by responding to the section of the cover page for DMP in NSPIRES (limited to 4000 characters). DMPs shall describe how data generated by proposed research will be shared and preserved and how data collected will be made available to the public. If the proposer does not believe data should be publically shared, then the proposer shall provide an explanation as to why data-sharing and/or preservation is not possible or scientifically appropriate. Additionally, the DMP shall describe how data sharing and preservation will enable validation of results, or how results could be validated if data are not shared or preserved. The DMP shall provide a plan for making all research data underlying results and findings in publications digitally accessible at the time of publication. NASA will review each proposer's DMP during the evaluation/peer review of proposals. Costs of the DMP shall be included in the proposed budget. For further information, see Section 3.11 in the *NASA Guidebook for Proposers* and the following website: <https://www.nasa.gov/open/researchaccess>.

2. AWARD INFORMATION

2.1 Award Type and Availability of Funds for Awards

Awards made resulting from this NRA will be in the form of grants or cooperative agreements, depending on the nature of the submitting institution and/or the specific requirements for awards given in each activity description in the appendices. The type of award to be offered to selected proposers will generally follow the policies in Appendix F of the *Guidebook for Proposers*, although in a few cases, only one type of award may be offered, as specified in the activity description. NASA will determine the appropriate award instrument for the selections resulting from this solicitation. Grants and cooperative agreements will be subject to the provisions of 2 CFR 1800, the *NASA Grant and Cooperative Agreement Manual* (GCAM), and Appendix D of the *Guidebook for Proposers* (all found at https://prod.nais.nasa.gov/pub/pub_library/srba/index.html). If there is a conflict between the content of this NRA and the *Guidebook for Proposers*, this NRA takes precedence. Prospective proposers to this NRA are advised that in general, funds are not available to award all solicited activities at the time of this NRA release. The Government's obligation to make awards is contingent upon the availability of sufficient appropriated funds from which payment can be made and the receipt of proposals that NASA determines are acceptable for award under this NRA. Further, continuation of the awards in the second and subsequent years (if applicable) will be contingent on the availability of appropriated funds, progress of the project, and continued relevance of the project to NASA programs.

The amount of funds expected to be available for new awards for proposals submitted in response to this NRA is given in the *Summary of Key Information* at the end of each activity description in the appendices. Given the submission of meritorious proposals, the number of awards that may be made for each activity is also provided. A list of MUREP solicited activities is provided in Table 2 at the end of Section 2.

2.2 Award Period of Performance

The maximum period of performance (duration) for awards made under this NRA is given in the *Summary of Key Information* at the end of each activity description in the appendices. Any proposed period of performance shall be justified in the proposal. The appropriateness of the

proposed period of performance will be evaluated by peer review. NASA reserves the right to select proposals for shorter award durations than proposed.

2.3 Cancellation of NASA Research Announcement (NRA)

NASA reserves the right not to make any awards under this NRA and/or to cancel this NRA at any time prior to award. If this occurs, NASA assumes no liability (including reimbursement of proposal costs) for canceling the NRA or for any entity's failure to receive an actual notice of cancellation.

2.4 Schedule for Awards

Every effort will be made to announce selections within six (6) months from the proposal submission deadline. Selection notifications will be communicated electronically via NSPIRES to the institution's Authorized Organization Representative (AOR) and Principal Investigator (PI). NSPIRES sends a decision notice via email requesting the PI or AOR to log into NSPIRES. This decision notice e-mail means that NSPIRES has been updated to indicate the status of a proposal in NASA's selection review process. When a PI or AOR logs into NSPIRES the following are examples of the types of decisions possible:

- A "declined" status means that: 1) NASA's review of the proposal is concluded; and 2) no NASA funds are available to support the proposed project.
- A "selected" or "selectable (pending)" status means that the proposal's review continues and the proposal has NOT received an award. A "selected" or "selectable (pending)" proposal status in NSPIRES is NOT a commitment that a proposal has or will receive an award by the NSSC nor that any funds have been or will be transferred from NASA Headquarters to a NASA Center.

Proposers are strongly cautioned that only a NASA Grant Officer may make commitments, obligations or awards on behalf of NASA or authorize the expenditure of funds. **A commitment by NASA to fund an award is only made through a grant or cooperative agreement signed by a NASA Grant Officer.** A PI or organization that makes financial and/or personnel commitments in the absence of a grant or cooperative agreement signed by a NASA Grant Officer does so at their own risk. Please refer to Section 5.4 of the *Guidebook for Proposers* for more information.

2.5 Successor Proposals and Resubmissions

Generally, researchers holding previous awards selected through any of the projects offered through earlier NRAs may submit "successor" proposals that seek to continue a previously funded line of work. However, each individual project will provide specific information on eligibility as outlined in the Appendix. For future offerings under continuing proposals, it is NASA Office of Education's policy that successor proposals will be considered along with new proposals submitted for that same activity; will undergo the full peer review process, and will not be advantaged nor disadvantaged in the evaluation process because they are successor proposals. Instructions regarding successor proposals may be found in Section 3.5 of the *Guidebook for Proposers*.

Proposals that were submitted but not selected from any previous NASA solicitation may be submitted either in a revised or original form. Such proposals will undergo full peer review, along with new proposals that NASA receives, and will not be advantaged nor disadvantaged in the evaluation process because they were previously submitted.

2.6 Proposal Funding Restrictions

In addition to the funding restrictions and requirements included in the *Guidebook for Proposers*, 2 CFR 1800, and the GCAM, the following restrictions are applicable to this EONS NRA.

- As directed in the *Guidebook for Proposers*, Section 3.18, other than the special cases discussed in the same Section 3.18, and unless specifically noted otherwise in the specific EONS activity appendix, the proposing PI institution shall subcontract the funding of all proposed Co-Is who reside at other non-Government institutions.
- The construction of facilities is not allowed for any of the activities solicited in this NRA unless specifically stated. For further information on what costs are permissible, refer to the cost principles in Subpart E of 2 CFR 200, Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards.
- U.S. award recipients may directly purchase supplies and/or services from non-U.S. sources that do not constitute research, but award funds may not be used to fund research carried out by non-U.S. institutions. However, a foreign national may receive payment through a NASA award for the conduct of research while employed either full-time or part-time by a U.S. institution (see Section 3.2 of the *Guidebook for Proposers*; see also Appendix B and C).
- Reasonable and justified travel by a participant in the research investigation, whether for the purpose of conducting the research, for collaboration, or for attending a conference, is considered to be a reasonable expense. NASA conducts its collaborations with foreign institutions on a no-exchange-of-funds basis. NASA funding may not be used for foreign institutions to conduct research efforts at any level. Therefore, NASA funding shall not be used for travel expenses for any participant who is not employed either full-time or part-time by a U.S. institution (see Section 3.2 of the *Guidebook for Proposers*; see also Appendix B and C).

TABLE 2. MUREP Solicited Activities [1]

APPENDIX	ACTIVITY	NOTICE OF INTENT (NOI) DUE DATE	PROPOSAL DUE DATE
F	MUREP Innovations in Space Technology Curriculum (MISTC)	October 9, 2018	December 10, 2018
G	MUREP Institutional Research Opportunities (MIRO)	October 9, 2018	December 10, 2018

Note [1]: Amended due dates and new activities will be indicated with bold red text as EONS-2019 is amended during the 2019 fiscal year.

2.7 Intellectual Property Developed under Awards

2.7.1 Data Rights

NASA encourages the widest practicable dissemination of research results at any time during the course of the investigation. The award will contain the Rights in Data clause at 2 CFR 1800.909 that allows a Grant/Cooperative Agreement recipient to assert copyright in any work that is subject to copyright and was developed, or for which ownership was acquired, under the NASA award. NASA will reserve a royalty-free, nonexclusive and irrevocable right to reproduce, publish, or otherwise use the work for Government purposes, and to authorize others to do so, in any such copyrighted work. Note that the Grant Officer may revise the language under this Rights in Data clause to modify each party's rights based on the particular circumstances of the program and/or the recipient's need to protect specific proprietary information.

2.7.2 Patent Rights

Awards are subject to the provisions of 37 CFR 401.3(a) which requires use of the standard clause set forth at 37 CFR 401.14 “Patent Rights (Small Business Firms and Nonprofit Organizations),” along with NASA supplemental language at 2 CFR 1800.908 “Patent Rights.”

3. ELIGIBILITY INFORMATION

3.1 Proposing Institutions

The following categories of U.S. institutions are eligible to propose to the various activities under MUREP. Refer to each activity description for more details.

TABLE 3. Table of Eligibility for Lead Institution [1]

	MUREP ACTIVITY SAMPLE	MISTC	MIRO
Historically Black Colleges and Universities (HBCU)			✓
Hispanic Serving Institutions (HSI)	✓		✓
Tribal Colleges and Universities (TCU)	✓		✓
Asian American and Native American Pacific Islander-Serving Institutions (AANAPISIs)			✓
American Indian and Alaskan Native Serving Institution (AIANSI)			✓

Predominately Black Institutions (PBI)			✓
Minority Serving Community Colleges (includes community colleges with the above designations)		✓	✓
Nonprofit Institutions (see Note 1)	✓		

Note [1] See *Guidebook for Proposers*, Section 3.18.

For a list of designated MSIs, please go to:

<https://www2.ed.gov/about/offices/list/ope/itudes/em2017.xls>

For institutions that serve a substantial Hispanic enrollment but have not been designated as an HSI or MSI by the US Department of Education, the institution shall submit documentation that its full-time undergraduate Hispanic enrollment is at least 25 percent of its total enrollment.

NASA Centers, Federal Government Agencies (other than NASA), Federally Funded Research and Development Centers (FFRDCs), non-minority serving higher education institutions, state government agencies, local government agencies, federally recognized tribal government agencies, science museums and planetariums, for-profit companies, non-U.S. institutions and other institutions including those types listed in the table above may participate through a partnership with the lead institution.

All institutions receiving funds shall be listed on the proposal cover page.

Work to be performed through subcontracts/subawards shall be proposed in accordance with Section 3.20 of the *Guidebook for Proposers*.

In accordance with Federal statutes and NASA policy, no eligible applicant shall be excluded from participation in, denied the benefits of, or be subjected to discrimination under any program or activity receiving financial assistance from NASA on the grounds of race, color, creed, age, sex, national origin, or disability.

For more information on national policy with regard to MSIs, please see the following websites:

- White House Initiative on Educational Excellence for African Americans
<http://sites.ed.gov/whieea/>
- White House Initiative on Historically Black Colleges and Universities
<http://www.ed.gov/edblogs/whhbcu/>
- White House Initiative on Educational Excellence for Hispanic Americans
<http://www2.ed.gov/about/inits/list/hispanic-initiative/index.html>
- White House Initiative on American Indian and Alaska Native Education
<http://www.ed.gov/edblogs/whiaiane/>
- White House Initiative on Asian American and Pacific Islanders
<https://sites.ed.gov/aapi/>

3.2 Number of Proposals and Teaming Arrangements

The individual appendices contain specific requirements regarding the number of proposals that an institution may submit as well as information regarding teaming arrangements. If more than one proposal is allowed, each proposal shall be a separate, stand-alone, complete document in order for NASA to properly evaluate it.

3.3 Principal Investigators and Proposal Team Members

Every institution submitting a proposal in response to this NRA shall designate a single individual, the Principal Investigator (PI), who will be responsible for the quality and direction of the entire proposed effort and for the use of all awarded funds. Because EONS does not accept the designation of a “Co-Principal Investigator;” there shall be only one PI who is solely responsible for the proposed investigation.

Individuals from institutions other than eligible lead institutions may be identified in a proposal as a Co-Investigator (Co-I) or other type of team member/collaborator but not as a PI or Co-PI. (See Section 3.17 of the *Guidebook for Proposers*). Proposals that include the participation of an individual from a NASA Center or NASA’s Jet Propulsion Laboratory (JPL) (NASA’s only FFRDC) shall include a statement of commitment acknowledging his/her participation, and should identify such team member(s) with a NASA Partner role in the NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES; <http://nspires.nasaprs.com>).

3.4 Cost Sharing or Matching

Responders to this NRA are not required to propose or provide matching funds; however, NASA can accept cost sharing if it is voluntarily offered (see 2 CFR 200.306 “Cost Sharing or Matching”).

3.5 Special considerations for NASA team members

Any proposal that includes a NASA team member shall include the NASA Center on the cover page. The total budget request for the NASA Center (as stipulated in the accompanying Letter of Support) shall also be specified under the NASA Partner team member.

Since NASA funding sent to NASA Centers shall be obligated in the same fiscal year (FY) in which it is received, proposals including NASA Centers (except for JPL) shall provide a breakdown of funding by NASA Center and by fiscal year, assuming the start date given in the “Summary of Key Information” table at the end of the appendix (the default is six months after proposal submission). For example, an EONS-2019 proposal for a two-year award that starts in late FY 2019 could phase the funds for civil servants as follows: 1/4 of a year’s funding in FY 2019, a full year’s funding in FY 2020, and 3/4 of a year’s funding in FY 2021.

3.6 Submissions from Non-Domestic Entities

NASA may consider proposals from entities outside the U.S. However, foreign entities are generally not eligible to receive funding from NASA. Therefore, unless otherwise noted in this NRA, proposals from foreign entities should not include a cost plan unless the proposal involves

collaboration with a U.S. institution, in which case a cost plan for only the U.S. entity's participation shall be included. Proposals from foreign entities and proposals from U.S. entities that include foreign participation shall be endorsed by the respective government agency or funding/sponsoring institution in the country from which the foreign entity is proposing. Such endorsement shall indicate that the proposal merits careful consideration by NASA, and if the proposal is selected, that sufficient funds will be made available to execute the activity as proposed.

4. CERTIFICATIONS OF COMPLIANCE

See the Certifications and Assurances link on the NASA Grant and Cooperative Agreement webpage and Section 3.9 of the *Guidebook for Proposers*. Both can be found at the following site: https://prod.nais.nasa.gov/pub/pub_library/srba/index.html.

The Authorized Organizational Representative (AOR's) signature on the proposal automatically certifies that the proposing organization has read and is in compliance with the identified certifications, assurances, and representations.

5. PROPOSAL INSTRUCTIONS AND SUBMISSION INFORMATION

5.1 Proposal Submission Date and Time

All information needed to apply to this solicitation is contained in this EONS NRA and in the *Guidebook for Proposers*. For each solicitation opportunity (activity) provided in the appendices of this NRA, the electronic proposal shall be submitted in its entirety by an AOR no later than the proposal deadline on the appropriate proposal due date given in Table 2 of this NRA. Unless stated otherwise in the relevant appendix to this NRA, the proposal deadline is 11:59 p.m. Eastern Time. Please refer to the activity descriptions in the appendices for specific due dates.

On-time electronic submission is required for every proposal. While every effort is made to ensure the reliability and accessibility of the websites 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 or Grants.gov site and to submit the required proposal materials well in advance of the proposal submission deadline. Difficulty in registering with or using the NSPIRES or Grants.gov proposal submission systems is not, in and of itself, a sufficient reason for NASA to consider a late proposal. Proposers may contact the NSPIRES help desk by email at nspires-help@nasaprs.com or by calling, Monday through Friday from 8:00 am to 6:00 pm Eastern Time at (202) 479-9376, excluding federal holidays. The grants.gov contact center is available by email at support@grants.gov, or by calling 1-800-518-4726 and via website at <http://www.grants.gov/>.

5.2 Submission of Proposals

All proposals submitted in response to this EONS NRA shall be submitted in a fully electronic form. Hard copy proposal or components of the proposal submissions will not be accepted. Electronic proposals shall be submitted by one of the officials at the PI's institution who is

authorized to make such a submission, the AOR. The AOR's electronic submission of the proposal fulfills the requirement for signature of the proposal by an authorized official of the proposing institution.

Proposers may opt to submit proposals in response to this EONS NRA via two different electronic proposal submission systems: either NSPIRES or Grants.gov. In all cases, registration on NSPIRES is required for review and award of any funded activity offered through this solicitation; **therefore, proposers are encouraged to use the NSPIRES system for submission of the proposal.** Proposals submitted via Grants.gov will be transferred to NSPIRES for review. Additional information about NSPIRES and Grants.gov can be found in Sections 4.2 and 4.3 of the *Guidebook for Proposers*. Note that entities may begin working in these systems as soon as the NRA is released. Further, entities may edit the required information as many times as needed until the proposal and accompanying cover sheet information are ready for submission.

IMPORTANT NOTICE ABOUT GRANTS.GOV: As of January 1, 2018, applicants are no longer be able to download the single PDF application package of forms in Grants.gov. Instead, applications submitted through Grants.gov must be submitted through the “Workspace” feature. Information on the Workspace feature can be found at the [Grants.gov Workspace Overview Page](#).

5.3 Registration

In order to submit a proposal, all team members and their institutions shall first be registered in the NSPIRES (<http://nspires.nasaprs.com>) system. Proposers submitting through Grants.gov shall also register on Grants.gov. Details of the multi-step registration process, which takes three (3) business days (or up to four (4) weeks if all steps are not completed in a timely manner) to register a new institution, are described in

http://www.grants.gov/help/html/help/index.htm#t=Get_Started%2FGet_Started.htm.

Registration in NSPIRES cannot be accomplished until each applicable institution obtains a Data Universal Number (DUNS) and registers in the System for Award Management (SAM, <http://sam.gov>). Once the DUNS and SAM steps are complete, the institutions and each team member shall then register with NSPIRES and with Grants.gov if that submission medium will be used.

PLEASE NOTE: registration with NSPIRES is required in order to complete transfer of the Grants.gov proposal to NASA for review. Linking a team member's registration with its institution will automatically associate all required numbers (DUNS, CAGE, and EIN) with the same proposal.

To identify the AOR, who also can register the institution if it is not already registered, a potential PI can contact his or her Sponsored Research Office (SRO). If an institution is not registered in SAM, then the point of contact (POC) from the Office of Sponsored Research/Electronic Business POC shall register it in SAM.

No later than the due date for proposals, proposers to this NRA are required to have:

- 1) a DUNS number;
- 2) a valid registration with the SAM;

- 3) a valid CAGE Code; and
- 4) a valid registration with NSPIRES

5.4 Special Advisory Regarding Grants.gov Submissions to an EONS Appendix

Applicants choosing to submit a proposal via Grants.gov shall **also** register in the NSPIRES site well in advance of the proposal due date. Grants.gov proposals are transcribed manually to NSPIRES so that NASA is able to review them. Grants.gov proposals cannot be transcribed for entities that are: 1) not eligible to compete or 2) not registered in NSPIRES by the due date for proposals for this NRA. Technical Note: Grants.gov does not use the NASA budget template and lacks data quality control checks that are available to proposals that are submitted via NSPIRES.

Additional instructions for formatting and submitting proposals via Grants.gov may be found in the *NASA Guidebook for Proposers*, Sections 4.3.

Instructions for NASA-specific forms and NASA program-specific forms are included in the solicitation and at <https://nspires.nasaprs.com/external/faq.do>. These NASA program-specific forms are required, and failure to properly include them with the NSPIRES and/or Grants.gov submissions may result in the proposal being deemed nonresponsive and rejected without peer review. 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.

Assembly of Electronic Proposals (see Section 3.22 of the *NASA Guidebook for Proposers*).

For proposals submitted electronically, the *Scientific/Technical/ Management Section* and other required sections of the proposal are submitted as one unlocked, searchable PDF file that is attached to the electronic submission using one of the proposal submission systems. All required and permitted appendices and attachments shall be submitted in the PDF file that is attached to the electronic submission. Including any part of the proposal twice creates an additional burden on the peer reviewers. Each proposer shall assemble its proposal into one PDF file before submission. A proposals may be deemed noncompliant and not forwarded for peer review evaluation if it is not submitted in the required PDF format.

Sections of proposals transferred from Grants.gov to NSPIRES may appear in a slightly different order. This will be considered compliant as long as the Proposer originally submitted all of the required forms and documents to Grants.gov.

NASA Requirements for Uploaded PDF Files (see Section 3.23 of the *NASA Guidebook for Proposers*).

It is essential that the PDF file submitted meet NASA requirements. This will ensure that the submitted file can be accepted by NSPIRES, regardless of whether the proposal is submitted via NSPIRES or Grants.gov. This will also ensure that proposals can be accessed by community reviewers and NASA staff using a wide variety of computers, operating systems, and PDF readers. At a minimum, it is the responsibility of the Proposer to ensure:

- (1) that the PDF file is unlocked and that edit permission is enabled;
- (2) that all fonts are embedded in the PDF file; and
- (3) that only Type 1 or TrueType fonts are used.

In addition, any proposer that 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.

All proposers are encouraged to reference http://nspires.nasaprs.com/tutorials/PDF_Guidelines.pdf for more information on creating PDF documents that are compliant with NSPIRES. There have been recent occurrences in which pdf files produced using newer versions of Microsoft Word have not been accepted properly into NSPIRES. PDF files that do not meet NASA requirements cannot be accepted by the NSPIRES system; such files may be deemed noncompliant and not submitted to peer review for evaluation.

It is the responsibility of each applicant to verify the accuracy and completeness of its proposal, including all text, figures, tables, and required forms. NSPIRES provides the “Generate” function (found on the “View Proposal” page within NSPIRES) to allow applicants to verify before submission that all information contained in proposal PDF file(s) being provided to NSPIRES is complete and accurate. Well in advance of the proposal due date, the applicant shall “Generate” the “Complete Proposal,” then download and review the resulting file from NSPIRES to ensure that all text, figures, tables, and required forms are complete and accurate. **Please note that generating a proposal is independent of the submission process.** The applicant should immediately call the NSPIRES Help Desk for assistance with any proposal that is not complete and correct.

The file size limit for proposals submitted electronically to NASA through either NSPIRES or Grants.gov is ten (10) MB. This limit applies to the combined size of all files that are uploaded for a single proposal. Note that large file sizes can impact the time it takes for NASA and peer reviewers to download and access each proposal. In order to increase the ease in reviewing proposals, applicants shall crop and compress any embedded photos and graphic files to an appropriate size and resolution.

Grants.gov provides proposals to NASA and then those proposals are transcribed to NSPIRES for applicants that registered in NSPIRES by the proposal due date. NSPIRES then generates a NASA proposal number for the Grants.gov users and sends a notification by e-mail. Depending on the volume of proposals submitted to Grants.gov, Grants.gov users can expect an email no earlier than 15 business days from the proposal due date. If a Grants.gov submitter has not submitted a complete registration in NSPIRES (including AOR, PI, proposed sub awards) by the time NASA is ready to transcribe the proposal from Grants.gov into NSPIRES, the proposal shall be considered late. (See Appendix C of this NRA.)

Finally, if a Grants.gov submitter did not format the proposal so it can be transcribed cleanly (without consultation with the submitter) into NSPIRES for review, NASA shall consider the Grants.gov proposal to be late. Grants.gov users are responsible for understanding all the required fields in NSPIRES to ensure accurate transcription. NASA is not responsible for transcription errors in NSPIRES resulting from proposals that were originally submitted to Grants.gov.

5.5 Notice of Intent to Propose

To assist in the planning of the proposal evaluation process, NASA strongly encourages all prospective proposers to submit a Notice of Intent (NOI) to propose by the date given in each appendix. An NOI is not required, but is strongly encouraged. The information contained in an NOI is used to help expedite the proposal review activities; therefore, it is of considerable value to both NASA and the Proposer. To be of maximum value, NOIs are to be submitted electronically by entering the requested information through NSPIRES at <http://nspires.nasaprs.com> by the dates given in Table 2 of this NRA for each activity in the relevant appendix. Note that NOIs may be submitted within NSPIRES directly by the PI; no action by an institution's AOR is required to submit an NOI.

Grants.gov does not provide NOI capability; therefore, NOIs shall be submitted via NSPIRES, regardless of whether the proposal will be submitted via NSPIRES or Grants.gov. Interested Proposers shall register with NSPIRES before it can be accessed for use. NSPIRES is open for the submission of NOIs for typically 30 days, starting about 90 days in advance of the due date for proposals. Since NOIs submitted after these deadlines may still be useful to NASA, late NOIs may be submitted as directed in Section 3.3 of the *Guidebook for Proposers*.

NOIs also aid NASA in establishing a peer review process that is free from conflicts of interest and that incorporates the requisite expertise. A separate NOI should be submitted for each intended proposal. The submission of a NOI is not a commitment to submit a proposal, nor is information contained therein considered binding on the submitter. NOIs will be treated as competition-sensitive material. Additional information about the NOI is included in Section 3.3 of the *Guidebook for Proposers*.

5.6 Team Member Confirmation

Each individual team member (e.g., PI, Co-Is, etc.), including all personnel listed on the proposal's electronic cover page, shall confirm their participation on that proposal (indicating team member role) and specify an institutional affiliation. For proposals submitted via NSPIRES, this confirmation is via NSPIRES. For proposals submitted via Grants.gov, this confirmation is via "Statements of Commitment" included within the proposal. The institutional affiliation specified on the cover page shall be the institution through which the team member would work and receive funding while 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. **Any institution requesting NASA funds through the proposed investigation shall be listed on the Proposal Cover Page.** Team members shall ensure that their contact information is current. Changes can be made using the "Account Management" link on the "NSPIRES Options" page.

5.7 Withdrawal of Proposals

The proposer may withdraw proposals at any time before award. Proposers shall timely notify NASA if the proposal is funded by another institution or of any other changed circumstances that necessitate withdrawal of the proposal.

5.8 Questions Related to this NRA

Questions regarding this NRA or its activities shall be directed to the cognizant Activity Manager identified in the *Summary of Key Information* subsection that concludes each activity description. Any clarifications or questions and answers that are published will be posted on the relevant activity's NSPIRES web page. Interested proposers shall routinely check for such information prior to submitting their proposals.

Clarification questions regarding this solicitation shall be submitted in writing or via e-mail to the designated Activity Manager given for each activity as soon as possible but no later than ten (10) days prior to the proposal due date.

5.9 Conflict of Interest Check Information

NASA requires all peer reviewers and/or panelists to disclose any conflicts of interest (see the *Guidebook for Proposers*). Peer reviewers are also expected to disclose situations that may give the appearance of bias, or that may cause a reasonable observer to question the ability of the reviewer to provide an unbiased evaluation of a proposal. Peer reviewers are required to sign a nondisclosure/conflict of interest form prior to being granted access to proposals. **To facilitate adherence to the required conflict of interest disclosures, any institution requesting NASA funds through the proposal SHALL be listed on the proposal cover page.**

5.10 Other Submission Requirements

All proposals shall comply with the general requirements of this NRA. Upon receipt, proposals will be reviewed for compliance to ensure that the proposal includes the following:

- Submission of a complete proposal with all required elements.
- Submission of a proposal from an eligible Proposer as specified in the Eligibility Information. (Section 3 of this NRA).
- Submission of a budget narrative that includes details of any subawards and that is for a funding period consistent with this NRA.
- Submission of a proposal that is consistent with the page limitations and formatting guidelines specified in this NRA and the *Guidebook for Proposers*.

At NASA's discretion, non-compliant proposals may be rejected and not considered or evaluated further for funding.

5.11 Content and Format of the Proposal Submission

Required elements of the proposal as described in Table 4 shall be submitted via the NSPIRES website or Grants.gov. **Proposers shall assemble their proposal into one PDF file (except the NSPIRES-generated Proposal Cover Page) prior to upload of the proposal.** Proposers shall comply with all format requirements identified in this NRA and in the *Guidebook for Proposers*. Please refer to Section 3 of the *Guidebook for Proposers* for more information on proposal submission procedures. Section 3.6 of the *Guidebook for Proposers* provides important guidelines for style formats. A sample proposal cover page can be found in Appendix B.

TABLE 4. Required Proposal Elements

Proposal Elements	Page Guideline
<p>NSPIRES Cover Page and Budget Form (Section 3.7 of the <i>Guidebook for Proposers</i>): The NSPIRES Cover Page contains the following:</p> <ul style="list-style-type: none"> • Proposal Information: PI information, proposal title, proposed start and end dates, submitting institution information, certification and authorization. • Certifications Regarding Lobbying, Disbarment, Suspension and Other Responsibility Matters: The AOR’s signature on the Proposal Cover Page automatically certifies that the proposing organization has read and shall comply with these certifications. No additional form is necessary. See <i>2 CFR 1800</i>, Appendix A. • Team Members: Names, institution and contact information. (<u>Note:</u> Each team member shall register him/herself in NSPIRES and complete all required data. Each team member shall establish an organizational relationship; i.e., identify the organization or other auspices through which the person is participating in the proposal. A proposal <u>cannot</u> be submitted if an organizational relationship within NSPIRES is missing for any team member.) • Proposal Title: Include a meaningful title for the proposed project applicable to specific Appendix. (<u>Note:</u> Title length may not exceed 255 characters including spaces.) • Project Summary (max. 4000 characters, Section 3.7 & 3.9 of the <i>Guidebook for Proposers</i>): Provide a brief description of the project, including objectives, targeted audience, partners, method of approach, relevance to NASA themes, use of NASA content, and outcomes. • Budget Figures: Include figures for <u>each</u> year (up to <u>the number of years of the period of performance</u>) of the proposed project in the spaces provided. This is the total budget, including any sub-awards. • Data Management Plan: limited to 4000 characters <p><u>Note:</u> Sample Cover Pages are located in Appendix B of this NRA. NASA is not permitted to fund institutions that are not listed on the Proposal Cover Page. This includes NASA Centers.</p>	<p>1 or more—NSPIRES will generate the necessary number of pages</p>
<p>Note: To improve proposal reviewability, Proposers shall submit <u>one</u> PDF file to NSPIRES that begins with the Table of Contents and includes all information described below:</p>	
<p>Table of Contents (TOC) (Section 3.7 & 3.12 of the <i>Guidebook for Proposers</i>) NSPIRES does not offer a stand-alone TOC file upload choice. If not uploading a complete end-to-end- proposal in a single PDF, include a TOC as the first page(s) of the project description even if that results in the project description being longer than 15 pages.</p>	<p>1-2 pages</p>
<p>Project Description: A detailed description of the proposed plan. Page limit includes all illustrations, tables, and figures, where each “n-page” foldout counts as n-pages and each side of a sheet containing text or an illustration counts as a page.</p>	<p>maximum 15 pages</p>
<p>References and Citations (Section 3.14 of <i>Guidebook for Proposers</i>)</p>	<p>1 or more (if applicable)</p>
<p>Biographical Sketches: Submit sketches for key personnel using the guidelines from Section Check Sections 3.15 of <i>Guidebook for Proposers</i> and references therein.</p>	<p>PI: max 2 pages Each Co-I and Other Key Personnel: max 1 page</p>

Proposal Elements	Page Guideline
Past, Current and Pending Support (Section 3.16 of Guidebook for Proposers and references therein):	1 or more (if none, so state)
Statements of Commitment and Letters of Support (Section 3.17 of Guidebook for Proposers)	1 or more (if appropriate)
Budget Justification: Narrative and Details (Section 3.18 of Guidebook for Proposers): Include a budget breakdown for each year of proposed work, along with total budget figures for the entire period of performance. Appendix C of the Guidebook for Proposers contains Facilities and Administrative (F&A)/Indirect Costs proposal guidelines and submission instructions.	1 or more
Special Notifications and/or Certifications	As needed

6. PROPOSAL EVALUATION AND SELECTION

6.1 Proposal Review Information

Unless specifically stated in the individual Appendices (specific activities), all NASA-sponsored education activities are evaluated, at a minimum, against the following criteria: (1) **Intrinsic Merit**, (2) **Relevance to NASA**, and (3) **Budget/Cost** (see Appendix D of the *Guidebook for Proposers*). Additional criteria may be added based upon the uniqueness of the requirement of the activity. Refer to each individual appendix for specific details on proposal evaluation criteria.

6.2 Review and Selection Processes

Review of proposals submitted to this announcement will be consistent with the general policies and provisions given in the *Guidebook for Proposers*, Appendix D. Evaluation criteria described in Appendix D of the *Guidebook for Proposers* are superseded by the evaluation criteria described in each EONS activity. Selection procedures will be consistent with the procedures identified in Appendix D of the *Guidebook for Proposers*.

Proposals will be evaluated by a merit review process composed of the proposers' professional peers (Government and non-government), including STEM education and evaluation experts, who have been screened in advance for any conflicts of interest. Unless specifically stated in the individual Appendices (specific activities), proposals will be evaluated and assessed on their strengths and weaknesses for each of the three criteria (Intrinsic Merit, Relevance to NASA, and Budget/Cost) and their sub-elements.

NASA seeks a balanced project award portfolio. NASA also considers diversity factors in the final award portfolio, such as but not limited to, different types of institutional representation, participation by individuals traditionally underrepresented in STEM studies and careers, and geography.

The Selecting Official for each activity is identified in the *Summary of Key Information* at the end of each appendix description.

6.3 Review of Applicants in the Federal Awardee Performance and Integrity Information System (FAPIS)

Prior to making a Federal award with a total amount of Federal share greater than the simplified acquisition threshold (currently \$150,000), NASA is required to review and consider any information about the applicant that is in the designated integrity and performance system (currently the Federal Awardee Performance and Integrity Information System—(FAPIS)) accessible through the SAM (<https://www.sam.gov>) (see 41 U.S.C. 2313).

At its option, an applicant may review information currently in FAPIS and comment on any information about itself that NASA previously entered.

NASA will consider any comments by the applicant, in addition to the other information in FAPIS, in making a judgment about the applicant's integrity, business ethics, and record of performance under Federal awards when completing the review of risk posed by applicants as described in 2 CFR 200.205, Federal awarding agency review of risk posed by applicants.

7. AWARD ADMINISTRATION INFORMATION

7.1 Notice of Award

NASA is committed to announcing selections and initiating awards as quickly as possible, consistent with ensuring the quality of the selection and award process and subject to the appropriation of Federal funds for the initiation of new research awards.

Selections are typically announced between 150-210 days after the proposal due date. The initiation of the award typically occurs between 45 and 90 days after the announcement of selections (see *NASA Guidebook for Proposers*, Section 6 Award Notification).

NASA has no obligation to evaluate ineligible proposals or those that do not meet all stated requirements of this NRA (see *NASA Guidebook for Proposers*, Section 5.6. Proposal Rejected by NASA Without Review).

In all cases, only after the Selecting Official's approval is obtained, any proposals recommended for funding will be forwarded to the NASA Grant Officer for final eligibility review of business, financial, and policy implications and the processing and issuance of a grant or cooperative agreement.

Proposers are strongly cautioned that only a NASA Grant Officer may make commitments, obligations or awards on behalf of NASA or authorize the expenditure of funds. The Grant Officer is dually referred to as an Award Officer in the *NASA Guidebook for Proposers*. No commitment on the part of NASA should be inferred from technical or budgetary discussions with any NASA individual other than the Grant/Award Officer. A PI and/or institution that makes financial or personnel commitments in the absence of a written instrument signed by a NASA Grant Officer does so at their own risk. Grant or cooperative agreement awards are made to the proposing institution, not to the proposed PI or to any other individual.

Notification of both the selected and the non-selected proposals will be consistent with the policy stated in the *NASA Guidebook for Proposers*, Appendix D. For selected proposals, a NASA Grants Officer, who is the only official authorized to obligate the Government, will contact the offeror's business office. The NASA Shared Services Center (NSSC) will handle the negotiation and award of any grants or cooperative agreements. Any costs that the proposer incurs in anticipation of a grant or cooperative agreement award will be subject to the policies and regulations of 2 CFR 1800.209. Expenditures incurred within the 90-day period preceding the effective date of the award may be authorized by the recipient organization, but such expenditures are made completely at the recipient's risk. Expenditures after the scheduled expiration date of the award may be made only to honor documented commitments made on or before the expiration date.

In order to announce selection decisions for grants and cooperative agreements as soon as is possible, even in the presence of budget uncertainties, the Selection Official may defer selection decisions on some proposals while making selection decisions on others. If a Selection Official uses this option, then proposals will be either "selected," "not selected at this time," or "not selected."

Proposals that are "not selected at this time" may be considered for a supplemental selection if and when circumstances allow. All proposers that receive "not selected at this time" will eventually be notified whether their proposal is selected through a supplemental selection, or is no longer being considered for a supplemental selection.

Proposers that are not selected will be notified by electronic mail and offered a debriefing consistent with the policy in Appendix D of the *NASA Guidebook for Proposers*.

7.2 Process for Appeals Prior to Formal Requests for Reconsideration

This NRA is limited to the awarding of grants and cooperative agreements to MSIs. Accordingly, the appeals and reconsideration processes under this NRA do not include protest rights either at the U.S. Government Accountability Office (GAO) or with the Agency, as defined in FAR 33.101. The provisions at 48 FAR 52.233-2 ("Service of Protest") and NFS 1852.233-70 ("Protests to NASA") do not apply to this NRA.

A PI who is not satisfied with the explanation of the basis for the declination of its proposal may contact the Selecting Official, in writing (delivered via e-mail, fax or regular mail) stating the reasons for requesting reconsideration of the declination and requesting a written or oral debriefing (see Formal Request for Reconsideration, below).

Formal Requests for Reconsideration

(i) Debriefing by the Activity Manger. A PI whose proposal has been not selected may request a written or oral debriefing from the Activity Manager. The debriefing will be provided expeditiously, i.e., usually within two weeks.

(ii) Written Request for Reconsideration to Selecting Official. Following the debriefing, dissatisfied PIs shall, within 30 calendar days of the debriefing, submit in writing a Request for Reconsideration to the Selecting Official. If no debriefing has been conducted, the Request for Reconsideration shall be submitted within 60 calendar days of notification that the proposal had not been selected. The Selecting Official will respond in writing to the Request for Reconsideration within 30 calendar days of receipt of the request. If additional time is required to prepare a response, an explanation of the need for more time will be given to the PI within 30 calendar days.

Following a response from the Selecting Official, if the PI is still not satisfied with the Selecting Official's decision, the PI may request a formal reconsideration within 30 days of the deselecting Official's decision. Electronic or faxed requests for formal reconsiderations will not be accepted. Formal requests shall only be submitted through the United States Postal Service (USPS) and shall: 1) detail the reasons for the reconsideration request; 2) be printed on institutional letterhead; 3) be co-signed by the PI and the AOR; and 4) be addressed to the Deputy Associate Administrator for Education:

Deputy Associate Administrator for Education
NASA Headquarters
Washington, DC 20546
Telephone: 202-358-0711

(iii) Appeals above the Deputy Associate Administrator for Education (DAAE). Appeals above the DAAE shall be made within 30 calendar days of receipt of that decision. The written appeal shall be submitted to the Associate Administrator for Education or the Assistant Administrator of the Mission Directorate or Office issuing the solicitation. A response to the appeal will be provided to the PI within 30 calendar days.

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

Mr. Bill Roets
Deputy Assistant Administrator for Procurement
Office of Procurement
NASA Headquarters
300 E Street SW Room 5L14
Washington, DC 20546-0001
Telephone: (202) 358-1050
Facsimile: (202) 358-3082
Email: agency-procurementombudsman@nasa.gov

7.3 Administrative and National Policy Requirements

Grant and cooperative agreement awards are subject to the regulations at 2 CFR 200 and the NASA Grant and Cooperative Agreement Manual (GCAM), located at https://prod.nais.nasa.gov/pub/pub_library/srba/index.html. The GCAM consists of eight

sections that prescribe the policies and procedures relating to the award and administration of NASA grants and cooperative agreements.

7.4 Award Reporting Requirements

The reporting requirements for awards made through this NRA will be consistent with any applicable NASA and Federal regulations. Any additional requirements are specified in the activity description.

Award recipients may be subject to reporting requirements under the [NASA Plan for Increasing Access to Results of Federally Funded Research](#). Any such requirements will be identified in the Notice of Award.

If the Federal share of any award issued under this NRA is more than \$10,000,000 over the period of performance, additional reporting requirements will apply. See 2 CFR 200 Appendix XII—Award Term and Condition for Recipient Integrity and Performance Matters (http://www.ecfr.gov/cgi-bin/text-idx?SID=4b63b1740bdb186d3bf5d346f5ddf42c&mc=true&node=ap2.1.200_1521.xii&rgn=div9)

7.5 Additional Terms and Conditions

Personal Identity Verification (PIV) of Grant/Cooperative Agreement Personnel

If any proposal personnel are expected to work on site at a NASA Center, they shall comply with the *NASA Guidebook for Proposers*, Appendix E and the Grant and Cooperative Agreement Manual, Appendix C. These sections provide information about recipients requiring access to a NASA Center, facility, or computer system, or to NASA Technical Information, which requires “Personal Identity Verification of Recipient Personnel.”

8. POINTS OF CONTACT FOR FURTHER INFORMATION

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

Ms. Joeletta O. Patrick
Manager, Minority University Research and Education Project
Office of Education
National Aeronautics and Space Administration
300 E Street SW
Washington, DC 20546-0001
Telephone: (202) 358-2370
Email: joeletta.o.patrick@nasa.gov

Note: Proposals shall not be submitted to this address. Proposals shall be submitted electronically as described in Section 5 of this NRA.

Specific questions about a given activity in this NRA shall be directed to the Project Manager(s) listed in the Summary of Key Information subsection that concludes each activity description.

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

Inquiries about accessing or using Grants.gov located at <http://www.grants.gov> are available by email at support@grants.gov, or by calling 1-800-518-4726 and via the website at <http://www.grants.gov>.

9. ANCILLARY INFORMATION

9.1 Announcement of Updates/Amendments to Solicitation

Because this NRA is released in advance of many of the deadlines given in Table 2, additional major programmatic information for any of its elements may develop before proposal due dates. If so, such information will be added as a formal amendment to this NRA and posted at EONS homepage at <http://nspires.nasaprs.com> (select “Solicitations” then “Open Solicitations” then “NNH18XXXXXXXX”). Prospective proposers shall regularly check this NRA’s homepage for updates concerning the activity(s) of interest.

Any clarifications or questions and answers that are published will be posted on the relevant activity’s web page at <http://nspires.nasaprs.com> (select “Solicitations” then “Open Solicitations” then “NNH18XXXXXXXX” then “List of Activities” then the relevant activity). FAQs may be updated until the proposal due date.

APPENDIX A

PIV Card Issuance Procedures in accordance with FAR Clause 52.204-9, Personal Identity Verification of Contractor Personnel (Jan. 2011)

The enrollment and processing of NASA identity data and the issuance of credentials to those identities is to be completed in the Identity Management and Account Exchange (IdMAX) system following the requirements found in NPR 1600.4. Figure 1 depicts the processes described in steps 2 through 5.

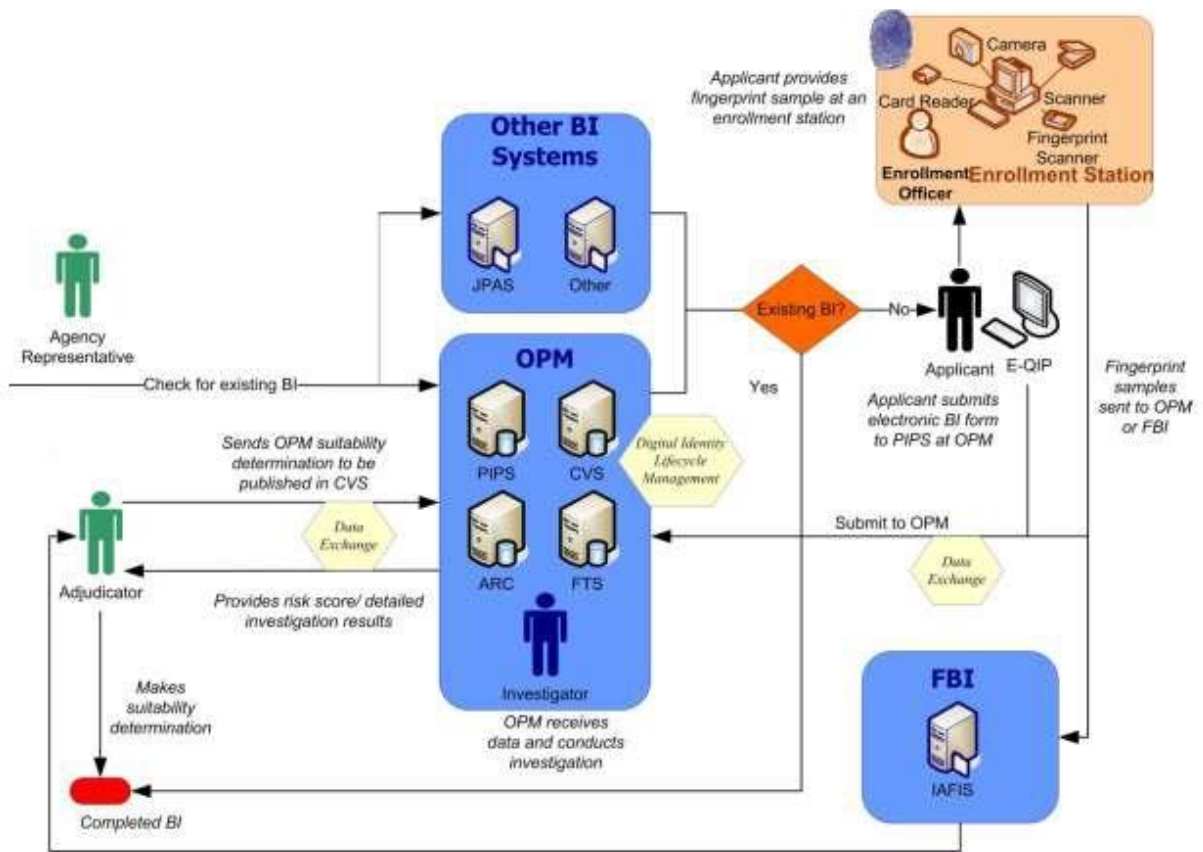


Figure 1. Review Process

Step 1

The grantee or recipient submits a formal letter that provides a list of the names of individuals (applicants) who require access to a NASA-controlled facility or access to a NASA information technology (IT) system to the cognizant NASA Technical Officer (TO). In the case of a foreign national applicant, approval through IdMAX shall be obtained for the visit or assignment before any processing for a PIV or alternate agency credential (collectively referred to as a credential)

can take place. Further, if the foreign national is not under a grant or cooperative agreement where a technical officer has been officially designated, the foreign national will provide the information directly to their visit/assignment host, and the host sponsor will fulfill the duties of the technical officer mentioned herein.

In each case, the letter shall include the subject grant or cooperative agreement number, the NASA Center organization code, the applicant's full name (first, middle and last), countries of citizenship, email address, and phone number. If the applicant has a current satisfactorily completed Tier 1 or an equivalent or higher degree of background investigation, the letter shall indicate the type of investigation, the agency completing the investigation, and date the investigation was completed. Also, the letter shall specify the access requirements and the risk/sensitivity level associated with the position in which each applicant will be working (NPR 1600.3, §2.3 is germane). Further, the letter shall also acknowledge that applicants may be denied access to NASA facilities, information, and/or information systems based on an unsatisfactory background investigation/adjudication.

After reviewing the letter for completeness and concurring with the risk/sensitivity levels, the technical officer/host shall forward the letter to the Center Office of Protective Services (OPS).

Step 2

Upon acceptance of the letter/background information, the Center OPS shall create a remote identity invitation in IdMAX. The applicant shall utilize the invitation tool link and password in their email to review, correct, and submit additional personal data securely.

Upon receipt of the completed remote invite, the Center OPS shall ensure review of the OPM databases (e.g., DCII, PIPS, et al.) and validation of the applicant's investigation status. Requirements for a Tier 1 or other investigation shall be initiated only if necessary. Applicants who do not currently possess the required level of background investigation shall be directed to the e-QIP web site to complete the necessary background investigation forms online. The Center OPS shall provide to the technical officer/host information and instructions on how to access the e-QIP for each grantee, recipient or foreign national employee requiring access.

Upon completion of the e-QIP, the Center OPS will advise the applicant that in order to complete the investigation process, he or she shall appear in-person before the authorized registrar and submit two forms of identity source documents in original form. The identity source documents shall come from the list of NASA-approved identity source documents, one of which shall be a Federal or State issued picture identification. The registrar will electronically scan the submitted documents; any document that appears invalid will be rejected by the registrar.

Fingerprints and a photograph will be taken at this time. The applicant shall appear no later than the entry on duty date. The information submitted by the applicant will be used to create or update the applicant identity record in IdMAX.

Step 3

Upon the applicant's completion of the investigation forms, the Center OPS reviews the information, and resolves discrepancies with the applicant as necessary. When the applicant has appeared in person and completed fingerprints, the package is electronically submitted to initiate the background investigation. The Center OPS includes a request for feedback on the National Criminal History Check (NCHC) portion of the background investigation at the time the request is submitted.

Step 4

Prior to authorizing physical access of a grantee or recipient to a federally-controlled facility or access to a Federal information system, the Center OPS will ensure that required database checks have been performed. If this process yields negative information, the Center OPS will immediately notify the Center Chief of Security (CCS) and the technical officer/host.

Step 5

Upon receipt of the completed NCHC, the Center OPS will update IdMAX and indicate the result of the suitability determination. If an unsatisfactory suitability determination is rendered, the technical officer will advise the grantee or recipient that the applicant is being denied physical access to all federally-controlled facilities and Federal information systems.

Based on favorable results of the NCHC, National Crime Information Center (NCIC) Interstate Identification Index (III) check, and/or other required checks, the Center OPS will authorize the issuance of the appropriate credential in IdMAX. For foreign nationals the International Visit Coordinator (IVC), in consultation with other organizations, based on information provided in the access control plan, will determine what physical access the applicant should be granted once the appropriate credential is issued.

Step 6

Using the information provided by the applicant during his or her in-person appearance, the credential will be created and activated following necessary procedures for that credential.

Step 7

The applicant proceeds to the credential issuance facility to begin processing for receipt of his/her credential.

The applicant provides to the credential issuing operator the same identity source documents submitted for registration. The credential issuing operator will verify that the facial image, and optionally referenced finger print, matches the enrollment data used to produce the card. Upon verification of identity, the operator will locate the employee's record and modify the record to indicate the credential has been issued. If required, the applicant will select a PIN for use with his or her new credential.

Note: A non-PIV government identification badge, including the NASA Photo Identification Badge, SHALL NOT BE USED for the original issuance of a PIV-vetted credential.


ALTERNATIVE FOR APPLICANTS WHO DO NOT HAVE A COMPLETED AND ADJUDICATED NCHC AT THE TIME OF ENTRANCE ON DUTY (EOD)

Steps 1 through 4 shall be accomplished for all applicants in accordance with the process described above. If the applicant is unable to appear in person until the time of entry on duty, or does not, for any other reason, have a completed and adjudicated NCHC portion of the background investigation at the time of entrance on duty, the following interim procedures shall apply for US citizens and legal permanent residents. These procedures are not applicable to foreign nationals who must have a completed fingerprint check before EOD.

1. If the documents required to submit the background investigation have not been completed prior to EOD, the applicant will be instructed to complete all remaining requirements for submission of the investigation request. This includes presentation of identity source documents and completion of fingerprints, if not already accomplished. If the applicant fails to complete these activities as prescribed in NPR 1600.4 (Chapters 3 & 4), it may be considered as failure to meet the conditions required for access to a NASA-controlled facility or access to a NASA IT system, and result in denial of such access.
2. Based on favorable results of the NCIC III, the applicant shall be issued an appropriate alternate agency credential for a period not-to-exceed six months. If at the end of the six month period the NCHC results have not been returned, the agency will at that time make a determination as to whether an additional extension will be granted for the temporary alternate agency credential.
3. Upon return of the completed background investigation, the process will continue from Step 5.

APPENDIX B

Sample Proposal Format

	Cover Page for Proposal Submitted to the National Aeronautics and Space Administration	NASA Proposal Number			
NASA PROCEDURE FOR HANDLING PROPOSALS					
This proposal shall be used and disclosed for evaluation purposes only, and a copy of this Government notice shall be applied to any reproduction or abstract thereof. Any authorized restrictive notices that the submitter places on this proposal shall also be strictly complied with. Disclosure of this proposal for any reason outside the Government evaluation purposes shall be made only to the extent authorized by the Government.					
SECTION I - Proposal Information					
Principal Investigator		E-mail Address		Phone Number	
Street Address (1)			Street Address (2)		
City		State / Province		Postal Code	Country Code
Proposal Title :					
Proposed Start Date	Proposed End Date	Total Budget	Year 1 Budget	Year 2 Budget	Year 3 Budget
SECTION II - Application Information					
NASA Program Announcement Number		NASA Program Announcement Title			
For Consideration By NASA Organization <i>(the soliciting organization, or the organization to which an unsolicited proposal is submitted)</i>					
Date Submitted		Submission Method	Grants.gov Application Identifier	Applicant Proposal Identifier	
Type of Application	Predecessor Award Number	Other Federal Agencies to Which Proposal Has Been Submitted			
International Participation	Type of International Participation				
SECTION III - Submitting Organization Information					
DUNS Number	CAGE Code	Employer Identification Number (EIN or TIN)		Organization Type	
Organization Name (Standard/Legal Name)				Company Division	
Organization DBA Name				Division Number	
Street Address (1)			Street Address (2)		
City	State / Province		Postal Code	Country Code	
SECTION IV - Proposal Point of Contact Information					
Name		Email Address		Phone Number	
SECTION V - Certification and Authorization					
Certification of Compliance with Applicable Executive Orders and U.S. Code By submitting the proposal identified in the Cover Sheet/Proposal Summary in response to this Research Announcement, the Authorizing Official of the proposing organization (or the individual proposer if there is no proposing organization) as identified below: <ul style="list-style-type: none"> • 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 in the two Certifications and one Assurance contained in this NRA (name), (i) the Assurance of Compliance with the NASA Regulations Pursuant to Nondiscrimination in Federally Assisted Programs, and (ii) Certifications, Disclosures, and Assurances Regarding Lobbying and Debarment and 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).					
Authorized Organizational Representative (AOR) Name		AOR E-mail Address		Phone Number	
AOR Signature <i>(Must have AOR's original signature. Do not sign "for" AOR.)</i>				Date	

FORM NRESS-300 Version 3.0 Apr 09

PI Name :		NASA Proposal Number	
Organization Name :			
Proposal Title :			
SECTION VI - Team Members			
Team Member Role	Team Member Name	Contact Phone	E-mail Address
Organization/Business Relationship		Cage Code	DUNS#
International Participation	U.S. Government Agency		Total Funds Requested
Team Member Role	Team Member Name	Contact Phone	E-mail Address
Organization/Business Relationship		Cage Code	DUNS#
International Participation	U.S. Government Agency		Total Funds Requested
Team Member Role	Team Member Name	Contact Phone	E-mail Address
Organization/Business Relationship		Cage Code	DUNS#
International Participation	U.S. Government Agency		Total Funds Requested

SAMPLE

PI Name :	NASA Proposal Number
Organization Name :	

Proposal Title :

SECTION VII - Project Summary

SAMPLE

PI Name :		NASA Proposal Number
Organization Name :		
Proposal Title :		
SECTION VIII - Other Project Information		
Environmental Impact		
Does this project have an actual or potential impact on the environment?	Has an exemption been authorized or an environmental assessment (EA) or an environmental impact statement (EIS) been performed?	
Environmental Impact Explanation:		
Exemption/EA/EIS Explanation:		

SAMPLE

PI Name :	NASA Proposal Number
Organization Name :	
Proposal Title :	
SECTION IX - Program Specific Data	

SAMPLE

PI Name :		NASA Proposal Number		
Organization Name :				
Proposal Title :				
SECTION X - Budget				
Cumulative Budget				
Budget Cost Category	Funds Requested (\$)			
	Year 1 (\$)	Year 2 (\$)	Year 3 (\$)	Total Project (\$)
A. Direct Labor - Key Personnel	0.00	0.00	0.00	0.00
B. Direct Labor - Other Personnel	0.00	0.00	0.00	0.00
Total Number Other Personnel	0	0	0	0
Total Direct Labor Costs (A+B)	0.00	0.00	0.00	0.00
C. Direct Costs - Equipment	0.00	0.00	0.00	0.00
D. Direct Costs - Travel	0.00	0.00	0.00	0.00
Domestic Travel	0.00	0.00	0.00	0.00
Foreign Travel	0.00	0.00	0.00	0.00
E. Direct Costs - Participant/Trainee Support Costs	0.00	0.00	0.00	0.00
Tuition/Fees/Health Insurance	0.00	0.00	0.00	0.00
Stipends	0.00	0.00	0.00	0.00
Travel	0.00	0.00	0.00	0.00
Subsistence	0.00	0.00	0.00	0.00
Other	0.00	0.00	0.00	0.00
Number of Participants/Trainees				0
F. Other Direct Costs	0.00	0.00	0.00	0.00
Materials and Supplies	0.00	0.00	0.00	0.00
Publication Costs	0.00	0.00	0.00	0.00
Consultant Services	0.00	0.00	0.00	0.00
ADP/Computer Services	0.00	0.00	0.00	0.00
Subawards/Consortium/Contractual Costs	0.00	0.00	0.00	0.00
Equipment or Facility Rental/User Fees	0.00	0.00	0.00	0.00
Alterations and Renovations	0.00	0.00	0.00	0.00
Other	0.00	0.00	0.00	0.00
G. Total Direct Costs (A+B+C+D+E+F)	0.00	0.00	0.00	0.00
H. Indirect Costs	0.00	0.00	0.00	0.00
I. Total Direct and Indirect Costs (G+H)	0.00	0.00	0.00	0.00
J. Fee	0.00	0.00	0.00	0.00
K. Total Cost (I+J)	0.00	0.00	0.00	0.00
Total Cumulative Budget				0.00

PI Name :		NASA Proposal Number	
Organization Name :			
Proposal Title : I523 Test 1			
SECTION X - Budget			
Start Date :	End Date :	Budget Type :	Budget Period :
F. Other Direct Costs			
			Funds Requested (\$)
1. Materials and Supplies			0.00
2. Publication Costs			0.00
3. Consultant Services			0.00
4. ADP/Computer Services			0.00
5. Subawards/Consortium/Contractual Costs			0.00
6. Equipment or Facility Rental/User Fees			0.00
7. Alterations and Renovations			0.00
Total Other Direct Costs			0.00
G. Total Direct Costs			
			Funds Requested (\$)
Total Direct Costs (A+B+C+D+E+F)			0.00
H. Indirect Costs			
		Indirect Cost Rate (%)	Indirect Cost Base (\$)
Cognizant Federal Agency:		Funds Requested (\$)	
		Total Indirect Costs	
		0.00	
I. Direct and Indirect Costs			
			Funds Requested (\$)
Total Direct and Indirect Costs (G+H)			0.00
J. Fee			
			Funds Requested (\$)
			Fee
			0.00
K. Total Cost			
			Funds Requested (\$)
Total Cost with Fee (I+J)			0.00

PI Name :		NASA Proposal Number	
Organization Name :			
Proposal Title :			
SECTION X - Budget			
Start Date :	End Date :	Budget Type :	Budget Period :
C. Direct Costs - Equipment			
Item No.	Equipment Item Description	Funds Requested (\$)	
	Total Equipment Costs	0.00	
D. Direct Costs - Travel			
		Funds Requested (\$)	
1. Domestic Travel (Including Canada, Mexico, and U.S. Possessions)		0.00	
2. Foreign Travel		0.00	
	Total Travel Costs	0.00	
E. Direct Costs - Participant/Trainee Support Costs			
		Funds Requested (\$)	
1. Tuition/Fees/Health Insurance		0.00	
2. Stipends		0.00	
3. Travel		0.00	
4. Subsistence		0.00	
Number of Participants/Trainees:		Total Participant/Trainee Support Costs	0.00

PI Name :						NASA Proposal Number		
Organization Name :								
Proposal Title :								
SECTION X - Budget								
Start Date :			End Date :		Budget Type :		Budget Period :	
A. Direct Labor - Key Personnel								
Name	Project Role	Base Salary (\$)	Cal. Months	Acad. Months	Summ. Months	Requested Salary (\$)	Fringe Benefits (\$)	Funds Requested (\$)
		0.00				0.00	0.00	0.00
Total Key Personnel Costs								0.00
B. Direct Labor - Other Personnel								
Number of Personnel	Project Role	Cal. Months	Acad. Months	Summ. Months	Requested Salary (\$)	Fringe Benefits (\$)	Funds Requested (\$)	
0	Total Number Other Personnel						0.00	
Total Direct Labor Costs (Salary, Wages, Fringe Benefits) (A+B)								0.00

PI Name :		NASA Proposal Number	
Organization Name :			
Proposal Title :			
SECTION X - Budget			
Start Date :	End Date :	Budget Type :	Budget Period :
F. Other Direct Costs			
			Funds Requested (\$)
1. Materials and Supplies			0.00
2. Publication Costs			0.00
3. Consultant Services			0.00
4. ADP/Computer Services			0.00
5. Subawards/Consortium/Contractual Costs			0.00
6. Equipment or Facility Rental/User Fees			0.00
7. Alterations and Renovations			0.00
Total Other Direct Costs			0.00
G. Total Direct Costs			
			Funds Requested (\$)
Total Direct Costs (A+B+C+D+E+F)			0.00
H. Indirect Costs			
	Indirect Cost Rate (%)	Indirect Cost Base (\$)	Funds Requested (\$)
Cognizant Federal Agency:		Total Indirect Costs	0.00
I. Direct and Indirect Costs			
			Funds Requested (\$)
Total Direct and Indirect Costs (G+H)			0.00
J. Fee			
			Funds Requested (\$)
			Fee
			0.00
K. Total Cost			
			Funds Requested (\$)
Total Cost with Fee (I+J)			0.00

APPENDIX C

EONS Policy on Late Proposals

NASA does not pre-approve the submission of a late proposal. The decision to submit a late proposal is solely that of the Proposer, and it is then NASA's decision whether to accept it. If NSPIRES is available for submissions, the site automatically captures the time that the system received the proposal. Proposals submitted later than 11:59 PM Eastern time on the due date of proposals are considered "LATE." The NSPIRES system may prevent the submission of proposals after the deadline.

NSPIRES generates an automatic acknowledgement when proposals are submitted. The acknowledgement for on time and late proposals is the same and will resemble the following:

Sample Acknowledgement of Submission

-----Original Message-----

From: nspires@nasaprs.com

Sent: <Name of the day of the Week>, Name of Month, Date, Year <Message Time Hour:Minute>

To: <email address of submitter>

Cc: <email address of submitter>

Subject: NASA NSPIRES - Proposal has been submitted to NASA

The following proposal has been submitted for consideration of an award by NASA:

Proposal Number: xx-201?[EONS Appendix]-000X

Proposal Title: <Name as submitted by the AOR>

Submitting Organization: <Name that shows up in NSPIRES>

Authorized Organization Representative: First and then Last NAME

Principal Investigator: First then Last NAME

Date submitted: Numeric Month/ Numeric Day /Numeric Year Hour:Minute:Second

To log in to NSPIRES, click on this link: <http://nspires.nasaprs.com/>

If the above URL is not an active link, please cut and paste the entire URL into your web browser.

If you have questions or problems regarding this, or any other NSPIRES business, please contact the NSPIRES Help Desk:

E-mail: NSPIRES-HELP@nasaprs.com

Phone Support: (202) 479-9376

Hours: Monday through Friday, 8:00 AM to 6:00 PM EST/EDT

This message is being sent from an outbound-only mail server. Please do not reply to this message.

-----End of Excerpt-----

If a Proposer does not receive a notice similar to the sample above after proposal submission, first check spam filters and junk boxes. If unable to locate the e-mail acknowledgement, then

Proposers shall contact the NSPIRES Help Desk or log in directly to NSPIRES to check a submission status.

Only the Selection Official or a designee may accept a late proposal for assignment to external review. Normally, late proposals are only considered for review if there is a practical way of reviewing the proposal along with the on-time proposals. If for some known or unknown reason an entity's proposal was not submitted by the proposal due date, the Proposer shall send a detailed explanatory note via e-mail to NASA's Support Contractor for this NRA:

NASA Research & Education Support Services
2345 Crystal Drive, Suite 500
Arlington, VA 22202
202-479-9030
202-479-0511 (fax)
Email: help@nasaprs.com

Decisions about each proposal submitted—either on time or late—will be communicated electronically (not by phone or personalized email) to each PI and AOR via NSPIRES. It is entirely possible that a late Proposer may not know whether it was accepted for review until all Proposers are notified approximately nine months from the NRA's proposal due date.

When decisions resulting from the evaluation process for proposals are made, a computer-generated e-mail goes out requesting the PI/AOR to log in. It will resemble the following:

Sample Decision Notice E-mail

-----Original Message-----

From: nspires@nasaprs.com [mailto:nspires@nasaprs.com]

Sent: Name of Weekday, Month ??, 20?? H:Min PM/AM

To: NSPIRES-admin@nasaprs.com

Subject: NASA NSPIRES - Decision has been made.

A decision has been made by NASA for:

Solicitation Number: NNH????????

Solicitation Title: [EONS Appendix Reference]

Acronym: [EONS Appendix Reference]

Proposal Due Date: 0?/?/20??

You may access information regarding this decision by logging in to NSPIRES:

<http://nspires.nasaprs.com/>

Decision information can be accessed in two ways:

After logging in, the Principal Investigator selects the "Proposals" link, the "Submitted Proposals/NOIs" link, and then clicks on the proposal submitted to the solicitation identified above. The document(s) provided by NASA will be displayed under the heading "PI Information Package" located at the bottom of the "View Proposal" page.

After logging in, the Authorized Organization Representative selects "Organization Mgmt" link and, from within the submitting organization, selects the "Organization Proposals" link, the "Submitted Proposals" link and then clicks on the proposal submitted to the solicitation identified above. The document(s) provided by NASA will be displayed under the heading "PI Information Package" located at the bottom of the "View Proposal" page.

If the above URL is not an active link, please cut and paste the entire URL into your web browser.

If you have questions or problems regarding this, or any other NSPIRES business, please contact the NSPIRES Help Desk:

E-mail: nspires-help@nasaprs.com

Phone Support: (202) 479-9376

Hours: Monday through Friday, 8:00 AM to 6:00 PM EST/EDT

This message is being sent from an outbound-only mail server. Please do not reply to this message.

-----End of Excerpt-----

From the *NASA Guidebook for Proposers*

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

Proposers should be aware that neither NASA personnel nor the employees of the support contractor that receives and handles proposals for NASA are able to authorize the submission of a late proposal and, therefore, such permission should not be requested. The decision to submit a late proposal is solely that of the Proposer, and it is then NASA's decision whether to accept it. Late proposals may be considered for review and possible selection only if they appear to offer a distinct benefit to NASA [Ref. Section 5]. In this regard it is important to note that, since almost every NRA receives many more high-quality proposals than can be supported with the available funds, a determination by NASA that a late proposal is of distinct benefit over its competitors is likely to be rare. Additionally, Proposers should note that Grants.gov does not accept late proposals. Proposals or proposal modifications received after the latest date specified for receipt may be considered if a significant reduction in cost to the Government is probable or if there are significant technical advantages, as compared to proposals previously received.

Also see 48 FAR 1852.235-72 Instructions for Responding to NASA Research Announcements (July 2016) found at: <https://www.gpo.gov/fdsys/pkg/CFR-2014-title48-vol6/pdf/CFR-2014-title48-vol6-sec1852-235-72.pdf>

Allowances for Technical Problems

In every NASA solicitation, Proposers are advised that it is their responsibility to begin the proposal submission process early enough to account for ubiquitous technical problems with computer systems and with the internet. If an emergency or unanticipated event interrupts normal Government processes so that proposals cannot be received at the Government office designated for receipt of proposals by the exact time specified in the solicitation, and urgent Government requirements preclude amendment of the solicitation closing date, the time specified for receipt of proposals will be deemed to be extended to the same time of day specified in the solicitation on the first work day on which normal Government processes resume. An example might be an act of nature (e.g., hurricane or blizzard affecting NASA or a Proposer's region) or an act of man (e.g., NSPIRES is offline). The failure of the proposing team to complete its proposal prior to the deadline, for whatever reason, does not constitute a technical problem. The failure of the Proposer to meet a known delivery deadline does not constitute a technical problem. Other circumstances that may constitute a technical problem will be reviewed on a case-by-case basis. The NASA Selection Official may declare a proposal "on time" if a proposal would have been received by NASA before the proposal deadline in the absence of the technical problem, if the

technical problem could not have been reasonably anticipated and was beyond the Proposer's reasonable control, and if the Proposer does not gain an unfair competitive advantage as a result of these circumstances.

Any Changes or Revisions to a Proposal After the Due Date make the Proposal Late:

It is not possible for a proposal to be updated, particularly the substance of a proposal, without NASA considering such revisions/updates as a late proposal. If a Proposer wants to provide new material, revise, clarify or change or expand a submitted proposal, such a substantial update is akin to submitting a new proposal after the proposal's due date. Changes or updates to basic descriptive data (e.g., a PI has retired or the submitting organization has a new President) are not changes to the proposal's substance under the NRA; however, such changes cannot be reflected in the proposal submission, nor can they be considered in the review of the proposal. If, during the time between the proposal due date and decision announcement, there have been changes to the AOR and PI, the Proposer shall immediately notify the above mentioned NSPIRES Support Contractor for this NRA to confirm that the proposing organization will still be able to access NSPIRES.

APPENDIX D

Glossary of Acronyms and Definitions

ACRONYMS

AANAPSI	Asian American and Native American Pacific Islanders Serving Institutions
AIANSI	American Indian and Alaskan Native Serving Institution
AOR	Authorized Organization Representative
APG	Annual Performance Goal
API	Annual Performance Indicator
ARC	Ames Research Center, Moffett Field, CA
AFRC	Armstrong Flight Research Center, Edwards, CA
ARMD	Aeronautics Research and Mission Directorate
CCE	Climate Change Education
CCR	Central Contractor Registry
CO	Contracting Officer
CO-I	Co-Investigator
DUNS	Data Universal Numbering System; a unique nine-digit sequence recognized as the universal standard for identifying and keeping track of over 100 million businesses worldwide
EIN	Employer Identification Number
EONS	Education Opportunities in NASA STEM
EPD	Educator Professional Development
ESTEEM	Earth Systems, Technology and Energy Education for MUREP
FAQ	Frequently Asked Questions
FY	Fiscal Year (Federal) (October – September)
GO	Grants Officer
GRC	Glenn Research Center, Cleveland, OH
GSFC	Goddard Space Flight Center, Greenbelt, MD
HBCUs	Historically Black Colleges and Universities
HSIs	Hispanic Serving Institutions
HEOMD	Human Exploration and Operations Mission Directorate
JPL	Jet Propulsion Laboratory, Pasadena, CA
JSC	Johnson Space Center, Houston, TX
KSC	Kennedy Space Center, Cape Canaveral, FL
LaRC	Langley Research Center, Hampton, VA
MAA	MUREP Aerospace Academy
MAHVMC	MUREP Aerospace High Volume Manufacturing Challenge
MAIANSE	MUREP for American Indian and Alaskan Native STEM Engagement
MC3I	MUREP Community College Curriculum Improvement
MEI	MUREP Educator Institutes
MITTIC	MUREP Innovation and Technology Transfer Idea Competition
MISTC	MUREP Innovations in Space Technology Curriculum
MIRO	MUREP Institutional Research Opportunity
MOO	MUREP Other Opportunities
MSIs	Minority Serving Institutions (refers collectively to HBCUs, HSIs, TCUs, and other minority serving institutions of higher education)
MSFC	Marshall Space Flight Center, Huntsville, AL

MUREP	Minority University Research and Education Project
MUSIC	MUREP Sustainability and Innovation Collaborative
NEIP	NASA Education Implementation Plan
NOI	Notice of Intent
NIF	NASA Internships and Fellowships
NPD	NASA Policy Directive
NSF	National Science Foundation
NRA	NASA Research Announcement
NRESS	NASA Research and Education Support Services
NSPIRES	NASA Solicitation and Proposal Integrated Review and Evaluation System
NSSC	NASA Shared Services Center
NSTC	National Science and Technology Council
OE	Office of Education
OEPM	Office of Education Performance Measurement System
PBIs	Predominately Black Institutions
PI	Principal Investigator
PL	Public Law
SE	STEM Engagement
SEA	STEM Education and Accountability
SMD	Science Mission Directorate
SRO	Sponsored Research Office
SSC	Stennis Space Center, Hancock County, MS
STEM	Science, Technology, Engineering, and Mathematics
STMD	Space Technology Mission Directorate
TCUs	Tribal Colleges and Universities
TM	Technical Monitor
TO	Technical Officer

DEFINITIONS

American Indian or Alaskan Native: A person having origins in any of the original peoples of North America, and who maintains cultural identification through tribal affiliation or community recognition.

Asian: A person having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent including, for example, Cambodia, China, India, Japan, Korea, Malaysia, Pakistan, the Philippine Islands, Thailand, and Vietnam.

Black or African-American: A person having origins in any of the black racial groups of Africa.

EPD: Educator Professional Development uses NASA's missions, education resources, and unique facilities to provide high-quality STEM content and hands-on learning experiences to in-service, pre-service, and informal educators.

Executive Orders: Presidential Directives are considered a form of executive order issued by the President of the United States with the advice and consent of a major agency or department found within the executive branch of the government.

Hispanic or Latino: A person of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish Culture.

IE: Institutional Engagement increases the STEM capabilities at formal and informal educational institutions and organizations by incorporating content based on NASA's missions.

NASA Mission Directorates: There are four NASA Mission Directorates: Aeronautics Research Mission Directorate (ARMD), Human Exploration and Operations Mission Directorate (HEOMD), Science Mission Directorate (SMD), and Space Technology Mission Directorate (STMD).

NASA Strategic Objective 3.3: Inspire and engage the public in aeronautics, space, and science. Inspires, engage, educate and employ the next generation of explorers through NASA-unique science, technology, engineering and mathematics learning opportunities.

NASA's Unique Facilities: There is an Education Office at each of the following NASA facilities: Ames Research Center (ARC), Armstrong Flight Research Center (AFRC), Glenn Research Center (GRC), Goddard Space Flight Center (GSFC), Jet Propulsion Laboratory (JPL), Johnson Space Center (JSC), Kennedy Space Center (KSC), Langley Research Center (LaRC), Marshall Space Flight Center (MSFC), Stennis Space Center (SSC).

NIF: NASA Internships and Fellowships leverage NASA's unique missions and programs to enhance and increase the capability, diversity, and size of the Nation's future STEM workforce.

OEPM: The Office of Education Performance Measurement system provides a centralized collection point for performance measurement and program monitoring data, a means to collect the same data consistently across all like projects, and quarterly reporting on all relevant education activities and investments.

OMB: The Office of Management and Budget is the largest office within the Executive Office of the President of the United States. The main function of the OMB is to assist the president in preparing the budget and policy development and execution.

NASA Intern Application Management System: A NASA-wide system for the recruitment, application, selection and career development of undergraduate and graduate students primarily in science, technology, engineering and mathematics disciplines. Opportunities for students in other disciplines are available.

Pacific Islander: A person having origins in any of the original peoples of Hawaii; the US Pacific Territories of Guam, American Samoa, and the North American Marianas; the U.W. Trust Territory of Palau; the islands of Micronesia and Melanesia; and the Philippines.

SE: STEM Engagement activities are designed to provide opportunities for participatory and experiential learning activities that connect learners to NASA-unique resources. The STEM Engagement line of business consists of Public Education Activities, Experiential Learning Opportunities and STEM Challenges.

Targeted Disabled: A person having a physical or mental impairment that substantially limits one or more major life activities; who has a record of such impairment or who is regarded as having such impairment. (See the LEAD (Leadership for the Employment of Americans with Disabilities) pages at the U.S. Equal Employment Opportunity Commission, <http://www.eeoc.gov/initiatives/lead/why.html>.)

White: A person having origins in any of the original peoples of Europe, North Africa, or the Middle East.

Underrepresented Minority: Refers to persons from racial and ethnic groups whose enrollment in STEM education or participation in STEM professions is much smaller than that group's representation in the general population. African Americans, Hispanics/Latinos, and Native Americans and Pacific Islanders currently fit this definition.

APPENDIX E

GAO-11-646SP Performance Measurement and Evaluation: Definitions and Relationships

<http://www.gao.gov/new.items/d11646sp.pdf>

Program Performance Assessment

Both the executive branch and congressional committees need evaluative information to help them make decisions about the programs they oversee—information that tells them whether, and why, a program is working well or not. In enacting the Government Performance and Results Act of 1993 (GPRA), Congress expressed frustration that executive and congressional decisionmaking was often hampered by the lack of good information on the results of federal program efforts. To promote improved federal management and greater efficiency and effectiveness, GPRA instituted a governmentwide requirement that agencies set goals and report annually on performance.

Many analytic approaches have been employed over the years by the agencies and others to assess the operations and results of federal programs, policies, activities, and organizations. Most federal agencies now use performance measures to track progress towards goals, but few seem to regularly conduct in-depth program evaluations to assess their programs' impact or learn how to improve results. Individual evaluation studies are designed to answer specific questions about how well a program is working, and GPRA explicitly encourages a complementary role for these types of program assessment. The GPRA Modernization Act of 2010 aims to improve program performance by requiring agencies to identify priority goals, assign officials responsibility for achieving them, and review progress quarterly. Complete and accurate information on how well programs are working and why will be key to its success.

This glossary describes and explains the relationship between two common types of systematic program assessment: performance measures and program evaluation. Based on GAO publications and program evaluation literature, it was first prepared in 1998. Major contributors were Stephanie Shipman and Joseph Wholey. Please address any questions to Stephanie Shipman at (202) 512-4041 or shipmans@gao.gov.



Nancy R. Kingsbury, Managing Director
Applied Research and Methods

GAO

United States Government Accountability Office
Glossary

May 2011

PERFORMANCE MEASUREMENT AND EVALUATION

Definitions and Relationships

GAO-11-646SP

Types of Program Performance Assessment

Performance Measurement	<p>Performance measurement is the ongoing monitoring and reporting of program accomplishments, particularly progress toward preestablished goals. It is typically conducted by program or agency management.</p> <p>Performance measures may address the type or level of program activities conducted (process), the direct products and services delivered by a program (outputs), or the results of those products and services (outcomes).</p> <p>A "program" may be any activity, project, function, or policy that has an identifiable purpose or set of objectives.</p>
Program Evaluation	<p>Program evaluations are individual systematic studies conducted periodically or on an ad hoc basis to assess how well a program is working. They are often conducted by experts external to the program, either inside or outside the agency, as well as by program managers.</p> <p>A program evaluation typically examines achievement of program objectives in the context of other aspects of program performance or in the context in which it occurs. Four main types can be identified, all of which use measures of program performance, along with other information, to learn the benefits of a program or how to improve it.</p>

Relationship between Performance Measurement and Program Evaluation

Different Focus	<p>Performance measurement focuses on whether a program has achieved its objectives, expressed as measurable performance standards. Program evaluations typically examine a broader range of information on program performance and its context than is feasible to monitor on an ongoing basis.</p> <p>Depending on their focus, evaluations may examine aspects of program operations (such as in a process evaluation) or factors in the program environment that may impede or contribute to its success, to help explain the linkages between program inputs, activities, outputs, and outcomes. Alternatively, evaluations may assess the program's effects beyond its intended objectives, or estimate what would have occurred in the absence of the program, in order to assess the program's net impact. Additionally, program evaluations may systematically compare the effectiveness of alternative programs aimed at the same objective.</p>
Different Use	<p>Both forms of assessment aim to support resource allocation and other policy decisions to improve service delivery and program effectiveness. But performance measurement, because of its ongoing nature, can serve as an early warning system to management and as a vehicle for improving accountability to the public.</p> <p>A program evaluation's typically more in-depth examination of program performance and context allows for an overall assessment of whether the program works and identification of adjustments that may improve its results.</p>

Types of Program Evaluation

Process (or Implementation) Evaluation	<p>This form of evaluation assesses the extent to which a program is operating as it was intended. It typically assesses program activities' conformance to statutory and regulatory requirements, program design, and professional standards or customer expectations.</p>
Outcome Evaluation	<p>This form of evaluation assesses the extent to which a program achieves its outcome-oriented objectives. It focuses on outputs and outcomes (including unintended effects) to judge program effectiveness but may also assess program process to understand how outcomes are produced.</p>
Impact Evaluation	<p>Impact evaluation is a form of outcome evaluation that assesses the net effect of a program by comparing program outcomes with an estimate of what would have happened in the absence of the program. This form of evaluation is employed when external factors are known to influence the program's outcomes, in order to isolate the program's contribution to achievement of its objectives.</p>
Cost-Benefit and Cost-Effectiveness Analyses	<p>These analyses compare a program's outputs or outcomes with the costs (resources expended) to produce them. When applied to existing programs, they are also considered a form of program evaluation. Cost-effectiveness analysis assesses the cost of meeting a single goal or objective and can be used to identify the least costly alternative for meeting that goal. Cost-benefit analysis aims to identify all relevant costs and benefits, usually expressed in dollar terms.</p>

APPENDIX F

MUREP Innovations in Space Technology Curriculum (MISTC) – Group 2

F.1 SCOPE OF ACTIVITY

F.1.1 Overview of Opportunity

F.1.1.1 Goals and Objectives

The goal of the MISTC is to contribute to the preparation, training, and development of NASA's future workforce. This will be accomplished by utilizing the National Aeronautics and Space Administration (NASA or agency) unique contributions in collaboration with **two-year/community college Minority Serving Institutions (MSIs)** to develop innovations in curriculum and experiential learning opportunities. These innovations will be aligned with the priorities of NASA's Space Technology Mission Directorate (STMD), which is responsible for developing the crosscutting, pioneering, new technologies and capabilities that the agency needs to achieve its current and future missions (<https://www.nasa.gov/directorates/spacetech/home/index.html>).

The MISTC solicitation seeks proposals that will contain plans for and be guided by curriculum innovations through partnerships with selected NASA Centers or facilities. The goal of each proposal will be to address a space technology focus area via **all three** of the following: (1) revising or developing at least **one** new course that will introduce and enhance student understanding of space technology development; (2) identifying and addressing campus laboratory equipment needs to support student learning in the course(s); and (3) hands-on learning opportunities related to the course(s) through internships at NASA Centers or facilities.

Proposers shall partner with one NASA center or facility from Table 1 to address one specific area of space technology development. Proposers are highly encouraged to partner with other academic institutions, such as other MSI two-year/community colleges or 4-year colleges/universities to share expertise, laboratory space, evaluation services, or collaborate in other ways during the curriculum development and piloting process. Proposers are also highly encouraged to partner with K-12 school districts on efforts such as dual enrollment in the new/revised college course(s), and/or the infusion of space technology content into high school courses.

Successful proposals will be funded as cooperative agreements with a two-year period of performance. During performance, awardees shall develop, obtain approval to offer, and pilot at least one new or revised space technology course. Awardees shall identify and address campus laboratory needs to support student learning in the course(s), and work with the NASA Center or facility partner to place students in internships.

TABLE 1. MISTC Approved Areas of Space Technology Focus and Lead NASA Centers/Facilities

Space Technology Areas	NASA Center(s)/ Facility
Aerosciences research for flight in all atmospheres	Ames Research Center (ARC)/Langley Research Center (LaRC)
Power technology and advanced development	Glenn Research Center (GRC)/Marshall Space Flight Center (MSFC)
Propulsion--technology and advanced development (chemical propulsion)	GRC/MSFC
Propulsion--technology and advanced development (electric propulsion systems)	GRC/MSFC
Entry, Descent and Landing	ARC /LaRC/Jet Propulsion Laboratory (JPL)
Vehicle Structures and Materials Technology	LaRC
Advanced Manufacturing	LaRC/MSFC
Communications and Navigation	GRC/GSFC/JPL
In-Situ Resource Utilization (ISRU) Technology	GRC/JPL
Robotics	GSFC/JPL/ARC
Autonomy	ARC/JPL/LaRC
Avionics technology and advanced development	GSFC/JPL
Cryogenic fluid flight systems	GRC

All proposed activities shall address the requirements outlined in this MISTC Appendix and in the broader Education Opportunities in NASA STEM (EONS) announcement.

MISTC will address the following NASA Strategic Goal and Objective that are outlined in the *2018 NASA Strategic Plan* (https://www.nasa.gov/sites/default/files/atoms/files/nasa_2018_strategic_plan.pdf):

NASA Strategic Goal 3: Address national challenges and catalyze economic growth.

NASA Strategic Objective 3.3: Inspire, engage, educate, and employ the next generation of explorers through NASA-unique Science, Technology, Engineering and Mathematics learning opportunities.

Furthermore, MISTC supports the following NASA Office of Education FY2018 Performance Goals and Annual Performance Indicators (APIs):

NASA Education Performance Goal 3.3.3: Provide opportunities for learners to engage with NASA’s aeronautics, space, and science people, content, and facilities in support of a diverse future NASA and aerospace industry workforce.

NASA Education Annual Performance Indicator 3.3.3: STEM-18-1: Provide significant, direct student awards in higher education to (1) students across all institutional categories and levels (as defined by the U.S. Department of Education); (2) racially or ethnically underrepresented students, (3) women, and (4) persons with disabilities at percentages that meet or exceed the national percentages for these populations, as determined by the most recent, publicly available data from the U.S. Department of Education’s National Center for Education Statistics for a minimum of two of the four categories.

NASA Education Performance Goal 3.3.5: Provide opportunities for learners to contribute to NASA’s aeronautics, space, and science missions and work in exploration and discovery.

NASA Education Annual Performance Indicator 3.3.5: STEM 18-5: Space Grant, EPSCoR, and MUREP investments will contribute to American technical capability through at least 1,200 paper presentations and peer-reviewed research publications.

F.1.1.2 NASA Relevance

All proposed activities shall utilize NASA’s exceptional engineering and scientific resources and facilities in order to give faculty, educators and students opportunities to learn about NASA missions; to interact and work with NASA personnel; and to understand and apply knowledge gained through NASA-unique experiential learning activities. To that end, each proposal shall clearly identify one NASA Center or facility and the space technology area(s) to which the proposed work is aligned. Proposals shall identify subject matter experts at the NASA Center or facility who will be responsible for providing guidance on the curriculum being developed for the new/revised course(s). Proposals may also identify and include additional NASA Centers or facilities that will benefit from the MISTC activities.

Project Guidelines

All proposed activities shall address all of the following requirements:

- Use evidence-based strategies that rely on verifiable data and information that has been gathered using the standards of professional research and evaluation organizations.
- Promote and ensure that underrepresented and underserved students participate in NASA Education, with the aim of encouraging more of these students to pursue STEM careers.
- Design and implement at least one course aligned with NASA's STMD, utilizing the unique strengths and capabilities of NASA's content, people, and facilities.
- Document intended outcomes and use metrics to demonstrate progress toward, and achievement of outcomes and contributions to the Performance Goals (PGs), applying appropriate and meaningful formative and summative evaluation through an independent evaluator or independent evaluation firm.

Proposers shall reference education research in course development, best practices to be employed, or other evidence supporting their rationale for their approach, tools, or techniques. NASA does not endorse or require the use of any specific source of information, but encourages proposers to survey research best practices described in peer-reviewed journals and credible institutions that specialize in STEM education research.

All proposals shall include a **Plan for Sustainability** and/or continuation of the course(s) beyond the funding period. It is expected that proposals also will include a plan for continuing the course(s) as part of the regular offerings at the lead institution. At the time of this Appendix release, NASA does not plan to extend funding beyond the initial performance period of two years.

The cultivation of diversity is both a management philosophy and a core value for all NASA Education efforts. The knowledge, expertise, and unique background and life experiences—including ethnicity, gender, race, religion, and cultural identity—of each individual strengthens NASA and the nation's STEM workforce. The MISTC activity seeks proposals that give sincere consideration to this NASA philosophy and core value.

NASA contributions and their use shall be specifically identified in each proposal via a letter of support from the NASA Center/facility.

Proposals for the development of stand-alone modules, websites, etc. are discouraged. Additional information on expectations is provided in Section 2 of this Appendix, and in the overall EONS announcement.

F.2 Award Information

F.2.1 Teaming

Proposers may partner with other colleges/universities, industry, non-profits, and/or other entities to increase student access to research and technology development opportunities;

leverage significant sources of additional funding; and/or to obtain essential services that are not available at the proposer's home institution. Although a broad range of partnerships and collaborations are encouraged, at a minimum, each proposal shall include the following:

- One MSI two-year/community college as the lead/proposing institution;

and

- One NASA Center or facility that is listed in Table 1, *F.1.1.1*.

Partnerships or collaborations with school districts and/or 4-year institutions of higher education are strongly encouraged. Examples of such collaborations can be found in Section *F.1.1.1*.

*It is expected that an independent evaluator or independent evaluation firm will participate in developing and implementing a robust evaluation of the proposed project. (see Appendix E of the overall EONS announcement for guidance).

F.2.2 Partnerships

The proposing MSI two-year/community college shall receive not less than 55% of the proposed budget. Non-NASA partners (see EONS Section 3.1) may receive up to 45% of the budget. NASA partners may receive up to 10% of the budget (Note that Centers and facilities will receive funds in the form of procurement dollars). Additionally, NASA employee and/or Contractor travel should be incorporated in NASA Center/facility budgets, independent of any award.

Under MISTC, proposers are required to partner with at least one NASA Center/facility. Subject matter experts (SMEs) at the partner NASA Center/facility shall be identified in the proposal. Proposers shall initiate contact with NASA collaborators during proposal development to ensure participation with NASA scientists, engineers, and educators, and to ensure that NASA unique facilities and resources are used as part of the proposed activities. A letter of support from the NASA Center or facility, indicating the names of collaborators, roles, and activities to be carried out shall be included in the proposal submission.

NASA MUREP points of contact, who may assist with the identification of SMEs, can be found at:

<http://www.nasa.gov/offices/education/programs/national/murep/contacts/index.html>

F.2.3 Integration with NASA and other NASA Education and/or Mission Activities

NASA will facilitate communication among MISTC awardees, and NASA SMEs in order to promote synergy, prevent duplication of effort, leverage ongoing work, and support relationship

building during the course of the awards. NASA will schedule periodic teleconference and WebEx discussions with awardees and appropriate members of the NASA Education and STMD communities to share information. Proposers shall participate in an annual Principal Investigator (PI) meeting, in order to facilitate communication and networks. Though the location may vary, and virtual tools may also be used, a two-day trip to the Washington, DC area should be budgeted each year for this purpose. NASA will also coordinate meetings in conjunction with conferences and events as appropriate. NASA will use social networking tools to create an interactive community for the MISTC education community.

F.2.4 Period of Performance

Projects may be proposed for up to two years in duration, contingent on the availability of appropriated funds. During the period of performance, awardees shall develop, obtain approval to offer, and pilot at least one new or revised space technology course. Awardees shall also identify and address campus laboratory needs to support student learning in the course(s), and work with the NASA center or facility partner to place students in internships.

F.3 ELIGIBILITY INFORMATION

F.3.1. Proposing Institutions

Only two-year/community college MSIs, as designated by the US Department of Education, are eligible to propose in response to this opportunity (<https://www2.ed.gov/about/offices/list/ope/idues/em2017.xls>). **Any other institution, or entity may apply through partnership with a two-year/community college MSI as the lead institution. Please note that all institutions receiving funds (including a NASA Center/facility) are required to be listed on the proposal cover page.**

MISTC 2018 (Group 1) Awardees are not eligible to apply to MISTC 2019 (Group 2) as the primary proposer/lead institution. However, MISTC Group 1 awardees may serve as a non-lead partner on proposals submitted by other eligible institutions.

F.4 PROPOSAL AND SUBMISSION INFORMATION

F.4.1. Proposal Submission

All information needed to respond to this announcement is contained in this Appendix, the overall EONS announcement, the *NASA Guidebook for Proposers Responding to a NASA Funding Announcement (FA) Edition - March 2018*: <https://www.hq.nasa.gov/office/procurement/nraguidebook/proposer2018.pdf> and the *NASA Grant and Cooperative Agreement Manual* (see https://naistst1.nais.nasa.gov/pub/pub_library/srba/index.html)

Note: If the information contained in this Appendix conflicts with the overall EONS announcement or the *NASA Guidebook for Proposers*, the information in this Appendix takes precedence.

F.4.2 Pre-proposal Teleconference

A pre-proposal teleconference will be held before proposals are due. Prospective proposers shall submit any written questions no later than five business days before the teleconference so that NASA will be able to cover as much information as possible at the teleconference. NASA plans to post written questions and answers and teleconference slides to the NSPIRES website. An opportunity to ask questions and solicit clarifications will be provided at the teleconference.

Potential proposers shall register in NSPIRES and sign up for notification emails so they will receive notice of this teleconference. Potential proposers shall refer to the MISTC web page on NSPIRES for detailed information on question submission and schedule information.

F.5 PROPOSAL EVALUATION AND SELECTION

F.5.1. Proposal Review Criteria

NASA will evaluate proposals based on the following criteria: (1) **Intrinsic Merit**, (2) **Relevance to NASA**, (3) **Evaluation Plan**, and (4) **Budget/Cost**. Proposers shall place a strong emphasis on a clear plan for advancing the contributions of two-year/community college MSIs to meeting NASA's goals and objectives and a demonstrated potential for making sound contributions to furthering NASA's STMD-relevant STEM learning opportunities for students.

F.5.1.1. Intrinsic Merit (40%)

Evaluation of **Intrinsic Merit** will consider if the sub-elements are clear, reasonable and properly aligned with the overall project goals & objectives. There are three sub-elements under this criterion. They are:

Educational merit:

- Degree to which the proposed effort advances the goals and objectives of the FY2018 NASA Strategic Plan and the FY2018 NASA Education Performance Goals and Annual Performance Indicators (see *F.1.1.1*)
- Degree to which the proposed effort offers innovative methods, approaches, and concepts;
- Degree to which the proposed effort builds on lessons learned and/or best practices of past education and/or research and learning activities undertaken by the proposed senior personnel;
- Degree to which the proposed effort includes reasonable and clear project goals and objectives; and
- Degree to which the proposed effort supports the research and activities for the applicability of STEM-based opportunities for students and faculty to deepen their knowledge about NASA's space technology. Evidence that the proposal takes into account current evidence-based research on teaching and learning, and advances the understanding of how to integrate experiential learning opportunities as an integral part of the educational experience for MSI students, which will lead to

greater entry into and retention in NASA relevant space technology disciplines and careers.

Technical merit:

- Degree to which the proposed effort includes evidence that the project makes appropriate use of current NASA unique engineering and scientific resources, and offers innovative methods, approaches, and concepts;
- Degree to which the proposed effort provides clear and feasible project goals and objectives;
- Degree to which the proposed effort includes a qualified and capable Principal Investigator (PI) and key management team, including education, science and/or engineering, NASA, and independent evaluation expertise; and
- Degree to which the proposed effort presents a realistic schedule/timeline or other description of how project goals, objectives and major milestones will be met, and partners with other projects, institutions, professional societies, and other appropriate groups to magnify the impact of the project and sustain the effort beyond the two year performance period.

Sustainability Plan:

- Degree to which the proposal addresses how funding received via this solicitation may be leveraged to ensure sustainability in the post-award phase;
- Degree to which the proposal addresses how the project may be suited for other solicitations after successful execution; and
- Degree to which the proposal describes how possible professional development of Key Roles in the project will allow for greater collaboration after completion of the project.

F.5.1.2. Relevance to NASA (30%)

Evaluation of Relevance to NASA includes consideration of the following criteria:

- Degree to which the proposed effort is aligned with one or more of the outcomes and objectives specified in this Appendix;
- Degree to which the proposed effort is aligned with the goals and outcomes of the FY2018 NASA Strategic Plan and the FY2018 NASA Education Performance Goals and Annual Performance Indicators;
- Degree to which the proposed effort cultivates diversity and facilitates effective usage of NASA materials and subject matter experts;
- Degree to which the proposed effort utilizes NASA's unique contributions to space technology;
- Degree to which the proposed effort aligns with one or more of the NASA Education objectives specified in Section 1.1.1 of this Appendix;
- Degree to which the proposed effort aligns with the MISTC objectives; and
- Degree to which the proposed effort is integrated with ongoing NASA Education activities (<https://www.nasa.gov/offices/education/programs/index.html>).

F.5.1.3. Evaluation Plan (15%)

Evaluation of the **Evaluation Plan** includes consideration of the following criteria:

- The Evaluation Plan and accompanying budget are appropriate for the scope of the proposed effort;
- The Evaluation Plan describes appropriate methods for determining the extent to which the project has achieved its goals and objectives;
- Evidence that appropriate evaluation processes are embedded throughout the lifecycle of the project;
- Evidence that an independent evaluation expert or independent evaluation firm participated in the development of the Evaluation Plan; and
- Evidence that the Evaluation Plan can be successfully implemented (e.g., citation from independent Evaluators statement of endorsement, some measurable data (i.e., number of completed surveys) or interview transcripts, etc.).

F.5.1.4. Budget (15%)

Evaluation of the **Budget/Cost** includes consideration of the following criteria:

- Not less than 55% of the proposed budget is received by the MSI/two-year community college;
- The proposed budget includes a clear alignment between the proposal narrative and budget;
- The proposed budget is adequate, appropriate, reasonable and realistic for all partners, including education, science and/or engineering, NASA, and evaluation expertise;
- The proposed budget demonstrates the effective use of funds for which outcomes justify total costs; and
- All proposed budget line items are fully explained and justified.

Note: Foreign travel requests are not permitted in the budget request, and if proposed, such requests will not be approved.

F.5.2. Review and Selection Process

Proposals will be evaluated by a merit review process composed of the proposers' professional peers (Government and non-Government), including science, engineering, education and evaluation experts, who have been screened in advance of reviewing any proposals for conflicts of interest. Proposals will be reviewed and assessed on the number and significance of strengths and weaknesses as measured against each of the four criteria (Intrinsic Merit, Relevance to NASA, Evaluation Plan and Budget/Cost) and their applicable sub-elements.

The Selection Official for the MISTC awards is the MUREP Project Manager at NASA Headquarters.

F.6 AWARD ADMINISTRATION INFORMATION

F.6.1. Award Reporting Requirements

The reporting requirements for award recipients under MISTC will be consistent with Appendix E in Section 8.0 of the *NASA Grant and Cooperative Agreement Manual* (see https://naistst1.nais.nasa.gov/pub/pub_library/srba/index.html).

Within one month after award each awardee shall:

- Submit a descriptive project abstract to the NASA MISTC Activity Manager; and
- Submit a management plan with associated timeline and milestones.

Within three months after award, each awardee shall:

- Submit an updated Evaluation Plan with input from the independent evaluator or independent evaluation firm.
- Submit monthly reports via teleconference, including:
 - Executive Summary – overall progress, accomplishments/milestones, challenges and/or lessons learned;
 - Report of activities including progress, accomplishments/milestones and any obstacles or lessons learned;
 - Reporting of metrics as required for the NASA Office of Education Performance Measurement (OEPM) system;
 - Assessment and evaluation efforts to-date;
 - Schedule status, including status of major tasks and a revised timeline if needed; and
 - Photos of Activities (include NASA Photo Release).

An annual progress report is required each year no later than 60 days prior to the anniversary date of the project start date. NASA will provide a report template. At a minimum, the report shall include the following:

- Project activities over the period of performance of the award;
- Project accomplishments measured against the proposed goals and objectives;
- Evidence of how project activities have furthered stakeholder priorities;
- Extent to which collaborations and/or partnerships have evolved;
- Summary of OEPM metrics for the year;

- Plan of activities for the next year; and
- Financial Report: budget versus actuals.

Each awardee shall submit a final report with summary information within 90 days of project completion.

F.6.2 NASA Education Metrics

- Awardees shall use templates, provided by the MISTC Activity Manager, to collect student information and activity metrics for the OEPM system. These are in addition to any project evaluation plan surveys.
- Awardees shall participate in OEPM training (may be virtual) to gain familiarity with the repository.
- Awardees shall use Project Activity Forms (provided by the MISTC Activity Manager) to report event-based information.

F.6.3 Summary of Key Information

Total available annual budget for MISTC activity	~\$2.5M total for all awards
Number of new awards pending adequate proposals of merit	~6 awards
Start date	May start as early as 6 months after proposal due date or as determined by the NSSC
Duration of awards	2 years
Award Type	Cooperative Agreement
MISTC Pre-proposal Conference (Optional)	(TO BE DETERMINED); Check the NSPIRES website for details.
Due date for Notice of Intent to propose (NOI)	October 9, 2018 (DATE SUBJECT TO CHANGE); 11:59 pm Eastern Time
Due date for proposals	December 10, 2018 (DATE SUBJECT TO CHANGE); 11:59 pm Eastern Time
Page limit for the central Scientific-Educational-Management section of proposal	15 pages; see also Section 3.7 - Overview of Proposal, in the <i>NASA Guidebook for Proposers</i>
Detailed instructions for the preparation and submission of proposals	See the <i>NASA Guidebook for Proposers</i> : http://www.hq.nasa.gov/office/procurement/nraguidebook/proposer2018.pdf
Submission medium	Electronic proposal submission is required via NSPIRES or grants.gov; hard copies will not be accepted. See Chapter 3 of the <i>NASA Guidebook for Proposers</i> .
Web site for submission of proposal via NSPIRES	http://nspires.nasaprs.com/ (help desk available at nspireshelp@nasaprs.com or (202) 479-9376 from 8:00 am to 6:00 pm Eastern Time, excluding federal holidays).
Web site for submission of proposal via grants.gov	http://grants.gov (Contact Center is available by email at support@grants.gov , or by calling 1-800-518-4726 and via website at https://grants-portal.psc.gov .)
Selection Official	Ms. Joeletta Patrick MUREP Manager NASA Headquarters Washington, DC 20546
NASA point of contact concerning this activity	Ms. Roslyn Soto NASA MISTC Activity Manager NASA Jet Propulsion Laboratory 4800 Oak Grove Drive Mail Stop 180-109 Pasadena, CA 91109 Roslyn.Soto@jpl.nasa.gov

APPENDIX G

MUREP Institutional Research Opportunity – MIRO

G.1 SCOPE OF ACTIVITY

G.1.1 Overview of the Funding Opportunity

The mission of the National Aeronautics and Space Administration (NASA) Office of Education is to advance high-quality Science, Technology, and Engineering and Mathematics (STEM) education across the United States. To maximize these efforts, NASA has consolidated its education activities into the Minority University Research and Education Project (MUREP). MUREP supports training and development of students and faculty in STEM at targeted colleges and universities, and provides opportunities for research and education to inspire and prepare increasing numbers of students for STEM careers. As an integral part of this mission, the MUREP Institutional Research Opportunity (MIRO), was established to strengthen and develop the research capacity and infrastructure of Minority Serving Institutions (MSIs) in areas of strategic importance and value to NASA's mission and national priorities. Overall, MIRO awards aim to promote STEM literacy and to enhance and sustain the capability of institutions to perform NASA-related research and education, which directly supports NASA's four Mission Directorates – Aeronautics Research, Human Exploration and Space Operations, Science, and Space Technology.

The goals and objectives of MIRO awards are to:

1. Expand the nation's base for aerospace research and development by fostering new aerospace research and technology development concepts aligned with NASA research priorities as defined by NASA Mission Directorates.
Objective 1.1 Develop significant scientific, engineering, and/or technology research centers at the MSI that align and engage one or more programs of the NASA Mission Directorates.
Objective 1.2 Increase the lead institution's capacity to contribute to the priorities of NASA's Mission Directorates (Aeronautics Research, Human Exploration & Operations, Science, and Space Technology) and NASA's ten Centers.
2. Promote institutional advancement and enhanced research capacity through partnerships among MSIs, other academic institutions, NASA research assets, and industry.
Objective 2.1 Increase the lead institution's ability to sustain research efforts through development of strategic partnerships.
Objective 2.2 Increase the lead institution's pursuit of additional funding opportunities offered by NASA, industry, and other agencies.

Objective 2.3 Increase the ability of research leadership at the lead institution to leverage resources to enhance its research capacity at the project, program, department, college, and/or university levels.

3. Strengthen participation of faculty, researchers, and students at MSIs in the research programs of NASA's Mission Directorates.

Objective 3.1 Develop faculty and researcher knowledge and skills in NASA-related research through professional development and NASA research opportunities.

Objective 3.2 Increase capacity to develop student knowledge and skills in NASA-related research through curriculum enhancement, redesign, and development at the course, degree, and/or department levels

Objective 3.3: Increase capacity to develop student knowledge and skills in NASA-related research through NASA internships and opportunities.

4. Facilitate mechanisms to insure the diversity of workers at NASA and in undergraduate and graduate degrees awarded to students from MSIs in NASA-related fields reflects the diversity of our nation.

Objective 4.1 Increase the number of undergraduate and graduate degrees awarded to students from MSIs in NASA-related fields.

In order to achieve maximum impact and success of MIRO Centers and Institutions awarded, proposals shall focus on the above goals and objectives. In addition, all proposed activities must address the requirements outlined in this appendix and in the broader EONS announcement.

G.1.2 National and Agency Wide Priorities

MIRO will address the following long-term goals and objectives outlined in the *NASA 2018 Strategic Plan*

(https://www.nasa.gov/sites/default/files/atoms/files/nasa_2018_strategic_plan.pdf). These measures will be supported by the agency's short-term Annual Performance Indicators, which set quantifiable targets for NASA offices, programs and projects. NASA's goals and objectives are subject to change over time to adapt to national and agency-wide priorities. NASA Strategic Goals and Objectives relevant to education are outlined in the *NASA 2018 Strategic Plan* and described below. See EONS NFA for Annual Performance Indicators associated with these Performance Goals.

STRATEGIC GOAL 3: ADDRESS NATIONAL CHALLENGES AND CATALYZE ECONOMIC GROWTH

Strategic Objective 3.3: Inspire and Engage the Public in Aeronautics, Space, and Science.

Inspire, engage, educate, and employ the next generation of explorers through NASA-unique Science, Technology, Engineering and Mathematics learning opportunities.

Performance Goal 3.3.3: Provide opportunities for learners to engage with NASA’s aeronautics, space, and science people, content, and facilities in support of a diverse future NASA and aerospace industry workforce.

Performance Goal 3.3.5: Provide opportunities for learners to contribute to NASA’s aeronautics, space, and science missions and work in exploration and discovery.

NASA’s education and outreach functions aim to inspire and engage the public and students, each playing a critical role in increasing public knowledge of NASA’s work and fostering an understanding and appreciation of the value of STEM, and enhancing opportunities to teach and learn. By augmenting NASA’s public engagement and communicating NASA’s work and value, the Agency contributes to our Nation’s science literacy. NASA is committed to inspiring an informed society; enabling the public to embrace and understand NASA’s work and value, today and tomorrow; engaging the public in science, technology, discovery, and exploration; equipping our employees to serve as ambassadors to the public, and providing unique STEM opportunities for diverse stakeholders. This strategic objective includes proactive efforts to diversify the STEM pipeline to NASA internships and employment.

G.1.3 Relevance to NASA

The NASA MUREP is designed to capitalize on the unique facilities, capabilities, and staff of MSIs to contribute to the priorities of NASA’s Mission Directorates (Aeronautics Research, Human Exploration & Operations, Science, and Space Technology) and NASA’s ten Centers.

Proposals shall clearly and concisely describe the relevance of the proposed work to NASA’s currently funded research priorities and programs of the NASA Mission Directorate(s). Proposals are required to address one or more research priorities of the Mission Directorates and Centers, which are summarized in [Section H.6.8 Research Priorities for NASA Mission Directorates and Centers](#) (in this appendix). The current NASA mission directorates are as follows.

- Aeronautics Research (<http://www.aeronautics.nasa.gov/>)
- Human Exploration Operations (<http://www.nasa.gov/directorates/heo/home/index.html>)
- Science (<http://science.nasa.gov/>)
- Space Technology (<http://www.nasa.gov/directorates/spacetech/home/index.html>)

In addition, each proposer shall identify the primary NASA Center where the proposed work is best aligned. This primary NASA Center will be responsible for reviewing and providing guidance on the work being performed and collaborating in the proposed research program. Additional NASA Centers that will benefit from the MIRO research activities may also be identified.

G.1.4 Relevance to Lead Institution

MIRO goals and objectives include strengthening institutional “research capacity and infrastructure” and increasing “the ability of research leadership at the lead institution to leverage resources to enhance its research capacity at the project, program, department, college, and/or university levels.” Proposals are to demonstrate how the proposed project will be a significant element of the lead Institution’s long and short-term STEM strategic research plans, interests, and capabilities; and how the project will result in enhanced research capacity at multiple levels. It is recommended that the proposal reference elements of department, college, and university strategic plan(s), research priorities, and/or other pertinent university documents.

G.2 AWARD INFORMATION

G.2.1 Award Value and Period of Performance

The period of performance is three (3) years. Recipients of awards under this FY 2019 solicitation will be designated as NASA MIRO Group 7. Successful proposals for Group 7 will be funded as multi-year cooperative agreements. Funding for each MIRO award may not exceed \$1,250,000/per year in any given year and shall not exceed a total of \$3,000,000. Regardless of the per year budget, the proposed plan and evaluation are required to run for three years. The period of performance will begin at the issuances of funds.

Proposers may have the option for a 2-year funded extension. However, proposers shall respond to this solicitation with a 3-year budget and plan. If offered, those proposers requesting continuation with additional funding will be required to submit a new proposal and complete a technical evaluation. Funded extensions will be dependent on availability of appropriated funds.

NASA funding beyond the first year is based on a satisfactory annual evaluation of documented progress; compliance with data reporting, applicable regulations and laws, and other program requirements; fulfillment of fiduciary responsibilities; and the continued availability of appropriated funds. Continuation of funding may be reduced if cost reporting indicates a significant level of unexpended funds, or if an institution’s performance is unsatisfactory (as determined by NASA).

G.2.2 Budget Guidelines and Requirements

The proposers shall use NASA funds for support of faculty and researchers to conduct research, engage in professional development, and redesign, enhance, or develop curriculum; for support of undergraduate students, graduate students, post-doctoral fellows and their research; for research-related equipment, travel, and materials; and to support project management, administration, and evaluation.

MIRO budget proposals shall address costs that will be incurred by NASA Centers for the use of facilities and/or contracted technical support. The costs of such NASA services shall be included in the proposal as part of the annual funding amount. For additional budget guidelines, see the *NASA Guidebook for Proposers responding to a NASA Funding Announcement (revised March 2018)* (<https://www.hq.nasa.gov/office/procurement/NFAGuidebook/proposer2018.pdf>).

The following guidelines and restrictions are placed on the use of MIRO funds:

- **Total Budget Guidelines and Restrictions**
 - A maximum of 30 percent of the total budget requested from NASA may be used for teaming organizations. Funds may not be used for subcontracted research efforts carried out by non-U.S. entities, but may be used for the direct purchase of supplies and/or services that do not constitute research from foreign sources. For additional guidance on foreign participation, see the section, Proposals Involving Non-U.S. Organizations, *NASA Guidebook for Proposers responding to a NASA Funding Announcement (revised March 2018)*, p. 29 (<https://www.hq.nasa.gov/office/procurement/NFAGuidebook/proposer2018.pdf>).
 - A maximum of 15 percent of the total budget may be used for acquiring direct NASA services related to the conduct of research (i.e., cost for use of NASA unique facilities, etc.).
 - A maximum of 15 percent of the total budget may be used for infrastructure (equipment and laboratory facilities).
 - A maximum of five (5) percent of the total budget may be distributed to NASA Centers that are partnering with institutions. These funds may not be used for NASA civil servant salaries or travel.
 - The lead MSI must retain a minimum of 70 percent of the total budget; thus a maximum of 30 percent of the total budget may be distributed for subcontracts to teaming organizations.
 - The maximum total 3-year budget is \$3,000,000. Regardless of the per year budget, the proposed plan and evaluation are required to run for three years.

- **Annual Budget Guidelines and Restrictions**
 - In order to facilitate development of infrastructure and institutional capacity, the maximum annual budget in years one and two is \$1,250,000, not to exceed the total budget of \$3,000,000.
 - The maximum annual budget for year three is \$1,000,000, not to exceed the total budget of \$3,000,000.
 - A minimum of 25 percent must be allocated for undergraduate and graduate student support (including fringe benefits and indirect costs, if any).
A minimum of 2.5 percent must be allocated to fund students participating in internships at NASA Centers (this is considered part of the 25% allocated for student support amount identified above). See the *NASA Grant and Cooperative Agreement Manual (GCAM)* at https://prod.nais.nasa.gov/pub/pub_library/srba/index.html
U.S Citizenship is required for individuals who need access to NASA Centers for participation in the mandatory internship experience. It is *strongly encouraged that these internships are for students from the awardee institutions and its partners.*

- **Other Guidelines and Restrictions**
 - A maximum of 50 percent of the annual salary for Principal Investigator, Co-Investigators, and senior researchers may be charged to this award.
 - The budget shall include support for an administrative assistant for the project, who will provide PI support for monitoring the budget, track project students, and assist with other administrative tasks. Alternatively, the proposal shall clearly indicate how other resources will support this role.
 - The budget shall include the Independent Evaluator compensation, including travel to project annual meetings and site visits.

G.2.3 Primary Roles

Principal Investigator

Every institution submitting a proposal will identify a single individual, Principal Investigator (PI), who will be responsible for the quality and direction of the entire proposed effort and for the use of all awarded funds. PIs shall meet all of the following criteria on the date of the proposal submission:

1. Must be a tenure or tenure-track faculty member of the lead institution if a tenure system is established. Eligible four-year Institutions that do not have a tenure track system shall submit a letter of commitment to comply with guidance provided under section *H.6.3 Summary of MIRO Grantee Responsibilities* (this document), which states that any proposed change to the PI under the agreement is subject to NASA approval;
2. Must have a Ph.D. or equivalent in an engineering, computer science, technology, mathematics, or science discipline relevant to NASA's research needs.

PI responsibilities include, but are not limited to:

- Providing visionary and contemporary leadership for the delivery of high-impact research and educational programs;
- Providing overall leadership, administration, and evaluation of the project and its activities;
- Engaging with the institution's department, college, and university leadership to promote institutional advancement and enhanced research capacity;
- Carrying out supervisory responsibilities for project staff in accordance with the organization's policies and applicable state and federal laws;
- Providing day-to-day management of project budgets and ensuring that all applicable institutional and NASA rules, as well as state and federal guidelines, are followed in the utilization of such funding; and
- Engaging with the Independent Evaluator and project administration support staff to insure evaluation and required reports are appropriately conducted, compiled, and reported; and
- Participating in MIRO program teleconferences and meetings.

Independent Evaluator

Every institution submitting a proposal shall identify a single individual, Independent Evaluator (IE), who will be responsible for analyzing qualitative and quantitative data for the sites evaluation activities and assisting the PI in development and implementation of the site's comprehensive Evaluation Plan. Within three (3) months after award, every institution submitting a proposal in response to this opportunity, shall submit a Comprehensive Evaluation Plan, for which both the PI and IE have concurred on in writing. The MIRO Management Team will provide guidance on the proposed plan.

Independent Evaluator responsibilities include, but are not limited to:

- Developing a Comprehensive Evaluation Plan for proposed program in collaboration with the PI and the MIRO Management Team;
- Coordinating and administering data collection, analysis, and reporting of proposed program evaluation data;
- Providing status updates to the PI on evaluation activities, progress, and challenges;
- Participating in annual kick-off meeting, virtual site visits, and evaluation technical assistance meetings with MIRO Management Team to review proposed program's progress in achieving MIRO goal and objectives; and
- Developing an annual evaluation report and final evaluation report.

G.2.4 Partnerships and Collaboration

Universities, industry, and other government agencies play major roles in carrying out much of NASA's work and in conducting research and development activities in related areas. Carefully constructed partnerships between MIRO recipients and other entities will lead to substantial benefits for all parties involved. The MIRO recipients will gain access to special purpose facilities; exposure to new work areas; leveraged support for their research efforts; and potential sources of future funding. Industry and other universities and colleges will gain from the capabilities that the MIRO recipients bring in specialized work areas, and from the MIRO students who will be recruited as future employees or graduate students. NASA benefits from the increased productivity that these partnerships bring to missions and projects.

The proposal shall demonstrate partnerships or cooperative agreements among a broad range of entities, including academic institutions, government agencies, business and industry, private research foundations, and non-profit agencies. Proposals shall describe how the proposed teams/collaborations will increase student access to research opportunities; achieve MIRO goals and objectives; leverage significant sources of additional funding; obtain essential services that are not available at the proposer's home institution; and/or contribute to sustainability. Partnerships shall be coordinated in advance and described in detail in the proposal. The budget narrative shall document how partnerships will contribute to the proposing institution's research capacity.

At a minimum, the proposal shall include each of the following partners:

- At least one four-year institution of higher education (in addition to the proposing institution), especially one that would provide mentoring in establishing a stronger research environment. Proposers are strongly encouraged to partner with two-year institutions of higher education, including those from which the lead institution receives a significant number of transfer students; and
- At least one NASA Center.

In addition, it is strongly encouraged that the proposal include partnership with at least one industry or other government agency that is relevant to the scientific, engineering, and/or technology proposed.

Proposers shall demonstrate the strength and efficacy of their partnerships, and are encouraged to do so through utilization of the following programs. Current/prior participation in these programs is not required, but it is highly recommended in order to provide a feasible plan for utilizing these programs through the course of the award.

- **NASA Established Program to Stimulate Competitive Research (EPSCoR):** The goal of EPSCoR is to provide seed funding to enable jurisdictions to develop an academic research enterprise directed toward long-term, self-sustaining, nationally-competitive capabilities in aerospace and aerospace-related research. EPSCoR funds Research Awards, Research Infrastructure Development (RID) Awards, International Space Station Flight Opportunity (ISS Flight Op) Awards and Rapid Response Research (R3) Awards. EPSCoR researchers are conducting leading edge research. For additional information about EPSCoR, see <https://www.nasa.gov/offices/education/programs/national/epscor/home/index.html> and their most recent solicitation posted on <https://nspires.nasaprs.com/external/index.do>.
- **NASA National Space Grant College and Fellowship Program:** This national network of colleges and universities works to expand opportunities for Americans to understand and participate in NASA's aeronautics and space projects by supporting and enhancing science and engineering education, research and public outreach efforts. More information regarding this program can be found at: <https://www.nasa.gov/offices/education/programs/national/spacegrant/about/index.html>
- **NASA Mentor-Protégé Program:** The NASA Mentor-Protégé Program encourages NASA prime contractors to assist eligible protégés, thereby enhancing the protégés' capabilities to perform NASA contracts and subcontracts; fostering the establishment of long-term business relationships between these entities and NASA prime contractors; and increasing the overall number of these entities that receive NASA contract and subcontract awards. More information regarding this program can be found at: <https://osbp.nasa.gov/mentor.html>.
- **NASA Small Business Technology Transfer Program:** The NASA STTR program funds the research, development, and demonstration of innovative technologies that fulfill NASA needs and have significant potential for successful commercialization. More information regarding this program can be found at: <https://sbir.nasa.gov/content/nasa-sbirsttr-basics>.

G.2.5 Integration with NASA and other NASA Education and/or Mission Activities

NASA Centers are responsible for implementing many of the plans, programs, missions, and activities established by the Mission Directorates. Accordingly, the primary mission responsibilities assigned to each Center define its work areas. Institutions receiving the MIRO award are required to build collaborations with NASA Centers when such collaborations will mutually benefit the MIRO recipients' and NASA Centers' abilities to accomplish the directorate goals. Proposers are strongly encouraged to identify professional development opportunities for faculty and researchers, such as establishing a faculty research program with the partner NASA Center.

NASA will facilitate communication among awardees, and NASA STEM and Subject Matter Experts (SMEs) in order to promote synergy, prevent duplication of effort, leverage ongoing work, and support relationship building during the course of the awards. NASA will schedule

periodic teleconference and/or web conference discussions with awardees and appropriate members of the NASA Education and STEM communities to share information.

In order to facilitate communication and networking, proposers shall plan and budget for participation in an annual MIRO Principal Investigators' Meeting. Though the location may vary, and virtual tools may also be used, one two-day trip to Washington, DC, shall be budgeted each year for this purpose. NASA will also coordinate meetings in conjunction with conferences and events as appropriate. NASA will also use social networking tools to create an interactive environment for the MIRO community.

G.2.6 Role of the External Advisory Committee

An External Advisory Committee (EAC) shall be established by the MIRO PI to promote sustainability of the project and advise on academic and research development.

Responsibilities of the EAC include, but are not limited to:

- Promoting sustainability of the project;
- Providing guidance and direction consistent with accomplishing the goals and objectives identified in the cooperative agreement; and
- Solidifying outreach coalitions that will lead to joint funding, facility and personnel access, and complimentary research and education opportunities.

Members of the EAC shall be professionals who represent non-NASA organizations, and may include representatives from academia, industry, and other governmental agencies. External Advisory Committee members may not be affiliated with the lead institution or its proposed collaborators. An initial lead for the EAC shall be submitted as part of the original proposal under the section for the Sustainability Plan.

G.2.7 Sustainability

MIRO projects leverage and achieve sustainability through their intrinsic design and the involvement of appropriate local, regional, and or national partners in their design, development, or dissemination. As appropriate, key aspects of the activity shall be replicable, scalable, and demonstrate potential for continuation beyond the period of direct NASA funding.

Proposers shall develop a Sustainability Plan to enhance local activity operations beyond NASA funding. The Sustainability Plan is required as part of the proposal. The Sustainability Plan shall include a road map for continued collaboration with partnerships identified in the proposal. The Sustainability Plan shall reflect the tapering of maximum MIRO budgets in year three (3). Preference will be given to those institutions that demonstrate a well-conceived and feasible roadmap towards sustainability through partnerships.

G.2.8 Evaluation

NASA identifies evidence of effective practices of MIRO activities through program evaluation. Evidence is a key criterion in NASA's competitive processes for allocating resources, ensuring that the most effective activities are supported. Program evaluations are planned studies using research methods to collect and analyze data to assess to what extent activities/programs are being implemented and what, if any, impact can be measured. Evaluations answer specific questions about performance and may focus on assessing activity/program process and outcomes.

Proposers shall develop a Comprehensive Evaluation Plan that follows generally accepted professional standards for evaluation research. An initial plan is required as part of the original proposal and shall include strategies for collecting data for performance metrics for MIRO Reporting Requirements as well as independent program evaluation.

Effective evaluation models are evidence-based, meaning that they are based on verifiable data and information that have been gathered using the standards of professional research and evaluation organizations. Such data may be qualitative and/or quantitative. A wide variety of evaluation designs may be utilized, such as case studies, quasi-experimental designs or experimental designs, as well as data collection methods, such as key informant interviews, surveys, direct observation, or focus group discussions. Regardless, such data shall pass the tests of reliability and validity, which are different for qualitative and quantitative data.

NASA sets concrete performance goals and is accountable to those goals through a framework that measures progress. Objective and verifiable performance metrics, internal and external review processes, valid and reliable data collection instruments, and evaluation studies are used to assess progress and performance across the portfolio, including lines of business, programs, projects, and activities. Through performance monitoring, assessment, and a meta-evaluation of the MIRO program, NASA will demonstrate its results-driven management approach that is focused on optimizing value to the American public. In accordance with this objective, the MIRO Management Team will provide feedback and negotiate the final evaluation plans with

grantees to insure commonality across evaluation methods so that this meta-evaluation may be achieved.

G.3 ELIGIBILITY INFORMATION

G.3.1 Proposing Institutions

All proposals shall originate from a minority-serving U.S. college or university, designated and listed by the U.S. Department of Education as a Minority Serving Institution (MSI) (see <http://www.ed.gov/about/offices/list/ocr/edlite-minorityinst.html>). Any arrangement or agreement to have the fiscal management and/or administration of the award performed by a third party is between the awardee and the third party, e.g., an affiliated Board of Regents, University System, or Foundation. Institutions not meeting these criteria are encouraged to partner with colleges or universities that do satisfy the requirements. See EONS NFA for additional information on eligible institutions.

G.3.2 Priority

Institutions that have not previously received MIRO award funding will receive higher priority in the selection process.

G.3.3 Limit on Number of Proposals per DUNS

Eligible institutions shall submit only ONE (1) lead proposal per any type of DUNS number. Eligible institutions that have multiple and/or different DUNS numbers shall submit no more than one lead proposal from each different DUNS number. If an eligible organization submits more than one lead proposal using the same DUNS number, then none of the proposals will be considered or evaluated.

Eligible institutions may submit a proposal as the lead institution in accordance with the above restriction, and/or be included as an unfunded partner or sub-awardee in any number of proposals for which it is in a non-lead role.

G.3.4 Export-Control Guidelines Applicable to Proposals Including Foreign Participation

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

G.4 PROPOSAL AND SUBMISSION INFORMATION

G.4.1 Proposal Submission

All information needed to respond to this announcement is contained in this Appendix, the EONS announcement, the *NASA Grant and Cooperative Agreement Manual (GCAM)* (https://prod.nais.nasa.gov/pub/pub_library/srba/index.html) and the *NASA Guidebook for Proposers Responding to a NASA Funding Announcement (revised March 2018)* (<https://www.hq.nasa.gov/office/procurement/NFAGuidebook/proposer2018.pdf>). Note: If the information contained in this Appendix conflicts with the GCAM or the *Guidebook for Proposers*, the information in this Appendix takes precedence.

G.4.2 Request for 'Notice of Intent'

Institutions planning to submit a proposal are strongly encouraged to submit a Notice of Intent (NOI) to propose. NOIs assist NASA in assessing the response to this CAN and to determine the expertise required for the proposal review panel. NOIs are to be submitted by the PI to the NSPIRES website (<http://nspires.nasaprs.com>) by no later than 45 days after posting. Eastern Time. Proposers shall register with NSPIRES before it can be accessed for use.

Since NOIs submitted after the deadline may still be useful to NASA, NASA will accept late NOIs (emailed to NASAMIRO@nasaprs.com). However, NASA strongly encourages Proposers to submit NOIs by the deadline. For requirements and instructions on submitting a NOI, see the

NASA Guidebook for Proposers Responding to a NASA Funding Announcement (revised March 2018) (<https://www.hq.nasa.gov/office/procurement/NFAGuidebook/proposer2018.pdf>).

The NOI shall include:

- 1. Name of the lead institution;**
- 2. College/University Minority Designation (i.e., HBCU, HSI, AANAPSI, etc. or “unsure”);**
- 3. Name, title, regular mail and e-mail address, telephone, and fax number of the proposed PI;**
- 4. Planned title and brief description of research focus;**
- 5. Primary affiliated NASA Mission Directorate, NASA Center and other collaborators; and**
- 6. Key words that describe the technical area of proposed research.**

G.4.3 Pre-proposal Teleconference and Questions and Answers

A pre-proposal teleconference will be held on Thursday, September 20 at 1:00 pm Eastern Time. Refer to the MIRO web page on NSPIRES for connection details. During this time, prospective proposers may verbally state questions they may have about the opportunity. Proposers may also receive technical assistance from project staff at this time, which may include tips and guidance for proposing.

Prospective proposers are requested to submit any written questions as instructed on the NSPIRES announcement of this opportunity. Responses to questions submitted will be provided in a list that will be posted on NSPIRES. The list will be updated periodically during the open period of the opportunity.

Interested proposers are strongly encouraged to register in NSPIRES and sign up for notification emails so that they will receive notice of this teleconference. Prospective proposers shall refer to the MIRO web page on NSPIRES for question submission and schedule information.

G.5 PROPOSAL EVALUATION AND SELECTION

G.5.1 Proposal Review Criteria

The principle elements for proposal evaluation are the following: Relevance to NASA Objectives (40%), Intrinsic Merit (40%), and Budget/Cost (20%). Prospective proposers shall review the following specific criteria for MIRO awards.

G.5.1.1 Relevance to NASA Objectives (40%)

Evaluation of **Relevance to NASA** considers the following sub-elements: **Technical Relevance**, **Educational Relevance**, and **Institutional Capacity Building**. Proposers shall adequately and clearly define how the activity proposes to address the following criteria:

a. Technical Relevance

- Identifies the primary Mission Directorate to which proposed research is aligned.
- Demonstrates how research findings, results, and products align with one or more of the research priorities of NASA Mission Directorates and Centers. See *H.6.8 Research Priorities for NASA Mission Directorates and Centers* for a list of these priorities.
- Describes the state of the art in the literature for proposed research and how the project will enhance, extend, or challenge the status quo.
- Demonstrates how designed research infrastructure will align with NASA technology and safety standards.
- Describes the use of NASA content, people, and/or facilities in the execution of the research activities.
- Develops mechanisms for increased participation by students, faculty, and researchers to engage in research activities.
- Clearly identifies all members of the technical team and how they will contribute towards the research efforts of the proposed activity.
- Describes how individuals in key positions are well versed in the proposed research and have the ability to facilitate all aspects of research development.
- Describes how the lead institution will establish, maintain, and sustain a suitable infrastructure to support research efforts.
- Demonstrates a strong evaluation plan that tracks the evolution of the research and research infrastructure.

b. Educational Relevance

- Demonstrates how project objectives align with the *NASA 2018 Strategic Plan* (https://www.nasa.gov/sites/default/files/atoms/files/nasa_2018_strategic_plan.pdf).

- Demonstrates innovative methods, approaches, and concepts to deliver the project by meeting MIRO objectives.
- Demonstrates capacity to support efforts to build a more diverse STEM workforce that reflects the diversity of the nation.
- Demonstrates how program activities will encourage continued student affiliation with NASA throughout their academic careers.
- Demonstrates culturally appropriate marketing and outreach plans that will engage students in NASA's mission, with emphasis on reaching geographically diverse underrepresented and underserved populations.
- Demonstrates easily accessible application materials and coordination of research and mentoring experiences.
- Demonstrates support of the institution to facilitate disbursement of scholarships and other funds.
- Demonstrates collaboration with other educational institutions will promote student recruitment and involvement.
- Demonstrates a strong evaluation plan that tracks student progress and program success.

c. Institutional Capacity Building

- Describes the value of the proposed research to the lead institution's strategic plan and research priorities (at both the college and university levels) and articulates how the proposed research activities will build institutional capacity.
- Demonstrates how research leadership will be involved in leveraging university, college, and department resources to support project.
- Provides overview of how institutional capacity for research will be developed over the course of the award, including modification of existing space and enhancement of facilities, equipment, and resources.
- Describes how and what curriculum will be enhanced/modified over the course of the award, including new graduate and/or undergraduate program pathways, courses, student research experiences, and/or instructional facilities and materials.
- Describes how and what faculty and researcher development will be provided to enhance overall research capacity, including how NASA assets will be leveraged to support professional development needs.
- Describes a plan for sustaining this capacity after award period ends.
- Demonstrates a strong evaluation plan that tracks institutional capacity development.

G.5.1.2 Intrinsic Merit (40%)

Evaluation of **Intrinsic Merit** considers the following sub-elements: *Management Plan, Collaboration Plan, Sustainability Plan, and Evaluation Plan*. The proposer shall address these criteria to demonstrate the capability of the institution, staff, faculty, collaborators, and targeted students to achieve successful outcomes for the proposed activity.

a. Management Plan

- Demonstrates a management plan that aligns with (1) MIRO goals and objectives, (2) the *NASA 2018 Strategic Plan* (https://www.nasa.gov/sites/default/files/atoms/files/nasa_2018_strategic_plan.pdf), and (3) awardee institution mission and goals.
- Provides a project Logic Model that illustrates the relationship between MIRO goals and objectives and project objectives, activities, benchmarks, and results.
- Demonstrates a clearly organized and feasible management plan for achieving research and educational goals and objectives, and includes clear lines of communication with NASA and other members of the collaborative team.
- Provides specific details of the organizational structure including the PI, administrative support, Co-Is, key partners and collaborators, the appropriate management oversight office at the lead institution, and an initial lead for the External Advisory Committee who will aid in the development of this committee. Provides organization chart for proposed management structure.
- Describes how the PI is qualified to serve as the PI for the project and includes biographical sketches for the PI and each Co-I.
- Identifies all populations served by the project (faculty, researchers, students, etc.), specifies their needs, and explains how these needs will be addressed.
- Describes how proposed administrative assistance will be sufficient for scope of project.
- Demonstrates an achievable timeline for program activities, including benchmarks for success.
- Provides a work breakdown structure for the proposed research plan that includes a timeline for project short and long-term outcomes.

b. Collaboration Plan

- Delineates mechanisms for building partnerships to enhance the ability of the lead institutions to achieve its objectives, to obtain and leverage sources of additional funding, and/or to obtain essential services not otherwise available.
- Includes a list of partners and collaborators, the organization to which they belong, their roles and responsibilities, the percentage of time allocated to support the proposed research, and capabilities that the partnership contributes. Collaborators may include, but are not limited to, individuals from NASA Centers, NASA EPSCoR jurisdictions, NASA Space Grant Consortia, and other government agencies; non-profits; community colleges, MSIs, and other universities; industry and other organizations.
- Presents a plan that outlines each collaborator's responsibilities to the proposed activities.
- Details specific contributions (such as financial, personnel, assets, and facilities) being provided by each collaborator and how they will contribute to the goals and objectives of the proposed research.
- Provides a letter of support from each collaborator that specifies the unique responsibilities and contributions as outlined above.

c. Sustainability Plan

- Describes a strategic roadmap that demonstrates sustainability beyond the award period and includes plans to apply for funding opportunities offered by NASA Mission Directorates, industry, and other funding agencies.
- Provides a multi-year plan demonstrating the process to acquire resources to sustain the project. Identifies resources or funding capabilities that are in place or will be pursued via the following entities: institutional support, federal or state agencies, contracting opportunities, etc.
- Identifies all long-term relationships that have been or will be established to ensure that the project will sustain educational programming, research activities, and utilization of research infrastructure.
- Describes how key project elements may be replicated and scalable in other environments.
- Identifies initial lead of the External Advisory Committee (EAC) and describes how the committee will support sustainability efforts.
- Demonstrates a strong evaluation plan that tracks sustainability efforts and successes.

d. Evaluation Plan

- Describes the planned approach that will be used to evaluate the proposed program, including processes to collect and analyze qualitative and quantitative data of indicators that may be utilized to track student engagement and progress; faculty, researcher, research, and curriculum development; quality of project infrastructure and programming; and institutional change.
- Identifies proposed evaluation questions, program measurable goals, objectives, outcomes, and data collection tools that describe progress towards meeting MIRO goals and objectives.
- Identifies and justifies capabilities of an Independent Evaluator who will develop the comprehensive evaluation plan, identify/develop tools or processes for data collection; carry out evaluation tasks; conduct analysis; and provide formative and summative feedback to the project leadership throughout the life cycle of the award.
- Describes an appropriate evaluation plan/process that will document outcomes and demonstrate progress toward achieving the objectives of proposed education activities. Evaluation methods shall be based upon reputable models and techniques that are appropriate to the content and scale of the project.
- Describes methods that will be used to track student progress. Student progress shall be evaluated at different levels/phases of involvement with the proposed project such as across cohort groups, per education level, and post-involvement.
- Provides a timeline of data collection, analysis, and reporting that aligns with MIRO Reporting Requirements outlined in *H.6.2 Cooperative Agreement Award Reporting Requirements*.
- Describes how feedback from institutional staff, faculty, and students, collaborators, partners and stakeholders will be obtained; shared with TRC, EAC, and MIRO Management Team members; and utilized to improve project activities.

G.5.1.3 Budget/Cost (20%)

Proposals shall include a detailed implementation/costing plan that clearly demonstrates how funds will be utilized for the duration of the award.

In addition, the budget shall:

- Align with budget guidelines and requirements outlined in *H.2.3 Budget Guidelines and Requirements* (in this document).
- Include sufficient travel funds to cover costs for the PI and other key staff to attend critical meetings, typically held in Washington, DC. Requested travel shall include purpose, the number of trips and expected location, duration of each trip, airfare, and per diem.
- Include annual stipend/scholarship support for students to participate in internship opportunities at NASA Centers and research facilities during NASA's spring, summer, or fall session. The agency's current (as of fall 2018) standard internship pay rate is \$730/week for undergraduate students and \$900/week for graduate students (at the master's and doctoral levels). This amount is subject to change based on guidance from the agency.
- Indicate how the proposed budget is clearly aligned with the proposal narrative and budget narrative.
- Describe how the proposed budget is adequate, appropriate, reasonable, and realistic.
- Demonstrate effective use of funds in which outcomes justify total costs.
- Include sufficient funds to support a project administrative assistant (or explanation of how project administration will be supported through other funding).
- Include sufficient funds to support the Independent Evaluator, including necessary travel.
- Provide a budget justification detailing how funds will be allocated to support project personnel, travel, student scholarships or support, research funding, and subcontracts.

G.5.2 Review and Selection Process

Reviewers and panelists with appropriate expertise will be identified to evaluate each proposal that is compliant and meets requirements that have been stated within the MIRO solicitation. Proposers shall provide sufficient detail to enable an effective evaluation by persons who are knowledgeable of, but not necessarily specialists in the proposed research area. The reviewers may include personnel from NASA, other government agencies, industry, and universities.

Proposals will be evaluated through a two-tiered process to include an evaluation completed by reviewers and panelists. The first tier of the evaluation will be conducted by reviewers online, and the second tier of evaluation will be conducted by panelists on site. The panelists will present final recommendations to the NASA selection official.

The selection official will be Ms. Joeletta Patrick, MUREP Manager at NASA Headquarters, or her designee.

Evaluation emphasis will be placed on proposals that address the following requirements:

As stated above, priority will be given to institutions that have not previously received MIRO award funding. In addition, the following proposal features will be given emphasis and favorably considered:

- The degree to which the proposal establishes synergetic partnerships and collaborations with other institutions and agencies, including members of NASA Centers, NASA EPSCoR jurisdictions, NASA Space Grant Consortiums, and other government agencies; non-profits; community colleges, minority-serving institutions, and other universities; and industry and other organizations;
- The degree to which the proposal develops core expertise and institutional capacity to sustain the project and obtain funding support from non-MIRO sources;
- The degree to which the proposal succinctly articulates the strategic focus of the research activities, plan for building institutional capacity, and strategies for enhancing knowledge and skills of faculty, researchers, staff, and graduate/undergraduate students; and
- The degree to which the proposal increases the number of STEM degrees awarded to students at the graduate and undergraduate levels in fields that contribute to NASA's mission.

In evaluating the proposals, NASA will assign one of the following overall ratings:

- Excellent - A comprehensive and thorough proposal of exceptional merit with one or more significant strengths. No deficiency or significant weakness exists.
- Very Good - A proposal having no deficiencies and which demonstrates over-all competence. One or more significant strengths have been found, and strengths outbalance any weaknesses that exist.
- Good - A proposal having no deficiencies and which shows a reasonably sound response. There may be strengths or weaknesses, or both. On a whole, weaknesses not offset by strengths do not significantly detract from the Proposer's response.
- Fair - A proposal having no deficiencies and which has one or more weaknesses. Weaknesses outbalance strengths.
- Poor - A proposal that has one or more deficiencies or significant weaknesses that demonstrate a lack of overall competence or that would require a major proposal revision to correct.

G.6 AWARD ADMINISTRATION INFORMATION

G.6.1 Role of the Technical Review Committee (TRC)

Award recipients will be assigned a NASA Technical Review Committee (TRC) that is comprised of SMEs from the NASA Field Centers and Headquarters. The Chair of the TRC will serve as the NASA Technical Monitor (TM) of the MIRO award.

Responsibilities of the TRC include, but are not limited to:

- Working with the PI to ensure that project technical goals are met;
- Advising MIRO recipients on the technical requirements of research activities;
- Facilitating the flow of information among Institutions receiving MIRO awards and NASA;
- Promoting greater involvement of MIRO personnel in NASA activities;
- Communicating with the PI and MIRO Management Team regarding project goals and activities; and
- Participating in an annual site visit and contributing to a TRC Site Visit Report.

G.6.2 Cooperative Agreement Award Reporting Requirements

The reporting requirements for award recipients under the MIRO will be consistent with the *NASA Grant and Cooperative Agreement Manual (GCAM)* (https://prod.nais.nasa.gov/pub/pub_library/srba/index.html). Unless otherwise noted, the MIRO PI shall submit reports via secure transfer and following Personally Identifiable Information (PII) requirements to the NASA MIRO Activity Manager. For additional information on PII, see *NASA Privacy* (<https://www.nasa.gov/privacy/index.html>) and *NASA Privacy of Information* (<https://www.grc.nasa.gov/its-training/best-practices/privacy-of-information/>).

- **Within one month (30 days) after award, using required report formats, award recipients shall:**
 - Submit a descriptive MIRO project abstract for the nasa.gov website.
- **Within three months after award, using required report formats, award recipients shall:**
 - Submit a Projected Milestones Chart that:
 - Outlines when major activities and expenditures will take place during the period of performance;
 - Is organized monthly and according to NASA quarters; and
 - Includes plan for all three years of the project.
 - NOTE: The MIRO Management Team will provide guidance on the development of the Projected Milestones Chart.
 - Submit a final Comprehensive Evaluation Plan that:
 - Is developed by the Independent Evaluator with concurrence by the PI;
 - Provides a clearly articulated logic model;

- Describes an appropriate evaluation plan/process that is based on reputable models and techniques;
 - Identifies how progress toward achieving the objectives of proposed education activities will be measured; and
 - Identifies a timeline and benchmarks for objectives that aligns with MIRO Reporting Requirements.
 - NOTE: The MIRO Management Team will provide guidance on the development of the Comprehensive Evaluation Plan.
- **On a trimester basis, using required report formats, award recipients shall:**
 - Submit Trimester Reports and OEPM Data Spreadsheets that include, at a minimum:
 - A narrative summary of progress; and
 - Accurate and comprehensive OEPM Data Spreadsheets of numbers of students served, achievement highlights, additional funding awarded, and other items such as that required by the Office of Education Performance Measurement (OEPM) system (i.e., generic questions about evaluation, status update about activity evaluation).
- **On an annual basis, using required report formats, award recipients shall:**
 - Participate in an annual Site Visit conducted by the Technical Review Committee with participation by the MIRO Management Team.
 - Submit a pre-site visit Self-Assessment that includes, at a minimum:
 - Project activities completed during the award period of performance;
 - Project accomplishments measured against the proposed goals and objectives;
 - Evidence of how project activities have furthered stakeholder priorities;
 - Extent to which collaborations and/or partnerships have evolved;
 - Plan of activities for the next year; and
 - Financial Report (spreadsheet of side-by-side comparison, cumulative and by year, by category, of budget versus actual with explanation of deviations from plan).
 - Submit an Annual Evaluation Report that includes, at a minimum:
 - Alignment with the Comprehensive Evaluation Plan; and
 - An annual and formative/summative assessment of the evaluation questions identified in site evaluation plans using the methods and instruments previously identified.
- **Within 90 days of the expiration of the project using required report formats, award recipients shall:**
 - Submit a final report with summary information from the entire project period of performance.

Grantees shall also complete all required reports as requested by the NASA Shared Services Center (NSSC) as listed on the cooperative agreement required reports and publications document.

G.6.3 Summary of MIRO Grantee Responsibilities

1. MIRO award recipients shall assume primary responsibility for implementing, operating, and managing the project as described in their original proposal and as modified in subsequent proposals for continuation beyond the initial period.
2. The Recipient shall appoint a PI in support of this Agreement. If the PI to be named is different from the individual identified in the proposal, the NASA MIRO Manager shall be notified in writing. Any proposed change to the PI under this Agreement is subject to NASA approval. NOTE: If NASA approves the proposed change, the NASA Grant Officer will issue a formal written modification to the Agreement to reflect such change. If NASA does not approve the change in the PI, the MIRO recipient will propose another PI until NASA approval is obtained.
3. The Recipient shall provide a written response on how the recommendations by the NASA MIRO Management Team and TRC will be integrated into the research and/or administrative plan.
4. The Recipient shall submit a variety of reports, including trimester progress reports, performance outcomes data, evaluation reports, and annual reports. The MIRO recipient will also host an annual on-campus NASA TRC site visit, following the schedule in the Management Guidelines. See additional information regarding reporting under *H.6.2 Cooperative Agreement Award Reporting Requirements* (this document).
5. The Recipient, in concert with the MIRO PI, is responsible for the financial management of the MIRO as specified in the basic award notice under the terms and conditions issued by NASA and in the *NASA Grant and Cooperative Agreement Manual (GCAM)* (https://prod.nais.nasa.gov/pub/pub_library/srba/index.html). Failure to comply with the terms and conditions of an award can result in termination by NASA.
6. The Recipient shall ensure that all peer-reviewed scientific research publications authored or co-authored by investigators and sub-recipients and funded, in whole or in part by NASA, are submitted to PubMed Central system at <http://www.ncbi.nlm.nih.gov>. The Recipient shall provide a list of publications with annual and final reports.
7. NASA reserves the right to impose additional requirements during the Cooperative Agreement period of performance to achieve broader MIRO or NASA objectives.

G.6.4 Office of Education Metrics

NASA utilizes the Office of Education Performance Measurement System (OEPM) for analyzing performance data. To facilitate data input into OEPM, the MIRO Management Team collects institutional data via trimester narrative and spreadsheet templates. PIs and their administrative assistants shall participate in reporting training (may be virtual) to improve their data collection. The MIRO Management Team will communicate training and data collection tasks in a timely manner.

Recipients may also be required to respond to data calls as requested by NASA's Office of Education. It is critical for all awardees to develop tracking methods or databases on project activities in order to respond to potential data calls. Additional communications and guidance regarding data calls and activity tracking will come from the MIRO Management Team. The recipient shall ensure that it has the appropriate staff and resources to facilitate data collection activities and complete tasks required for OEPM reporting.

G.6.5 Export Control

(a) Recipients shall comply with all U.S. export control laws and regulations, including the International Traffic in Arms Regulations (ITAR), 22 CFR Parts 120 through 130, and the Export Administration Regulations (EAR), 15 CFR Parts 730 through 799, in the performance of this cooperative agreement. In the absence of available license exemptions/exceptions, the Recipient shall be responsible for obtaining the appropriate licenses or other approvals, if required, for exports of hardware, technical data, and software, or for the provision of technical assistance.

(b) The Recipient shall be responsible for obtaining export licenses, if required, before utilizing foreign persons in the performance of this cooperative agreement.

(c) The Recipient shall be responsible for all regulatory record keeping requirements associated with the use of licenses and license exemptions/exceptions.

(d) The Recipient shall be responsible for ensuring that the provisions of this clause apply to its contractors, subcontractors, and partners. See additional information in *NASA Grant and Cooperative Agreement Manual (GCAM)*

(https://prod.nais.nasa.gov/pub/pub_library/srba/index.html) and Appendix A, See *NASA Guidebook for Proposers responding to a NASA Funding Announcement (revised March 2018)* (<https://www.hq.nasa.gov/office/procurement/NFAGuidebook/proposer2018.pdf>).

G.6.6 Data Management Plan (DMP) - Increasing Access to the Results of Federally Funded Research

Consistent with the *NASA Plan for Increasing Access to Results of Federally Funded*

Research, new terms and conditions about making manuscripts and data publicly accessible may be attached to NASA awards. All proposals shall provide a Data Management Plan (DMP) or an explanation of why one is not necessary given the nature of the work proposed. During the implementation phase of this new requirement, *the DMP shall be submitted by responding to the NSPIRES cover page question about the DMP (limited to 4000 characters)*. Any research project that does not require a DMP to be submitted shall explicitly indicate this fact in the DMP block.

The type of proposal that requires a DMP is described in the *NASA Plan for Increasing Access to Results of Scientific Research* (see link below):

https://www.nasa.gov/sites/default/files/atoms/files/206985_2015_nasa_plan-for-web.pdf

In addition, SMD has posted a Frequently Asked Questions (FAQ) website that addresses questions about DMP requirements at <http://science.nasa.gov/researchers/sara/faqs/dmp-faq-roses>. Note that although the questions pertain to the SMD ROSES Notice of Research Announcement (NRA), the requirements provided in the answers also apply to this opportunity.

Note: Proposers that include a plan to archive data shall allocate suitable time for this task. Unless otherwise stated, this requirement supersedes the DMP described in the *NASA Guidebook for Proposers*.

G.6.7 Summary of Key Information

Total ESTIMATED annual budget for MIRO activity	~ \$5M per year
Number of new awards pending adequate proposals of merit	~4-5
Start date (estimated)	2-4 months (estimated) from selection announcement
Duration of awards	Up to 3 years
Award Type	Cooperative Agreement
Release Date	September 10, 2018, 11:59 pm Eastern Time (DATE SUBJECT TO CHANGE); Check the NSPIRES website for details.
MIRO Pre-proposal Conference (Optional)	September 20, 2018, 1:00 pm Eastern Time (DATE SUBJECT TO CHANGE); Check the NSPIRES website for details.
Due date for Notice of Intent to propose (NOI)	October 9, 2018, 11:59 pm Eastern Time (DATE SUBJECT TO CHANGE); Check the NSPIRES website for details.
Due date for proposals	December 10, 2018, 11:59 pm Eastern Time (DATE SUBJECT TO CHANGE); Check the NSPIRES website for details.
Page limit for the central Scientific-Educational-Management section of proposal	15pp (includes all illustrations, tables, and figures, where each "n-page" foldout counts as n-pages and each side of a sheet containing text or an illustration counts as a page.); See <i>NASA Guidebook for Proposers Responding to a NASA Funding Announcement (revised March 2018)</i> (https://www.hq.nasa.gov/office/procurement/NFAGuidebook/proposer2018.pdf).
Detailed instructions for the preparation and submission of proposals	See <i>NASA Guidebook for Proposers Responding to a NASA Funding Announcement (revised March 2018)</i> (https://www.hq.nasa.gov/office/procurement/NFAGuidebook/proposer2018.pdf).
Submission medium	Electronic proposal submission is required via NSPIRES or grants.gov; no hard copy will be accepted. See <i>NASA Guidebook for Proposers Responding to a NASA Funding Announcement (revised March 2018)</i> (https://www.hq.nasa.gov/office/procurement/NFAGuidebook/proposer2018.pdf).

Web site for submission of proposal via NSPIRES	http://nspires.nasaprs.com/ (help desk available at nspires-help@nasaprs.com or (202) 479-9376 from 8 am to 6 pm Eastern Time) excluding federal holidays.
Web site for submission of proposal via grants.gov	http://grants.gov (Contact Center is available by email at support@grants.gov , or by calling 1-800-518-4726 and via website at https://grants-portal.psc.gov .)
Selection Official	Joeletta Patrick MUREP Manager NASA Headquarters Washington, DC 20546
NASA point of contact for this project	Dave Berger MUREP Institutional Research Opportunity (MIRO) Activity Manager NASA Armstrong Flight Research Center PO Box 273 MS 4830A Edwards, CA 93523-0273 Phone: (661) 276-5712 Email: NASAMIRO@nasaprs.com

G.6.7 Glossary of Definitions

Collaborator: A Collaborator is an individual who is less critical to the proposal than a Co-I but who is committed to provide a focused but unfunded contribution for a specific task. If funding support is requested in the proposal, such a person must be identified in one of the other categories above. For a proposal that is submitted via [Grants.gov](http://grants.gov), collaborators shall be listed on the Project Role “Other” line of the Senior/Key Person portion of the R&R 424 form.

Co-Investigator (Co-I): A Co-I is a member of the proposal’s investigation team who may hold either a full-time or limited-term appointment and who is a critical “partner” for the conduct of the investigation through the contribution of unique expertise and/or capabilities. A Co-I must have a well-defined, and generally sustained, continuing role in the proposed investigation, serve under the direction of the PI, and may or may not receive funding through the award. Only an individual who has formally agreed to the role may participate as a Co-I even if his/her participation is at no cost (i.e., contributed) to the proposal.

Independent Evaluator: The Independent Evaluator is a third party or a current employee of the awardee organization who is independent from the policy, operations, and management functions

of the project activity requiring evaluation. It is expected that the Independent Evaluator both works collaboratively with the Principal Investigator and retains independent objectivity in collecting and presenting evidence of effectiveness, impact on participants, proposed program outcomes, and progress toward achieving goals and objectives.

Principal Investigator (PI): The Principal Investigator is (are) the individual(s) a research organization designates as having an appropriate level of authority and responsibility for the proper conduct of the research, including the appropriate use of funds and administrative requirements such as the submission of scientific progress reports to the agency.

Technology transferred for commercialization: the development of dual use technologies that meet both NASA mission needs and other national objectives.

Underrepresented: Populations that are not present in the STEM professions relative to the size of the population at large. Refers to racial and ethnic populations as well as women and persons with disabilities.

Underserved: Often used interchangeably with “underrepresented,” particularly as it relates to the sciences and engineering. Specifically, it is used to promote access and opportunity to 23 persons of diverse backgrounds—racial, ethnic, gender, religious, age, sexual orientation, disabled, and other populations with limited access—to decent and affordable housing, gainful employment, and other services. In the STEM arena, “underserved” has typically referred to women and persons with disabilities.

G.6.8 Research Priorities for NASA Mission Directorates and Centers

NOTE: This section was extracted from the EPSCoR 2018 Solicitation without editing. For additional information about EPSCoR, see <https://www.nasa.gov/offices/education/programs/national/epscor/home/index.html> and their most recent solicitation posted on <https://nspires.nasaprs.com/external/index.do>.

5.

6. EPSCoR Appendix A: NASA Mission Directorates and Center Alignment

NASA’s Mission *to pioneer the future in space exploration, scientific discovery, and aeronautics research*, draws support from the following four Mission Directorates and nine NASA Centers, and NASA’s Jet Propulsion laboratory (JPL), each with a specific responsibility.

A.1 Aeronautics Research Mission Directorate (ARMD) conducts high-quality, cutting-edge research that generates innovative concepts, tools, and technologies to enable revolutionary

advances in our Nation’s future aircraft, as well as in the airspace in which they will fly. ARMD programs will facilitate a safer, more environmentally friendly, and more efficient national air transportation system. Using a Strategic Implementation Plan, NASA ARMD sets forth the vision for aeronautical research aimed at the next 25 years and beyond. It encompasses a broad range of technologies to meet future needs of the aviation community, the nation, and the world for safe, efficient, flexible, and environmentally sustainable air transportation. Additional information on ARMD can be found at: <http://www.aeronautics.nasa.gov>.

Areas of Interest

Researchers responding to the ARMD shall 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.

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. HEOMD also oversees low-level requirements development, policy, and programmatic oversight. The International Space Station (ISS), 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 HEOMD can be found at: (<http://www.nasa.gov/directorates/heo/home/index.html>)

Areas of Interest

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 Biology

The Space Biology research has three primary goals:

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

These goals are achieved by sponsoring research studies in five program elements to contribute basic knowledge of biological adaptation to spaceflight to accelerate solutions to biomedical problems affecting human exploration of space as well as human health on Earth: Microbiology; Cell and Molecular Biology; Plant Biology; Animal Biology; and Developmental Biology

Current Space Biology emphases include:

- Use ground-based facilities to characterize the effects of space-like radiation on biological systems. NASA is interested in projects that will characterize how radiation exposure impacts living organisms during a single lifecycle, or over multiple generations.
- Use ground-based simulations to study how spaceflight conditions might impact plant and microbial interactions and growth. Questions of interest to NASA include, but are not limited to, whether spaceflight induces changes in the virulence of plant pathogens and/or whether spaceflight might change benign or commensal microbes on plants into pathogenic ones.
- Use ground-based facilities to simulate a range of gravitational levels on biological specimens to understand and characterize the dose-response curve between 0 and 2 G for various biological systems to determine A) if there are G-level thresholds required to trigger gravity-specific responses in living organisms, and B) the effect that exposure to levels of gravity similar to those encountered on Mars (.38 G) or the moon (0.16 G), and/or hypergravity has on living organisms.

Further details about Space Biology goals, objectives and progress can be found at the [Space Biology 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:

- Biophysics: biological macromolecules, biomaterials.
- Combustion science: spacecraft fire safety, droplets, gaseous (premixed and non-premixed), solid fuels, supercritical reacting fluids.
- Complex fluids: colloidal systems, liquid crystals, foams, gels, granular flows.
- Fluid physics: adiabatic two-phase flow, boiling and condensation, capillary flow, interfacial phenomena, cryogenics storage and handling.
- Fundamental physics: space optical/atomic clocks, quantum test of equivalence principle, cold atom physics, critical point phenomena, dusty plasmas.
- Materials science: glasses and ceramics, granular materials, metals, polymers and organics, semiconductors.

Implementing Centers: NASA's Physical Sciences Research Program is carried out at the Glenn Research Center (GRC), the Jet Propulsion Laboratory (JPL) and the 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 & 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))

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 SMD can be found at: (<http://nasascience.nasa.gov>)

Areas of Interest

SMD has developed science objectives and programs to answer fundamental questions in Earth and space sciences in the context of our national science agenda. The knowledge gained by researchers supporting NASA's Earth and space science program helps to unravel mysteries that intrigue us all.

- What drives variations in the Sun, and how do these changes impact the solar system and drive space weather?
- How and why are Earth's climate and environment changing?
- How did our solar system originate and change over time?
- How did the universe begin and evolve, and what will be its destiny?
- How did life originate, and are we alone?

Each of the SMD's four science divisions – Heliophysics, Earth Science, Planetary Science, and Astrophysics – makes important contributions to address national and Agency goals. The NASA

2018 Strategic Plan

https://www.nasa.gov/sites/default/files/atoms/files/nasa_2018_strategic_plan.pdf reflects the direction NASA has received from our government's executive branch and Congress, advice received from the nation's scientific community, the principles and strategies guiding the conduct of our activities, and the challenges SMD faces. Specifically,

Heliophysics Division

Heliophysics encompasses science that improves our understanding of fundamental physical processes throughout the solar system, and enables us to understand how the Sun, as the major driver of the energy throughout the solar system, impacts our technological society. The scope of heliophysics is vast, spanning from the Sun's interior to Earth's upper atmosphere, throughout interplanetary space, to the edges of the heliosphere, where the solar wind interacts with the local interstellar medium. Heliophysics incorporates studies of the interconnected elements in a single system that produces dynamic space weather and that evolves in response to solar, planetary, and interstellar conditions.

The Agency's strategic objective for heliophysics is to **understand the Sun and its interactions with Earth and the solar system, including space weather**. The heliophysics decadal survey conducted by the National Research Council (NRC), *Solar and Space Physics: A Science for a Technological Society* (<http://www.nap.edu/catalog/13060/solar-and-space-physics-a-science-for-a-technological-society>), articulates the scientific challenges for this field of study and recommends a slate of design reference missions to meet them, to culminate in the achievement of a predictive capability to aid human endeavors on Earth and in space. The fundamental science questions are:

- What causes the Sun to vary?
- How do the geospace, planetary space environments and the heliosphere respond?
- What are the impacts on humanity?

To answer these questions, the Heliophysics Division implements a program to achieve three overarching goals:

- Explore the physical processes in the space environment from the Sun to the Earth and throughout the solar system
- Advance our understanding of the connections that link the Sun, the Earth, planetary space environment, and the outer reaches of our solar system
- Develop the knowledge and capability to detect and predict extreme conditions in space to protect life and society and to safeguard human and robotic explorers beyond Earth

Earth Science Division

Our planet is changing on all spatial and temporal scales and studying the Earth as a complex system is essential to understanding the causes and consequences of climate change and other global environmental concerns. The purpose of NASA's Earth science program is to advance our scientific understanding of Earth as a system and its response to natural and human-induced changes and to improve our ability to predict climate, weather, and natural hazards.

NASA's ability to observe global change on regional scales and conduct research on the causes and consequences of change position it to address the Agency strategic objective for Earth science, which is to advance knowledge of Earth as a system to meet the challenges of environmental change, and to improve life on our planet. NASA addresses the issues and opportunities of climate change and environmental sensitivity by answering the following key science questions through our Earth science program:

- How is the global Earth system changing?
- What causes these changes in the Earth system?
- How will the Earth system change in the future?
- How can Earth system science provide societal benefit?

These science questions translate into seven overarching science goals to guide the Earth Science Division's selection of investigations and other programmatic decisions:

- Advance the understanding of changes in the Earth's radiation balance, air quality, and the ozone layer that result from changes in atmospheric composition (Atmospheric Composition)
- Improve the capability to predict weather and extreme weather events (Weather)
- Detect and predict changes in Earth's ecosystems and biogeochemical cycles, including land cover, biodiversity, and the global carbon cycle (Carbon Cycle and Ecosystems)
- Enable better assessment and management of water quality and quantity to accurately predict how the global water cycle evolves in response to climate change (Water and Energy Cycle)
- Improve the ability to predict climate changes by better understanding the roles and interactions of the ocean, atmosphere, land and ice in the climate system (Climate Variability and Change)
- Characterize the dynamics of Earth's surface and interior, improving the capability to assess and respond to natural hazards and extreme events (Earth Surface and Interior)
- Further the use of Earth system science research to inform decisions and provide benefits to society

Two foundational documents guide the overall approach to the Earth science program: the NRC 2007 Earth science decadal survey (<http://www.nap.edu/catalog/11820/earth-science-and-applications-from-space-national-imperatives-for-the>) and NASA's 2010 climate-centric

architecture plan

(http://science.nasa.gov/media/medialibrary/2010/07/01/Climate_Architecture_Final.pdf).

The former articulates the following vision for Earth science research and applications in support of society:

Understanding the complex, changing planet on which we live, how it supports life and how human activities affect its ability to do so in the future is one of the greatest intellectual challenges facing humanity. It is also one of the most challenges for society as it seeks to achieve prosperity, health, and sustainability.

The latter addresses the need for continuity of a comprehensive set of key climate monitoring measurements, which are critical to informing policy and action, and which other agencies and international partners had not planned to continue. NASA's ability to view the Earth from a global perspective enables it to provide a broad, integrated set of uniformly high-quality data covering all parts of the planet. NASA shares this unique knowledge with the global community, including members of the science, government, industry, education, and policy-maker communities.

Planetary Science Division

Planetary science is a grand human enterprise that seeks to understand the history of our solar system and the distribution of life within it. The scientific foundation for this enterprise is described in the NRC planetary science decadal survey, *Vision and Voyages for Planetary Science in the Decade 2013-2022* (<http://www.nap.edu/catalog/13117/vision-and-voyages-for-planetary-science-in-the-decade-2013-2022>). Planetary science missions inform us about our neighborhood and our own origin and evolution; they are necessary precursors to the expansion of humanity beyond Earth. Through five decades of planetary exploration, NASA has developed the capacity to explore all of the objects in our solar system. Future missions will bring back samples from some of these destinations, allowing iterative detailed study and analysis back on Earth. In the future, humans will return to the Moon, go to asteroids, Mars, and ultimately other solar system bodies to explore them, but only after they have been explored and understood using robotic missions.

NASA's strategic objective in planetary science is to **ascertain the content, origin, and evolution of the solar system and the potential for life elsewhere**. We pursue this goal by seeking answers to fundamental science questions that guide NASA's exploration of the solar system:

- How did our solar system form and evolve?
- Is there life beyond Earth?
- What are the hazards to life on Earth?

The Planetary Science Division has translated these important questions into science goals that guide the focus of the division's science and research activities:

- Explore and observe the objects in the solar system to understand how they formed and evolve
- Advance the understanding of how the chemical and physical processes in our solar system operate, interact and evolve
- Explore and find locations where life could have existed or could exist today.
- Improve our understanding of the origin and evolution of life on Earth to guide our search for life elsewhere
- Identify and characterize objects in the solar system that pose threats to Earth, or offer resources for human exploration

In selecting new missions for development, NASA's Planetary Science Division strives for balance across mission destinations, using different mission types and sizes. Achievement of steady scientific progress requires a steady cadence of missions to multiple locations, coupled with a program that allows for a consistent progression of mission types and capabilities, from small and focused, to large and complex, as our investigations progress. The division also pursues partnerships with international partners to increase mission capabilities and cadence and to accomplish like-minded objectives.

See Section 4.3 of the NASA 2014 Science Plan for specifics, including missions currently in operation, in formulation or development, and planned for the future.

Astrophysics Division

Astrophysics is the study of phenomena occurring in the universe and of the physical principles that govern them. Astrophysics research encompasses a broad range of topics, from the birth of the universe and its evolution and composition, to the processes leading to the development of planets and stars and galaxies, to the physical conditions of matter in extreme gravitational fields, and to the search for life on planets orbiting other stars. In seeking to understand these phenomena, astrophysics science embodies some of the most enduring quests of humankind.

Through its Astrophysics Division, NASA leads the nation on a continuing journey of transformation. From the development of innovative technologies, which benefit other areas of research (e.g., medical, navigation, homeland security, etc.), to inspiring the public worldwide to pursue STEM careers through its stunning images of the cosmos taken with its Great Observatories, NASA's astrophysics programs are vital to the nation.

NASA's strategic objective in astrophysics is to **discover how the universe works, explore how it began and evolved, and search for life on planets around other stars**. Three broad scientific questions flow from this objective:

- How does the universe work?
- How did we get here?
- Are we alone?

Each of these questions is accompanied by a science goal that shapes the Astrophysics Division's efforts towards fulfilling NASA's strategic objective:

- Probe the origin and destiny of our universe, including the nature of black holes, dark energy, dark matter and gravity
- Explore the origin and evolution of the galaxies, stars and planets that make up our universe
- Discover and study planets around other stars, and explore whether they could harbor life

The scientific priorities for astrophysics are outlined in the NRC decadal survey *New Worlds, New Horizons in Astronomy and Astrophysics* (<http://www.nap.edu/catalog/12951/new-worlds-new-horizons-in-astronomy-and-astrophysics>). These priorities include understanding the scientific principles that govern how the universe works; probing cosmic dawn by searching for the first stars, galaxies, and black holes; and seeking and studying nearby habitable planets around other stars.

The multidisciplinary nature of astrophysics makes it imperative to strive for a balanced science and technology portfolio, both in terms of science goals addressed and in missions to address these goals. All the facets of astronomy and astrophysics—from cosmology to planets—are intertwined, and progress in one area hinges on progress in others. However, in times of fiscal constraints, priorities for investments must be made to optimize the use of available funding. NASA uses the prioritized recommendations and decision rules of the decadal survey to set the priorities for its investments.

NASA's Astrophysics Division has developed several strategies to advance these scientific objectives and respond to the recommendations outlined in the decadal survey on a time horizon of 5-10 years. The successful development of JWST is an Agency priority. Since its re-baseline in 2011, the project has remained on schedule and within budget for an October 2018 launch. JWST and the science it will produce are foundational for many of the astronomical community's goals outlined in the 2010 decadal survey. NASA's highest priority for a new strategic astrophysics mission is the Wide

Field Infrared Survey Telescope (WFIRST), the number one priority for large-scale missions of the decadal survey. NASA plans to be prepared to start a new strategic astrophysics mission when funding becomes available. NASA also plans to identify opportunities for international partnerships, to reduce the Agency's cost of the mission concepts identified, and to advance the science objectives of the decadal survey. NASA will also augment the Astrophysics Explorer Program to the extent that the budget allows. Furthermore, NASA will continue to invest in the Astrophysics Research Program to develop the science cases and technologies for new missions and to maximize the scientific return from operating missions.

See Section 4.4 of the NASA 2014 Science Plan for specifics, including missions currently in operation, in formulation or development, and planned for the future.

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 take 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)

Areas of Interest

Space Technology Mission Directorate (STMD) expands the boundaries of the aerospace enterprise by rapidly developing, demonstrating, and infusing revolutionary, high-payoff technologies through collaborative partnerships. STMD employs a merit-based competition model with a portfolio approach, spanning a wide range of space technology discipline areas and technology readiness levels. Research and technology development take place at NASA Centers, academia, and industry, and leverages partnerships with other government agencies and international partners.

STMD executes its mission according to the following tenets:

- Advancing transformative and crosscutting technologies that can be directly infused into future missions;
- Investing in a comprehensive portfolio covering low to high technology readiness levels;
- Competitively selecting research by academia, industry, and NASA Centers based on

technical merit;

- Executing with lean structured projects with clear start and end dates, defined budgets and schedules, established milestones, and project level authority and accountability;
- Operating with a sense of urgency and informed risk tolerance to infuse quickly or terminate judiciously;
- Partnering with other NASA Mission Directorates, other government agencies, and the private sector to leverage resources, establish customer advocacy, and support US commercial aerospace interests;
- Delivering new inventions, enabling new capabilities and creating a pipeline of NASA and national innovators

Current space technology topics of particular interest include:

- Advanced manufacturing methods for space and in space
- Autonomous in-space assembly of structures and spacecraft
- Ultra-lightweight materials for space applications
- Materials and structures for extreme environments (high temperature, pressure)
- Extreme environment (including cryogenic) electronics for planetary exploration
- Advanced robotics for extreme environment sensing, mobility, and manipulation
- Deep space optical communication
- Extremely High Frequency microwave technologies for communication, remote sensing, and navigation
- Advanced power generation, storage, and transfer for deep space missions
- Advanced entry, decent, and landing systems for planetary exploration
- Efficient in situ resource utilization to produce items required for long-duration deep space missions including fuels, water, oxygen, food, nutritional supplements, pharmaceuticals, building materials, polymers (plastics), and various other chemicals
- Radiation mitigation for deep space crewed missions
- Biological approaches to environmental control and life support systems
- Autonomous systems for deep space missions
- Advanced telescope technologies for exoplanet imaging
- Low size, weight, and power components for small spacecraft including high-bandwidth communication from space to ground, inter-satellite communication, relative navigation and control for swarms and constellations, precise pointing systems, power generation and energy storage, thermal management, system autonomy, miniaturized instruments and sensors, robotic assembly/manufacturing, and in-space propulsion
- Enabling technologies for low-cost small spacecraft launch vehicles
- Advancements in engineering tools and models supporting Space Technology focus areas

Applicants are strongly encouraged to familiarize themselves with the roadmap document most closely aligned with their space technology interests. The individual roadmap documents may be downloaded at the following link: <http://www.nasa.gov/offices/oct/home/roadmaps/index.html>

NASA's STMD current year version of the NASA Research Announcement (NRA) entitled, "Space Technology Research, Development, Demonstration, and Infusion" has been posted on the NSPIRES web site at <http://nspires.nasaprs.com> (select "Solicitations" and then "Open Solicitations"). The NRA provides detailed information on specific proposals being sought across STMD programs.

A.5 NASA Centers Areas of Interest

Examples of Center research interest areas include these specific areas from the following Centers.

A.5.1 Goddard Space Flight Center (GSFC)

Applied Engineering and Technology Directorate:

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 and Instruments** - 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
 - Formation Flying
- **Automated Rendezvous and Docking (AR&D) techniques**
 - Algorithm development
 - Pose estimation for satellite servicing missions
 - Sensors (e.g., LiDARs, natural feature recognition)
 - Actuation (e.g., micro propulsion, electromagnetic formation flying)
- **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/Smallsat components, technologies and systems to support NASA technology demonstration and risk reduction efforts. Student teams will develop miniature CubeSat/Smallsat systems for: power generation and distribution, navigation, communication, on-board computing, structures (fixed and deployable), orbital stabilization, pointing, and de-orbiting. These components, technologies and systems shall be made available for use by NASA for integration into NASA Cubesat/Smallsats. They may be integrated into complete off-the-shelf "CubeSat/Smallsat 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.
- **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.
- **Integrated Photonic components and systems** - Integrated photonic components and systems for Sensors, Spectrometers, Chemical/biological sensors, Microwave, Sub-millimeter and Long-Wave Infra-Red photonics, Telecom- inter and intra satellite communications.
- **Radiation Effects and Analysis**
 - Flight validation of advanced event rate prediction techniques
 - New approaches for testing and evaluating 3-D integrated microcircuits and other advanced microelectronic devices

- End-to-end system (e.g., integrated component level or higher) modeling of radiation effects
- Statistical approaches to tackle radiation hardness assurance (i.e., total dose, displacement damage, and/or single-event effects) for high-risk, low-cost missions.

Sciences and Exploration Directorate

The Sciences and Exploration Directorate at NASA Goddard Space Flight Center

(<http://science.gsfc.nasa.gov>) is the largest Earth and space science research organization in the world. Its scientists advance understanding of the Earth and its life-sustaining environment, the Sun, the solar system, and the wider universe beyond. All are engaged in the full life cycle of satellite missions and instruments from concept development to implementation, analysis and application of the scientific information, and community access and services.

- The **Earth Sciences Division** plans, organizes, evaluates, and implements a broad program of research on our planet's natural systems and processes. Major focus areas include climate change, severe weather, the atmosphere, the oceans, sea ice and glaciers, and the land surface. To study the planet from the unique perspective of space, the Earth Science Division develops and operates remote-sensing satellites and instruments. We analyze observational data from these spacecraft and make it available to the world's scientists and policy makers. The Division conducts extensive field campaigns to gather data from the surface and airborne platforms. The Division also develops, uses, and assimilates observations into models that simulate planetary processes involving the water, energy, and carbon cycles at multiple scales up to global.
- The **Astrophysics Science Division** conducts a broad program of research in astronomy, astrophysics, and fundamental physics. Individual investigations address issues such as the nature of dark matter and dark energy, which planets outside our solar system may harbor life, and the nature of space, time, and matter at the edges of black holes. Observing photons, particles, and gravitational waves enables researchers to probe astrophysical objects and processes. Researchers develop theoretical models, design experiments and hardware to test theories, and interpret and evaluate observational data.
- The **Heliophysics Science Division** conducts research on the Sun, its extended solar-system environment (the heliosphere), and interactions of Earth, other planets, small bodies, and interstellar gas with the heliosphere. Division research also encompasses Geospace, Earth's magnetosphere and its outer atmosphere, and Space Weather—the important effects that heliospheric disturbances have on spacecraft and terrestrial systems. Division scientists develop spacecraft missions and instruments, systems to manage and disseminate heliophysical data, and theoretical and computational models to interpret the data. Possible heliophysics-related research includes: advanced software environments and data-mining strategies to collect, collate and analyze data relevant to the Sun and its effects on the solar system and the Earth (“space weather”); and advanced computational techniques, including but not limited to parallel architectures and the effective use of graphics processing units, for the simulation of magnetized and highly dynamic plasmas and neutral gases in the heliosphere.

- The **Solar System Exploration Division** builds science instruments and conducts theoretical and experimental research to explore the solar system and understand the formation and evolution of planetary systems. Laboratories within the division investigate areas as diverse as astrochemistry, planetary atmospheres, extrasolar planetary systems, earth science, planetary geodynamics, space geodesy, and comparative planetary studies. To study how planetary systems form and evolve, division scientists develop theoretical models as well as the investigations and space instruments to test them. The researchers participate in planetary and Earth science missions, and collect, interpret, and evaluate measurements.

Scientists in all four divisions publish research results in the peer-reviewed literature, participate in the archiving and public dissemination of scientific data, and provide expert user support.

Education efforts in all science divisions seek to develop interest in and understanding of the science at GSFC by K-12 educators and students and the development of future scientist and computer scientists at the undergraduate and graduate level.

Outreach efforts in all four science divisions raise public awareness of the projects and missions in which we are involved, the research we conduct, and the associated benefits to society.

- Quantum computing
- Artificial intelligence and machine learning
- (Big) data analytics

A.5.2 Ames Research Center (ARC)

ARC (or Ames) enables exploration through selected development, innovative technologies, and interdisciplinary scientific discovery. Ames provides leadership in the following areas: astrobiology; small satellites; entry decent and landing systems; supercomputing; robotics and autonomous systems; life Sciences and environmental controls; and air traffic management.

- [Entry systems](#): *Safely delivering spacecraft to Earth & other celestial bodies*
- [Supercomputing](#): *Enabling NASA's advanced modeling and simulation*
- [NextGen air transportation](#): *Transforming the way we fly*
- [Airborne science](#): *Examining our own world & beyond from the sky*
- [Low-cost missions](#): *Enabling high value science to low Earth orbit, the moon and the solar system*
- [Biology & astrobiology](#): *Understanding life on Earth and in space*
- [Exoplanets](#): *Finding worlds beyond our own*
- [Autonomy & robotics](#): *Complementing humans in space*
- [Lunar science](#): *Rediscovering our moon*
- [Human factors](#): *Advancing human-technology interaction for NASA missions*

- [Wind tunnels](#): *Testing on the ground before you take to the sky*

Additional Center core competencies include:

- Space Sciences
- Applied Aerospace and Information Technology
- Biotechnology
- Synthetic biology.
- Biological Sciences
- Earth Sciences
- High Performance Computing,
- Intelligent Systems
- Quantum Computing
- Nanotechnology-electronics and sensors.
- Small Spacecraft and Cubesats
- Airspace Systems
- Augmented Reality
- Digital materials

A.5.3 Glenn Research Center (GRC)

GRC's Research and technology, and engineering engagements include:

- 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

A.5.4 Armstrong Flight Research Center (AFRC)

AFRC's areas of focus include Autonomy (Collision Avoidance, Separation assurance, formation flight, peak seeking control)

- Adaptive Control
- Hybrid Electric Propulsion
- Control of Flexible Structures using distributed sensor feedback
- Supersonic Research (Boom mitigation and measurement)
- Supersonic Research (Laminar Flow)
- Environmental Responsive Aviation
- Hypersonic Structures & Sensors
- Large Scale Technology Flight Demonstrations (Towed Glider)
- Aerodynamics and Lift Distribution Optimization to Reduce Induced Drag

A.5.5 Marshall Space Flight Center (MSFC)

MSFC's areas of focus include:

Propulsion Systems

- Launch Propulsion Systems, Solid & Liquid
- In Space Propulsion (Cryogenics, Green Propellants, Nuclear, Fuel Elements, Solar-Thermal, Solar Sails, Tethers)
- Propulsion Test beds and Demonstrators (Pressure Systems)
- Combustion Physics
- Cryogenic Fluid Management
- Solid Ballistics
- Rapid Affordable Manufacturing of Propulsion Components
- Materials Research (Nano Crystalline Metallics, Diamond Film Coatings)
- Materials Compatibility
- Computational Fluid Dynamics
- Unsteady Flow Environments
- Acoustics and Stability
- Solid Ballistics
- Rapid Affordable Manufacturing of Propulsion Components
- Materials Research (Nano Crystalline Metallics, Diamond Film Coatings)
- Materials Compatibility

- Computational Fluid Dynamics
- Unsteady Flow Environments
- Acoustics and Stability

Space Systems

- In Space Habitation (Life Support Systems and Nodes, 3D Printing)
- Mechanical Design & Fabrication
- Small Payloads (For International Space Station, Space Launch System)
- In-Space Asset Management (Automated Rendezvous & Capture, De-Orbit, Orbital Debris Mitigation, Proximity Operations)
- Radiation Shielding
- Thermal Protection
- Electromagnetic Interference
- Advanced Communications
- Small Satellite Systems (CubeSats)
- Structural Modeling and Analysis
- Spacecraft Design (CAD)

Space Transportation

- Mission and Architecture Analysis
- Advanced Manufacturing
- Space Environmental Effects and Space Weather
- Lander Systems and Technologies
- Small Spacecraft and Enabling Technologies (Nanolaunch Systems)
- 3D Printing/Additive Manufacturing/Rapid Prototyping
- Meteoroid Environment
- Friction Stir and Ultrasonic Welding
- Advanced Closed-Loop Life Support Systems
- Composites and Composites Manufacturing
- Wireless Systems
- Ionic Liquids
- Guidance, Navigation and Control (Autonomous, Small Launch Vehicle)
- Systems Health Management
- Martian Navigation Architecture/Systems
- Planetary Environment Modeling
- Autonomous Systems (reconfiguration, Mission Planning)

Science

- Replicated Optics

- Large Optics (IR, visible, UV, X-Ray)
- High Energy Astrophysics (X-Ray, Gamma Ray, Cosmic Ray)
- Solar, Magnetospheric and Ionospheric Physics
- Radiation Mitigation/Shielding
- Earth Science Applications
- Convective and Severe Storms Research
- Climate Dynamics
- Lightning Research
- Geochronology, Geochemistry, Atmospheres and Interiors of Planetary Bodies
- Physical Science Informatics
- Biophysics (Protein Crystals)

A.5.6 Kennedy Space Center (KSC)

KSC's areas of focus include:

- TA 4.0 Robotics and Autonomous Systems
 - 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
 - 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
 - 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
 - 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

- 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.

A.5.7 Jet Propulsion Laboratory (JPL)

JPL is NASA's only Federally Funded Research and Development Center. JPL's areas of focus are:

- 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

A.5.8 Johnson Space Center (JSC)

JSC's areas of focus include:

- **In-space propulsion technologies**
- **Energy Storage Technologies-Batteries, Regenerative Fuel cells**
- **Robotics and TeleRobotics**
- **Crew decision support systems**
- **Immersive Visualization**
 - **Virtual windows leading to immersive environments and telepresence systems**
- **Human Robotic interface**
- **Flight and Ground communication systems**
 - **Audio**
 - **Array Microphone Systems and processing**
 - **Large bandwidth (audio to ultra-sonic) MEMs Microphones**
 - **Front end audio noise cancellation algorithms implementable in FPGAs- example Independent Component Analysis**
 - **Audio Compression algorithms implementable in FPGAs.**
 - **COMSOL Acoustic modeling**
 - **Sonification Algorithms implementable in DSPs/FPGAs**
 - **Video**
 - **Ultra-High Video Compressions**
 - **H265 Video Compression**
 - **Rad-Tolerant Imagers**
 - **Lightweight/low power/radiation tolerant displays**
- **Advanced habitat systems**
- **GN&C for descent systems**
- **Large body GN&C**
- **Human system performance modeling**
- **Imaging and information processing**
 - **Lightweight/Low power Display Technology**

- Scalable software-implementable graphics processing unit
- **Simulation and modeling**
- **Materials and structures**
- **Lightweight structure**
- **Human Spaceflight Challenges**
 - <http://humanresearchroadmap.nasa.gov/explore/>
- **Human System Interfaces**
 - **OLED Technology Evaluation for Space Applications**
 - **Far-Field Speech Recognition in Noisy Environments**
 - **Radiation Hardened Graphics Processing**
 - **Human Computer Interaction design methods (Multi-modal and Intelligent Interaction) and apparatuses**
 - **Human Systems Integration, Human Factors Engineering: state of the art in Usability and performance assessment methods and apparatus.**
 - **Humans Systems Integration Inclusion in Systems Engineering**
- **ECLSS**
 - **Air Revitalization**
 - **Advanced water, O2 and CO2 monitoring and sensors**
 - **Advance thermally regenerated ionic fluids for CO2 and Humidity Control**
 - **Water Recovery and Management**
 - **Brine water recovery systems and wastewater treatment chemical recover for reuse or repurpose**
 - **Waste Management**
 - **Advance wastewater treatment systems (lower toxicity, recoverable)**
 - **Advanced trace contaminant monitoring and control technology**
 - **Quiet fan technologies**
- **Active Thermal Control**
 - **Lightweight heat exchangers and cold plates**
 - **Condensing heat exchanger coatings with robust hydrophilic, antimicrobial properties**
 - **Development and demonstration of wax and water-based phase change material heat exchangers**
- **EVA**
 - **Pressure Garment**
 - **Portable Life Support System**
 - **Power, Avionics and Software**
- **Autonomous Rendezvous and Docking**
- **Crew Exercise**
 - **Small form Equipment**
 - **Biomechanics**
- **EDL (thermal)**
- **Wireless and Comm Systems**
 - **Wireless Energy Harvesting Sensor Technologies**
 - **Robust, Dynamic Ad hoc Wireless Mesh Communication Networks**
 - **Radiation Hardened EPC Global Radio Frequency Identification (RFID) Readers**

- **Computational Electromagnetics (CEM) Fast and Multi-Scale Methods/Algorithms**
- **EPC Global-type RFID ICs at frequencies above 2 G**
- **Radiation and EEE Parts**
 - **Monitoring**
 - **Mitigation and Biological countermeasures**
 - **Protection systems**
 - **Space weather prediction**
 - **Risk assessment modeling**
- **Wearable Tech**
 - **Wearable Sensors and Controls**
 - **Wearable Audio Communicator**
 - **Wearable sensing and hands-free control**
 - **Tattooed Electronic Sensors**
- **In-Situ Resource Utilization**
 - **Mars atmosphere processing**
 - **CO2 collection, dust filtering, Solid Oxide CO2 electrolysis, Sabatier, reverse water gas shift**
 - **Lunar/Mars regolith processing**
 - **Regolith collection and drying**
 - **Water collection and processing, water electrolysis**
 - **Methane/Oxygen liquefaction and storage**

A.5.9 Stennis Space Center (SSC)

SSC's areas of focus include:

- **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 cryogenics 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 maneuvering 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.

A.5.10 Langley Research Center (LaRC)

LaRC's areas of focus include:

- Intelligent Flight Systems – Revolutionary Air Vehicles
- Atmospheric Characterization – Active Remote Sensing
- Systems Analysis and Concepts - Air Transportation System Architectures & Vehicle Concepts
- Advanced Materials & Structural System – Advanced Manufacturing
- Aerosciences - Trusted Autonomy
- Entry, Decent & Landing - Robotic Mission Entry Vehicles
- Measurement Systems - Advanced Sensors and Optical Measurement