APPENDIX E

Minority University Research and Education Project (MUREP) Aerospace Academy
EONS 2018

1.0 SCOPE OF ACTIVITY

1.1 Overview of the Funding Opportunity

NASA’s Office of Education Minority University Research and Education Project (MUREP) solicits proposals from Minority Serving Institutions (MSIs) to establish a NASA MUREP Aerospace Academy (MAA) to increase participation and retention of historically underserved and underrepresented K-12 youth in the areas of Science, Technology, Engineering, and Mathematics (STEM).

NASA recognizes the need to increase the number of youth who have an effective, authentic STEM experience each year prior to completing high school and has thus created learning opportunities such as the MAA, to attract and retain underserved and underrepresented youth in grades K-12.

Utilizing curriculum enhancement activities, emerging technologies and family involvement, core components of the MAA, MSIs are afforded the opportunity to develop increased STEM awareness and understanding of STEM content and NASA missions by engaging students, family members, and educators in firsthand experiences in STEM at a similar or more advanced level.

Supported by evidence-based research, the MAA is generally conducted in an out of school setting, but may also be offered in a school setting. Through a portfolio of NASA-unique experiential learning opportunities and challenges related to NASA missions from development to launch, the MAA encourages innovation, critical thinking and problem-solving skills, which are characteristics required of our Nation’s future STEM workforce.

Proposers are encouraged to be innovative in their design and delivery of the MAA. Proposers are highly encouraged to identify and form partnerships with institutions interested in participating in the dissemination of activities, strategies, and materials. Successful Proposers shall have a clear plan for engaging partners to increase scalability and replication of the MAA. Proposers to this NRA that have also held NASA grants in the past, shall provide a description of how the project will improve and grow based upon past performance evaluation data and partnerships. Successful proposals for an MAA site will be funded as multi-year cooperative agreements not to exceed two (2) years.

1.1.1 Goals and Objectives

STEM engagement is a priority area for MUREP. STEM engagement establishes a mechanism for learners to be inspired, engaged and educated while progressively being challenged.
Research indicates that instructional approaches or learning opportunities that engage students actively increase skill acquisition and information retention; encourage more positive attitudes toward STEM disciplines; and strengthen student persistence to study STEM disciplines. Through coordinated and collaborative efforts as an Agency, utilizing STEM engagement, NASA is attracting and retaining students in STEM disciplines who will contribute to the economic growth and global competitiveness of the United States. NASA is investing in the youth of today in order to meet its STEM-related missions of tomorrow. Through activities such as the MAA, NASA is cultivating talent that will allow our Nation to explore space while improving life on Earth.

The goal of the NASA MAA is to utilize NASA’s unique resources to:

- Build the interest, skills and knowledge necessary for K-12 students to pursue STEM careers by engaging them in authentic STEM experiences built around NASA mission content.

The specific objectives of the MAA are to:

- Increase the number of historically underserved and underrepresented students interested in NASA-specific STEM careers.
- Provide skills to parents/caregivers to work with and encourage their children in STEM activities and programs.
- Involve community groups, business, industry, museums and educational and professional organizations through mentoring, field trips, guest speakers and other MAA activities.
- Engage students in firsthand experiences in STEM such as hands-on learning, research, use of advanced technology, peer support groups, and mentoring relationships with professionals working in the STEM fields.

To achieve these goals and objectives, NASA solicits proposals from MSIs to implement the NASA MAA; to engage youth particularly underserved and underrepresented in authentic STEM experiences related to NASA missions; and to inspire and captivate learners utilizing NASA’s unique assets to develop a keen interest in STEM.

1.1.2 Agency-wide Priorities

NASA’s education programs work in collaboration with other Federal agencies to improve the quality of STEM education in the United States, which supports both NASA’s current Strategic Plan and the measurement and performance goals. The MAA addresses NASA’s Strategic Plan goals and objectives outlined to the Office of Education. The activity also addresses NASA’s short term Multi-year Performance Goals and Annual Performance Indicators, which set quantifiable targets for NASA offices, programs and activities. NASA Strategic Goals and Objectives relevant to education are outlined in the 2014 NASA Strategic Plan: http://www.nasa.gov/sites/default/files/files/FY2014_NASA_SP_508c.pdf.

MAA proposals should focus on the following NASA Strategic Goal and Objective:

**Goal 2:** Advance understanding of Earth and develop technologies to improve the quality of life on our home planet.

*Objective 2.4: Advance the Nation’s STEM education and workforce pipeline by working collaboratively with other agencies to engage students, teachers and faculty in NASAs missions and unique assets.*

The MAA supports the following NASA Office of Education Multi-year Performance Goal and Annual Performance Indicators.

Primary focus:

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<tr>
<th>Multi-Year Performance Goal</th>
<th>Annual Performance Indicator</th>
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<td>2.4.5: Continue to provide opportunities for learners to participate in STEM education engagement activities that capitalize on NASA-unique assets and content.</td>
<td>ED-17-5: Provide NASA STEM engagement to at least 50,000 elementary, secondary, and higher education students through authentic STEM experiences.</td>
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<td>2.4.6: Ensure that grantees and cooperative agreement awardees conduct independent evaluations, providing evidence for the effectiveness of NASA STEM education investments.</td>
<td>ED-17.3: Ensure that at least 30 percent of grantees and cooperative agreement awardees conduct independent evaluations and report to NASA on their evaluation activities.</td>
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Secondary focus:

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<th>Multi-Year Performance Goal</th>
<th>Annual Performance Indicator</th>
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<td>2.4.2: Continue to support STEM educators through the delivery of NASA education content and engagement in educator professional development opportunities.</td>
<td>ED-17-2: Engage with at least 10,000 educators in NASA educator professional development through face-to-face, online, partner-delivered, and community-requested activities.</td>
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<td>2.4.4: Continue to provide opportunities for learners to engage in STEM education through NASA-unique content provided to informal education institutions designed to inspire and educate the public.</td>
<td>ED-17-4: Support informal education institutions, including youth-serving organizations, to use NASA-unique content in no fewer than 40 states, U.S. Territories and/or the District of Columbia.</td>
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The MAA is intended to provide experiential learning opportunities (ELO) for students. ELOs are designed to increase learners’ involvement, knowledge, comprehension and application of learning in one or more STEM subjects/disciplines. They involve inquiry-based/activity-based
learning approaches designed to the level of the learner to inspire, engage, and educate them while progressively being challenged. ELO activities enable learners to acquire knowledge, understand what they have learned, and apply that knowledge through inquiry-based/activity-based activities.

1.1.3 NASA Relevance

The NASA MUREP Program is designed to capitalize on the unique facilities, capabilities and staff of Minority Serving Institutes to contribute to the priorities of NASA’s Mission Directorates. Through a network of MAA sites across the US, NASA seeks to engage tens of thousands of students in high quality design challenges, investigates and inquiry based STEM experiences built upon the Agency’s unique mission of research and discover. NASA has organized its mission priorities into 6 communications themes that reflect major operations. The table on page 13 lists the themes and a sampling of current education products and experiences designed for K-12 audiences. The table is intended to serve as a useful resource for Proposers to build a program to engage local and regional students. Each Proposer shall identify the primary NASA area(s) with which the proposed curriculum will align. NASA-themed space exploration, aeronautics, space science, earth science, or microgravity, or combinations of these themes are samples, but not limited to eligible technical content areas. The following websites can also be used to access additional information about the NASA Mission Directorates:

- Aeronautics Research  
  http://www.aeronautics.nasa.gov/
- Human Exploration Operations  
  http://www.nasa.gov/directorates/heo/home/index.html
- Science  
  http://science.nasa.gov/  
  2014 NASA Science Plan:  
  http://science1.nasa.gov/about-us/science-strategy/
- Space Technology  
  http://www.nasa.gov/directorates/spacetech/home/index.html

The MAA Annual Performance Report can be found at:  

1.1.4 MAA Evidence-Based Program Model

Selected proposals shall implement innovative teaching, learning, recruitment and retention strategies, and evaluation strategies based on evidence-based educational research and best practices. Proposed work shall be grounded in evidence-based education research and/or best practices, and incorporate formative, summative, and other evaluations, as appropriate.

The NASA MAA program model (see graphic on the next page) is built upon evidence-based research to effectively engage traditionally underserved and underrepresented students in high quality STEM programming. In partnership with MSIs, the MAA program achieves its goal and objectives by utilizing three core program components: Authentic STEM Experiences built around NASA’s mission; Technology-Rich Environments; and Family Involvement.
The MAA program opportunity is primarily targeted toward K-12, Out-of-School Time (OST) audiences in both summer and afterschool settings. NASA seeks proposals from either new or existing programs that support the following core attributes of the MAA program.

Equitable Access to Underserved and Underrepresented Audiences (Afterschool Alliance, 2016; Graves, 2016)

Proposed MAA programs should serve students who traditionally are underrepresented in STEM fields including females, African-Americans, Native Americans and Hispanics. NASA seeks programs that allow for equitable access for individuals from underserved groups and groups traditionally underrepresented in STEM fields and that do not inadvertently create barriers that may prevent participation. The 2014 cohort of MAA grantees had greater than 80% of the total student population coming from underrepresented populations based upon race and ethnicity. Proposals shall provide specific strategies for the recruitment and retention of target audiences in the MAA program.

Engagement in Long-Duration Experiences with NASA Mission Focused STEM Content (Lauer, et al., 2006; McLaughlin and Pitcock, 2009; Milgram, 2011; National Research Council, 2015; Winship et al., 2005)

A 2015 National Research Council (NRC) report on effective practices in out-of-school-time settings recommends that students engage in firsthand experiences with STEM. The NRC suggests that effective firsthand experiences with STEM go beyond simple hands-on activities to include a breadth of practices undertaken by real-world STEM practitioners: asking questions and defining problems; developing and using models; planning and carrying out investigations; analyzing and interpreting data; using mathematics and computational thinking; constructing
explanations and designing solutions; engaging in argument from evidence; and obtaining, evaluating, and communicating information. Firsthand experiences enable students to engage with relevant STEM questions, environments, and data in authentic forms. Engagement with STEM practices like these gives students an appreciation of the practices used to investigate, model, and explain the world, as well as an understanding of how scientists and engineers move iteratively between these practices. NASA seeks to provide each participating student with a minimum of 36 hours of high quality STEM content through the MAA program. NASA seeks proposals that identify and specifically document the education needs of a community. Submitted proposals shall address how NASA STEM resources and supports will be used to address local needs. NASA prioritizes proposals that maximize the engagement of students in long duration experiences. The average 2014 MAA grantee served over 1,400 students annually in sustained multi-day STEM experiences. Most members of the 2014 cohort of grantees offered sessions during the spring, summer, fall and winter to maximize student reach.

Engagement of Students in Technology Rich-Settings (Honey & Siegel, 2011; Lai, Khaddage, & Knezek, 2013; Niederhauser, & Schrum, 2016; Vossoughi and Bevan, 2014)

NASA seeks proposals that provide a plan for engaging students in the ongoing use of technology throughout their participation in the MAA program. The plan shall address how technology shall be integrated in the delivery of sustained authentic STEM experiences and in the engagement of families and communities. Emerging technologies such as 3-D Printing, Coding and Robotics are important skill sets for NASA’s future workforce. A new way of thinking about education within the concept of a learning environment, is the belief that “While students learn differently in school and out-of-school settings, learning can take place across boundaries, and what has been learned out of school can help shape what is learned in school.” Hands-on learning engages students in hands-on, interactive and applied learning that promotes STEM. Making and tinkering is a growing movement to engage youth in creative investigations. The philosophy is that technology now becomes a very useful tool to create, to solve problems or to investigate. Interest in making education activities has increased with the increased emphasis on design, design-thinking, and technology. Students learn about using 21st-century tools such as computer-controlled table saws, laser cutters, and 3-D printers to create prototypes and fabricate physical objects.

Partnerships and Coordination with the Larger STEM Ecosystem (Afterschool Alliance, 2015; Bell, et al., 2009; Falk et al., 2016; Milgram, 2011; Tran, 2011)

MAA programs that make connections should build on children’s past learning experiences and promote connections between in-school and out-of-school learning. Students’ abilities to make connections between formal and informal science experiences has been associated with achievement, science interest, science careers, science self-efficacy, perseverance, and science learning effort. A lack of coordination and cooperation between formal and informal institutions has been shown to contribute to fragmented STEM learning. The capacity of MAA program providers to deliver high-quality programs can be enhanced through partnerships with STEM-rich institutions. Building partnerships between science institutions and local communities is a promising practice for inclusive informal learning. Developing partnerships among OST STEM programs and community organizations could provide a sustainable revenue source to support program implementation.

NASA seeks to engage important members of a child's social context, such as parents or caregivers in MAA program with the child has been associated with positive outcomes such as increased STEM identity development and STEM career interest. Past research has indicated that parental encouragement and involvement in a children’s academic life is one of the most reliable predictors of sustaining motivation, academic achievement, and whether or not a child will attend college. 2014 MAA Awardees hosted Family Café’s that included workshops, guest speakers, discussions, family nights or take home STEM activities. A noteworthy practice among the 2014 cohort was to offer a variety of short duration outreach experiences such as STEM Days, one day educator workshops, speakers and special STEM events to create awareness for program opportunities and engage with the broader community.

Ongoing Professional Development and Support for Instructional Staff (Cooper, 2013; Fenichel & Schweingruber, 2010; Garet, et al., 2001; Guskey, 2014; Guskey & Yoon, 2009; Hill, 2012; Junge & Manglallan, 2011; NRC, 2015; and Peter, 2007)

MAA programs should provide instructional staff with an opportunity for participants to engage with STEM content and use STEM skills in the same manner as their students. Additionally, MAA programs should provide access to ongoing support and follow-up activities that support implementation. During professional development, learning goals should be explicitly stated and STEM content and practices should be presented with a clear rationale for their importance. Trainers should also lead discussions about possible student solutions or products and offer guidance and questioning prompts that instructors could use to support student learning. Professional development prepares instructional participants to respond to the diverse needs of their students and community. The MAA program seeks to maximize the use of licensed STEM educators as facilitators of experiences for students.

1.1.5 Roles and Responsibilities of MAA Program Key Personnel

Personnel Responsibilities

NASA currently considers the MAA Principal Investigator (PI) and Independent Evaluator (IE) as key personnel.

Principal Investigator

- Responsible for the overall leadership, administration and evaluation of educational programs and products involved with NASA MAA programming.
- Provides visionary and contemporary leadership for the delivery of high-impact educational programs, products and applied research as designed and provided by NASA.
- Assists MAA personnel in identifying the most effective and efficient means to deliver priority research-based information and programs to our diverse clientele and stakeholders.
- Responsible for the overall direction, coordination, and evaluation of the MAA office,
and carries out supervisory responsibilities for MAA staff in accordance with the organization’s policies and applicable state and federal laws.

- Responsible for day-to-day management of the MAA 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.
- Promotes and markets the program and assists in the preparation of grant applications to fund planned programs.
- Participates in MAA program teleconferences and meetings.

**Independent Evaluator**

- Develops comprehensive evaluation plan for proposed program in collaboration with PI.
- Coordinates and administers data collection, analysis and reporting of proposed program evaluation data.
- Provides status updates to the PI on evaluation activities, progress, and challenges.
- Commit to participate in annual kick-off meeting, virtual site visits, and evaluation technical assistance meetings with NASA and the NASA contract evaluator to review proposed program’s progress in achieving MAA goal and objectives in support of NASA’s Metaevaluation of the MAA program.
- Develops annual evaluation report and final evaluation report.

**2.0 AWARD INFORMATION**

**2.1 Award Value**

Subject to Congressional appropriation of sufficient funds, and NASA’s receipt of proposals of adequate merit, NASA expects to select up to seven (7) proposals for award. Each award shall not exceed two (2) years and will have a maximum value up to $325,000 for this two (2) year award period.

NASA may elect to offer selection of only a portion of a proposed project, usually at a level of support that is reduced from that requested in the original proposal. NASA may also offer tentative selections in which NASA requests Proposers to team on a joint project. Additionally, NASA may award an effort for less than the full duration of the proposal. In these instances, the Proposer will have the opportunity to accept or decline such a selection. If the Proposer accepts such an offer, a revised budget and statement of work may be required before NASA can initiate funding action on the proposal. If the Proposer declines the offer of a partial selection or participation in a joint proposal, NASA may withdraw the offer of selection in its entirety.

**2.2 Period of Performance**
Proposals shall cover the full two (2) years of duration. NASA funding 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 availability of appropriated funds.

2.3 Partnerships and Collaboration

National interest in the vital importance of STEM education has stimulated numerous state and regionally based organizations that are driving critical connections between industry, universities, non-profits and government in formal K–12 and out-of-school-time learning environments. In support of the national focus on improving the STEM Ecosystem, NASA requires Proposers to engage in a formal collaboration with regional or state-based organizations like Afterschool Networks, Afterschool Alliances or STEM Learning Networks. Collaborations can include but are not limited to: supporting MAA sites in meeting the identified local needs of students, recruiting and retaining target populations, recruitment and professional development of instructional staff, support for scaling or sustaining operations, coordination of efforts to ensure high quality student experiences in alignment with proposal goals or high quality evaluation.

When teaming is considered, the lead MSI shall receive not less than 60 percent of the proposed budget. If teaming with NASA partners is considered, NASA resources can be received as in-kind support in the proposal: however, funding shall not be allocated for NASA field Centers in the proposed budget.

2.4 Sustainability

Education investments 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 shall be included and submitted as part of the original proposal.

2.5 Evaluation

NASA identifies evidence of effective practices in STEM education through program evaluation. Evidence is a key criterion in NASA’s competitive processes for allocating resources, ensuring that the most effective STEM education 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.

Proposed MAA program evaluation shall follow generally-accepted professional standards for evaluative research. Evaluations 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 can be both qualitative and 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 metaevaluation of the MAA program, NASA will demonstrate its results-driven management approach that is focused on optimizing value to the American public.

The following describes key evaluation milestones associated with the MAA program:

- **Evaluation Plan** *(Submit a comprehensive evaluation plan 60 days after award)*
  - Describes an appropriate evaluation plan/process to document outcomes and demonstrate progress toward achieving the objectives of proposed education activities.
  - Evaluation methods shall be based upon reputable models and techniques.
  - Measure effectiveness and/or impact of the proposed project via evaluation questions, data collection and results to assess performance
  - “Evaluate with fidelity” – evaluations shall be conducted in the manner in which it was written. If there is a change, submit a revised plan.

- **Quarterly Reports** *(January 15th, April 15th, July 15th and October 15th)*
  - Update NASA on activity progress, including the number of educators, students and parents served, the timing and frequency of class sessions, achievement highlights, outside funding and other items such as OEPM (i.e. generic questions about evaluation, status update about activity evaluation).

- **Annual Report** *(60 days prior to Anniversary Date)*
  - Provide an annual review of program progress, including the number of students and parents served, the timing and frequency of class sessions, and achievements
  - **NOTE:** At the end of the performance period (2 years), the Annual Report will be considered a Final Report, which will be due within 90 days of the expiration date of the grant or cooperative agreement.

- **Evaluation Report** *(30 days after Anniversary Date, due annually)*
  - Provide an annual assessment of the evaluation questions identified in site evaluation plans using the methods and instruments previously identified.
  - **NOTE:** At the end of the performance period (2 years), the Evaluation Report shall provide the annual assessment of the evaluation questions along with a summary of the evaluation studies from both implementation years.

**3.0 ELIGIBILITY INFORMATION**
3.1 Proposing Institutions

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, or 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 satisfy the requirements.

Limit on Number of Proposals per DUNS
Eligible organizations shall submit only ONE (1) lead proposal per DUNS number. Eligible organizations that have multiple and/or different DUNS numbers shall submit no more than ONE (1) lead proposal from each different DUNS number.

Principal Investigator
Every institution submitting a proposal in response to this opportunity shall designate 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.

Independent Evaluator
Every institution shall propose, identify and designate 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 two (2) 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 to NASA. NOTE: The MAA Program Management Office will provide feedback/input on the proposed Evaluation Plan Approach, which should be addressed in the submitted Comprehensive Evaluation Plan.

4.0 PROPOSAL AND SUBMISSION INFORMATION

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 (https://prod.nais.nasa.gov/pub/pub_library/srba), and the Guidebook for Proposers Responding to a NASA Funding Announcement (NFA) (the 2017 NASA Guidebook for Proposers) that is located at https://www.hq.nasa.gov/office/procurement/nraguidebook/Proposer2017.pdf. Note: If the information contained in this Appendix conflicts with any other documents, the information in this Appendix takes precedence.

4.2 Request for ‘Notice of Intent’
Institutions planning to prepare a proposal package for the MAA are required 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 should be submitted by the Principal Investigator (PI) to the NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES) website http://nspires.nasaprs.com/ by January 18, 2018, 11:59 p.m. Eastern Time. Interested 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. However, NASA strongly encourages Proposers to submit NOIs by the deadline.

See Section 5.5 of the EONS NRA for requirements and instructions on submitting a NOI.

If submitted, the NOI shall include:

1. Name of the lead institution
2. College/University Minority Designation
3. Experience in hosting K-12 STEM Engagement activities
4. Name, title, regular mail or e-mail address, telephone, and fax number of proposed Principal Investigator and other designated key personnel

4.3 Technical Assistance Workshop and/or Pre-proposal Teleconference

A technical assistance workshop and/or pre-proposal teleconference will be held before the due date for proposals. Prospective Proposers are requested to submit any written questions not later than seven (7) business days before the technical assistance workshop and/or pre-proposal teleconference so that NASA will be able to cover as much information as possible during the meeting. An opportunity to ask questions and solicit clarification will be provided at the session.

NASA plans to post written questions and answers and technical assistance workshop and/or pre-proposal teleconference charts to the NSPIRES website. An opportunity to ask questions and solicit clarification will be provided during the meeting.

Interested Proposers should register in NSPIRES and sign up for notification emails in order to receive advance notice of the technical assistance workshop and/or pre-proposal teleconference. Proposers shall refer to the MAA solicitation page on NSPIRES for schedule information and additional details.

5.0 PROPOSAL EVALUATION AND SELECTION

5.1 Proposal Review Criteria

The principle elements for proposal evaluation are the following: Intrinsic Merit, Relevance to NASA Objectives, Budget/Cost and Evaluation Plan. Please review the following specific criteria for MAA ELO awards.
5.1.1 Intrinsic Merit (25 percent)

Evaluation of Intrinsic Merit considers the following sub-elements. Proposers 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 clear goals and objectives that are aligned with NASA, the Office of Education, and the institution where the MAA is awarded.
- Presents a clearly organized and workable management plan for achieving educational goals and objectives, and includes clear lines of communication with NASA.
- Presents a realistic schedule/timeline or other description of how activity goals, objectives and major milestones will be met. Includes a feasible timeline per proposed activity years and milestones or benchmarks for success.
- Provides details of the organizational structure. Clearly identifies key personnel, such as the Principal Investigator, Independent Evaluator and the appropriate office at the lead institution, that is ultimately responsible for the overall performance of the MAA.
- Clearly describes and defines how the site will interact with NASA and its identified customers (internal and external). Provides a clear overview that sites have worked within their local and regional STEM Ecosystems to leverage Formal/Informal Partnerships and Collaborations. Includes financial or in-kind letters of support from partners and collaborators.
- Identifies and proposes target audience (grade level, demographic targets) based upon documented local need.
- Identifies and describes the emerging technologies, content and the types of family engagement activities sites will offer.
- Documents that sites shall offer 36 hours of engagement for students in Authentic STEM experiences during each session.
- Includes sites annuals local evaluation plan and signed letter of agreement that documents sites shall participate in MAA Program Metaevaluation and Synthesis.
- Addresses and describes Past Performance relevant to the MAA activity. MAA Past Awards shall include and provide a description of how the project will improve and grow based upon evaluation data and partnerships.
- Aligns with NASA’s FY17 Annual Performance Indicators, see Section 1.1.2, Agency-wide Priorities.
b. Recruitment and Retention Plan

- Demonstrates an understanding of the unique challenges faced by the target population(s) in the STEM areas.
- Provides evidence of the ability to attract and retain students from target populations, give selection criteria and procedures, and provide a demographic profile of the community being served.
- Provides the expected number of student participants. Historically, MAA sites reached on average 1,450 students per year.

c. Partnership and Sustainability Plan

- 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.
- Provides financial or in-kind support in proposal with letters of support from partners (Afterschool Network, etc.).
- Provides a clear plan for the establishment of partner and/or collaborator relationships within their local and regional STEM Ecosystems with local schools, school districts, local businesses, industries, corporations, non-profit organizations, government, state and local vicinities, providers of informal education, youth serving organizations, etc.
- Provides a multi-year plan demonstrating the process to acquire resources to sustain MAA activities beyond NASA funding. Also indicates the likelihood that these resources will be in place.
- Identifies all long-term relationships that have been established, or will be established to ensure that the MAA will sustain educational programming.

d. Past Performance:

- Sites that received previous MAA awards shall provide and describe examples of how the newly proposed MAA project will improve and grow based upon evaluation data and partnerships.

5.1.2. Relevance to NASA (35 percent)

Evaluation of Relevance to NASA considers the following educational relevance and scientific relevance.
Proposers shall adequately and clearly define how the activity proposes to address the following criteria:

**a. Scientific Relevance:**

- Provides evidence that the activity utilizes NASA’s unique contributions to science, engineering, technology, and exploration. Identifies current NASA content which the site has selected and will be utilizing for their activities. These activities shall align with NASA’s Mission Directorates and Community Campaigns.

- Offers innovative methods, approaches, and concepts to engage students in other NASA activities. Provides evidence that proposed effort cultivates diversity and extends access to existing NASA content. Addresses how the selected NASA content will help meet the documented local needs.

**b. Educational Relevance:**

- Provides clear and feasible activity goals and objectives that are aligned with NASA’s Education goals and objectives as described in the 2014 NASA Strategic Plan, and the multi-year performance goal and annual performance indicator. Describes and provides examples as to how the site is and/or will meet their educational goals and objectives.

- Proposed effort offers innovative methods, approaches, and concepts to deliver the MAA by meeting the following objectives:
  
  - Increases the number of historically underserved and underrepresented students interested in NASA specific STEM careers.
  
  - Provides skills to parents/caregivers to work with and encourage their children in STEM activities and programs.
  
  - Involves community groups, business, industry, museums and educational and professional organizations through mentoring, field trips and guest speakers and other MAA activities.
  
  - Engages students in firsthand experiences in STEM such as hands-on learning, research, use of advanced technology, peer support groups, and mentoring relationships with professionals working in the STEM fields.

- Technology Plan. The Proposer shall provide a Technology Plan, which describes and provides examples as to how the site plans to support and update the identified emerging technologies.

- Describes how sites will provide professional development training and support for their educators and facilitators.

- The proposed effort builds on lessons learned and/or best practices of past education and/or research and learning activities. Specific examples are provided as to how the sites’ program design is aligned to evidence.
5.1.3. Budget/Cost (15 percent)

Proposers shall clearly describe how the proposed budget is appropriate. Proposals shall include a detailed implementation/costing plan with a clear narrative that demonstrates how funds requested will be fully utilized for the duration of the two (2) year grant award period.

The following sub-elements will be considered in the evaluation of the Budget/Cost:

- Clarity of alignment between the proposal narrative and budget.
- Budget is adequate, appropriate, reasonable and realistic for education, NASA, and evaluation expertise.
- Budget demonstrates effective use of funds in which outcomes justify total costs.
- All budget line items are fully explained and justified.
- Budget addresses the distribution of funds among the following items: Personnel, Staff Benefits, Consultants, Equipment, Emerging Technologies, Advertising, Printing, Business, Meeting Expenses, Material and Supplies, Postage, Travel, Training, and In-Kind Support.

5.1.4 Evaluation Plan Approach (25 percent)

Proposers shall adequately describe the planned approach that will be used to evaluate the proposed program. More emphasis and additional credit will be given to proposals with more rigorous evaluation plans that are supported by evidence-based research. To assist in development of their proposals, Principal Investigators and Independent Evaluators are encouraged to read the following resources:

- “Effective Practices for Evaluation STEM Out-of-School Time Programs”
- “Identifying and Implementing Educational Practices Supported by Rigorous Evidence: A User Friendly Guide”
- “User-Friendly Handbook for Project Evaluation”
- “Common Guidelines for Education Research and Development”
- “Designing Evaluations”

The proposed evaluation plan approach shall adequately describe the process to obtain qualitative and quantitative data and identify clearly defined indicators that can be utilized to track student progress and quality of MAA infrastructure and programming by addressing the following:

- **Proposed MAA Program Logic Model.** Logic models illustrate a sequence of cause-and-effect relationships—“a systematic and visual way to present and share your understanding of the relationships among the resources you have to operate your
program, the activities you plan, and the changes or results you hope to achieve” (W. K. Kellogg Foundation).

- **Proposed Evaluation Design and Methodology.** Describe an appropriate evaluation plan approach/process to document outcomes and demonstrate progress toward achieving objectives of proposed education activities. The forms of evaluation shall be based upon reputable models and techniques that are appropriate to the content and scale of the MAA. Identify the Independent Evaluator that will develop the comprehensive evaluation plan, develop or identify 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. Describe proposed evaluation questions, program measurable goals, objectives, outcomes, and data collection tools that describe progress towards meeting MAA goal, objectives and outcomes.

- **Evidence-Based Research and/or Best Practice Supporting MAA Proposed Program and Evaluation Plan Approach.** Evaluation methods shall also provide useful information on the effectiveness and/or impact of the proposed cooperative agreement, and how improvements will be implemented based on evaluation evidence.

5.2. Review and Selection Process

Proposals will be evaluated by a merit review process composed of the applicants’ peers (government and non-government), including technical, education and evaluation experts, who have been screened for conflicts of interest. Strengths and weaknesses for each of the four criteria (Intrinsic Merit, Relevance to NASA, Budget/Cost, and Evaluation Plan) and their sub-elements will be used to evaluate the proposals.

Awards will be made to those proposals determined to be the most advantageous to the Government, all factors considered, including the potential contributions of the proposed work to the overall research program and the availability of funding for the effort. NASA may consider geographic location and student reach and awards may be made to proposals determined to be selectable regardless of the proposal’s overall rating. At the end of the selection process, each proposing organization will be notified of its status (selection or non-selection). NASA will provide debriefings to Proposers that request one.

Proposals will be evaluated through a combined online and panel review process. Proposers are expected to provide sufficient detail to enable evaluation by persons who are knowledgeable of, but not necessarily specialists in the proposed subject area. The reviewers may include personnel from NASA, other government agencies, industry, and universities. Award decisions will be made following a panel review of all the proposals. The panel will make final recommendations to the NASA selection official. The Selection Official for the MAA awards is Ms. Joeletta Patrick, MUREP Manager, NASA Headquarters, or her designee.

In evaluating the proposals, NASA will assign the following ratings:

<table>
<thead>
<tr>
<th>Adjectival Rating</th>
<th>Definition</th>
</tr>
</thead>
</table>

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 deficiency 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 deficiency and which shows a reasonably sound response. There may be strengths or weaknesses, or both. As a whole, weaknesses not offset by strengths do not significantly detract from the Proposer’s response.

Fair
A proposal having no deficiency 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 would require a major proposal revision to correct.

6.0 AWARD ADMINISTRATION INFORMATION

6.1. Cooperative Agreement Award Reporting Requirements

The reporting requirements for award recipients under the MAA will be consistent with Exhibit E, NASA Grant and Cooperative Agreement Manual. (https://prod.nais.nasa.gov/pub/pub_library/srba/), see Appendix F in the Guidebook for Proposers and include the following:

Within one month (30 days) after award receipts shall:

- Submit a descriptive MAA abstract for the NASA.gov website.
- Submit a management plan with associated timeline and milestones.

Within two months (60 days) after award recipients shall:

- Submit a final Comprehensive Evaluation Plan developed by the Independent Evaluator with concurrence by the Principal Investigator to the NASA MAA Program Manager.
- NOTE: The MAA Program Management Office will provide feedback/input on the proposed Evaluation Plan Approach which should be addressed in the submitted Comprehensive Evaluation Plan.

Recipients shall submit an annual progress report each year no later than 60 days prior to the anniversary date of the project start date. The report, at a minimum, shall document the following:
1. Project activities over the period of performance of the award;
2. Project accomplishments measured against the proposed goals and objectives;
3. Evidence of how project activities have furthered stakeholder priorities;
4. Extent to which collaborations and/or partnerships have evolved; and
5. Plan of activities for the next year.

Recipients shall submit a final report with summary information within 90 days of the expiration date of the grant or the cooperative agreement.

6.2 **Summary of MAA Grantee Responsibilities**

1. Recipients of the MAA award will assume primary responsibility for implementing, operating, and managing the activity as described in their original proposal.

2. The MAA recipient shall appoint a Principal Investigator (PI) and an Independent Evaluator (IE) supported by this Agreement. If the PI or IE named is different from the individual identified in the proposal, the NASA MAA Manager shall be notified in writing. The Grant Officer will issue a formal modification to the Agreement to reflect the change.

3. The recipient shall submit monthly progress reports by the 10th day following the end of the prior month. For example, the progress report for September will be due by October 10th. If the 10th falls on a weekend or a federal holiday, the recipient shall submit the report by the close of the next business day. These reports shall be submitted by e-mailing the POC listed in the summary of key information at the end of this Appendix.

4. The MAA recipient shall submit quarterly reports on the 15th following the end of the fiscal year quarter (January 15th, April 15th, July 15th and October 15th). If the 15th falls on a weekend or a federal holiday, then the report is due by the close of the next business day. The quarterly report updates NASA on activity progress including the number of educators, students and parents served, the timing and frequency of class sessions, achievement highlights, outside funding and other items such as OEPM (i.e. generic questions about evaluation, status update about activity evaluation)

5. The lead institution, in concert with the MAA PI, is responsible for the financial management of the MAA as specified in the basic award notice under the terms and conditions issued by NASA and in 14 Code of Federal Regulations (CFR) Sections 1260.26 and 1260.160. Failure of the recipient to comply with the terms and conditions of an award may result in NASA terminating the award.

6. Annual Report/Final Report: An annual report providing an annual review of program progress including the number of students and parents served, the timing and frequency of class sessions, and achievements will be due within 60 days of the Anniversary date. The final report, in lieu of an annual report, shall be due within 90 days of the expiration date of this grant or cooperative agreement.
7. Evaluation Report: An annual evaluation report will be due within 30 days of the Anniversary date. This report shall provide an annual assessment of the evaluation questions identified in site evaluation plans using the methods and instruments previously identified. At the end of the performance period (2 years), the Evaluation Report shall provide the annual assessment of the evaluation questions along with a summary of the evaluation studies from both implementation years.

8. Performance Outcomes: All institutional PIs with NASA Office of Education grants and cooperative agreements shall provide and verify performance data for the awarded project and submit to NASA for review, prior to entry in the Office of Education Performance Measurement (OEPM) system.

9. The MAA PI shall submit one copy of the project’s annual report via email to the NASA Shared Service Center (NSSC) with a cc to the MAA Activity Manager. All project reports and plans shall also be submitted to the following entities via email or an alternative electronic format:
   - NASA MAA Activity Manager
   - Other individuals identified by the MSI

10. NASA may add additional requirements during the grant’s or cooperative agreement’s period of performance to achieve broader MAA or NASA Education objectives.

6.3 Office of Education Metrics

Recipients shall utilize all data collection tools and complete all assigned data entry tasks for the NASA OEPM system. NASA’s Office of Education and/or the MAA Management will communicate training and provide data collection tasks.

Recipients may also be required to respond to data calls at NASA’s Office of Education’s request. It is critical for all recipients to develop tracking methods or databases on project activities in order to respond to potential data calls in a timely manner. MAA management will provide additional communications and guidance regarding data calls and activity tracking. Recipients shall ensure that the project has the appropriate staff and resources to be able to facilitate data collection activities and complete tasks required for OEPM reporting by required due dates.

6.4 Summary of Key Information
<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total available annual budget for the MAA</td>
<td>$2.0 M</td>
</tr>
<tr>
<td>Individual awards will be made up to a maximum of $325,000 for the two (2) year award period.</td>
<td></td>
</tr>
<tr>
<td>Number of new awards pending adequate proposals of merit</td>
<td>Up to seven (7)</td>
</tr>
<tr>
<td>Start date</td>
<td>two (2) to four (4) months from selection announcement</td>
</tr>
<tr>
<td>Duration of awards</td>
<td>Two (2) years</td>
</tr>
<tr>
<td>Award Type</td>
<td>Cooperative Agreement</td>
</tr>
<tr>
<td>MAA Pre-proposal Teleconference and/or Technical Assistance Workshop (Optional)</td>
<td>Check the NSPIRES website for date and connection details.</td>
</tr>
<tr>
<td>Due date for Notice of Intent to propose (NOI)</td>
<td>January 18, 2018, 11:59 pm Eastern Time</td>
</tr>
<tr>
<td>Due date for proposals</td>
<td>March 22, 2018, 11:59 pm Eastern Time</td>
</tr>
<tr>
<td>Page limit for the central Scientific-Educational-Management section of proposal</td>
<td>15 pp; see also Chapter 3 of the 2017 NASA Guidebook for Proposers</td>
</tr>
<tr>
<td>Detailed instructions for the preparation and submission of proposals</td>
<td>See the 2017 NASA Guidebook for Proposers that is located at</td>
</tr>
</tbody>
</table>
Submission medium  | Electronic proposal submission is required via NSPIRES or grants.gov; no hard copy will be accepted. See Section 4 of the NASA Guidebook for Proposers.
--- | ---
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 8am to 6pm Eastern Time on weekdays, 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. Priscilla Mobley, NASA MAA Activity Manager NASA Glenn Research Center, MS 7-4 Cleveland, OH 44135 Email: NASAMAA@nasaprs.com

6.5 Glossary of Terms

**Experiential Learning Opportunities (ELO):** Increase learners’ involvement, knowledge, comprehension and application of learning in one or more STEM subjects/disciplines. They involve inquiry-based/project-based learning approaches designed to the level of the learner to inspire, engage, and educate them while progressively being challenged. ELO activities enable learners to acquire knowledge; understand what they have learned; and apply that knowledge through inquiry-based/project-based activities.

**Principal Investigator (PI):** 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.

**STEM Engagement (SE):** Activities designed to engage learners' from the K-12, Higher Education, and Informal Education communities to increase their involvement and interest in STEM, educate them on the value of STEM in their lives, and positively influence the perception of their ability to participate in STEM.

**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
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.

**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 MAA’s goal and objectives.
### Aeronautics: NASA Is With You When You Fly

<table>
<thead>
<tr>
<th>Name</th>
<th>Link</th>
<th>Grade Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Let It Glide</td>
<td><a href="https://www.nasa.gov/content/let-it-glide-overview/">https://www.nasa.gov/content/let-it-glide-overview/</a></td>
<td>5-8</td>
<td>Using the Engineering Design Process, students will develop and build a shoebox glider and improve it in terms of aircraft and wing materials, shapes, and structure, to produce the greatest glide slope possible.</td>
</tr>
<tr>
<td>Aeronautics Module</td>
<td><a href="https://www.nasa.gov/sites/default/files/atoms/files/nosl-grc-ps-01985-aeronautis-module.pdf">https://www.nasa.gov/sites/default/files/atoms/files/nosl-grc-ps-01985-aeronautis-module.pdf</a></td>
<td>4-8</td>
<td>Provide students with an understanding of, Newton’s Third Law of Motion, the engineering design process and interactions between the atmosphere and geosphere Investigation</td>
</tr>
<tr>
<td>With You When You Fly: Aeronautics for Introductory Physics (Grades 9-College)</td>
<td><a href="https://www.nasa.gov/sites/default/files/atoms/files/aero-intro-physics_0.pdf">https://www.nasa.gov/sites/default/files/atoms/files/aero-intro-physics_0.pdf</a></td>
<td>9-College</td>
<td>Inquiry-based interactive demonstrations, labs, and data/literary analysis activities appropriate for high school and introductory college level science students.</td>
</tr>
<tr>
<td>Flight Testing Newton’s Laws</td>
<td><a href="https://www.nasa.gov/audience/foreducators/topnav/mat">https://www.nasa.gov/audience/foreducators/topnav/mat</a></td>
<td>9-12</td>
<td>Investigate Newton’s three Laws of Motion and the four forces of flight apply to flight testing an aircraft.</td>
</tr>
</tbody>
</table>
Students solve problems involving kinematics and dynamics.

Students will learn the proper way to read and interpret artifacts or museum exhibits to obtain the information needed to fully understand what they are viewing.

Students learn about the position and motion of objects and the properties of objects and materials as they explore the basics behind the four forces of flight.

Guide aids in teaching math, physics, and chemistry concepts from the viewpoint of propulsion and aeronautics. Problems using real world applications are included in each section to provide practice on the concepts.

Guide presents the basic science of aeronautics by emphasizing hands-on involvement, prediction, data collections with interpretation, teamwork and problem solving.

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**Mars: Join Us on The Journey**

<table>
<thead>
<tr>
<th>Name</th>
<th>Link</th>
<th>Grade Level</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>NASA Imagine Mars - Mars Survival Kit</td>
<td><a href="https://mars.nasa.gov/participate/marsforeducators/sol/">https://mars.nasa.gov/participate/marsforeducators/sol/</a></td>
<td>K-12</td>
<td>Students design a sustainable community, considering criteria and constraints in an engineering and design</td>
</tr>
<tr>
<td><strong>NASA’s BEST:</strong> Mars Science Laboratory Entry, Descent, &amp; Landing Instrument</td>
<td><a href="https://www.nasa.gov/sites/default/files/best_medli_workbook.pdf">https://www.nasa.gov/sites/default/files/best_medli_workbook.pdf</a></td>
<td>5-8</td>
<td>Mars Science Laboratory Entry, Descent and Landing Instrumentation, or MEDLI -- Students design a small heat shield to protect fragile instruments during a Mars entry simulation.</td>
</tr>
<tr>
<td>NASA’s BEST: Design a Crew Exploration Vehicle</td>
<td><a href="https://www.nasa.gov/audience/foreducators/best/activities.html#V9uGfkrJhE">https://www.nasa.gov/audience/foreducators/best/activities.html#V9uGfkrJhE</a></td>
<td>K-2, 3-5, 6-8</td>
<td>Student’s focus on the engineering design process to build a vehicle.</td>
</tr>
<tr>
<td>Parachuting Onto Mars</td>
<td><a href="https://y4y.ed.gov/stemchallenges/nasa2015/ms/parachuting-onto-mars/1483/1">https://y4y.ed.gov/stemchallenges/nasa2015/ms/parachuting-onto-mars/1483/1</a></td>
<td>6-8</td>
<td>Student work in a team to design, build, and test a drag device.</td>
</tr>
<tr>
<td>Mars Student Imaging Project</td>
<td><a href="https://mars.nasa.gov/msip/teachers/overview/">https://mars.nasa.gov/msip/teachers/overview/</a></td>
<td>5-12</td>
<td>Students work with NASA scientists, mission planners, and educators to take their own picture of Mars and make discoveries.</td>
</tr>
<tr>
<td>Exploring Mars</td>
<td><a href="https://mars.nasa.gov/education/modules/webpages/module1.htm">https://mars.nasa.gov/education/modules/webpages/module1.htm</a></td>
<td>4-10</td>
<td>Five distinct lessons within a module provide students a powerful introduction to Mars, planets, astronomy, and space exploration.</td>
</tr>
<tr>
<td>The Mars Education Lesson Plans</td>
<td><a href="https://marsed.asu.edu/stem-lesson-plans">https://marsed.asu.edu/stem-lesson-plans</a></td>
<td>K-12</td>
<td>Lesson plans include elements of inquiry-based learning that are aligned to Common Core and <a href="https://www.nextgenscience.org">Next Generation Science Standards</a> (NGSS) as well as problem-based learning and the <a href="https://www.bscs.org">Biological Sciences Curriculum Study (BSCS)</a> 5-E instructional model.</td>
</tr>
<tr>
<td>Destination: Mars</td>
<td><a href="https://er.jsc.nasa.gov/seh/destmars.pdf">https://er.jsc.nasa.gov/seh/destmars.pdf</a></td>
<td>6-8</td>
<td>Guide allows students to explore Mars as scientists.</td>
</tr>
<tr>
<td>Name</td>
<td>Link</td>
<td>Grade Level</td>
<td>Description</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
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<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Earth Right Now: Your Planet is Changing. We’re On It</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Astrobiology Science Learning Activities for Afterschool</strong></td>
<td><a href="https://www.nasa.gov/pdf/145916main_Astrobiology.Guide.pdf">https://www.nasa.gov/pdf/145916main_Astrobiology.Guide.pdf</a></td>
<td>K-6</td>
<td>Students explore topics related to the search for life beyond their own planet using some of the same strategies that astrobiologists use.</td>
</tr>
<tr>
<td><strong>Planetary Geology</strong></td>
<td><a href="https://www.nasa.gov/pdf/58263main_Planetary.Geology.pdf">https://www.nasa.gov/pdf/58263main_Planetary.Geology.pdf</a></td>
<td>6-12</td>
<td>Students explore earth science to understand the natural processes that shape not only our planet, Earth, but all objects in the solar system.</td>
</tr>
<tr>
<td><strong>Meteorology: An Educator’s Resource for Inquiry-Based Learning</strong></td>
<td><a href="https://www.nasa.gov/pdf/288978main_Meteorology_Guide.pdf">https://www.nasa.gov/pdf/288978main_Meteorology_Guide.pdf</a></td>
<td>5-9</td>
<td>Inquiry-Based Learning for Grades 5-9 is written as a supplement to existing Earth and space science lessons.</td>
</tr>
<tr>
<td>Investigating the Climate System - Winds at Work</td>
<td><a href="https://www.nasa.gov/pdf/62325main_ICS_Winds.pdf">https://www.nasa.gov/pdf/62325main_ICS_Winds.pdf</a></td>
<td>5-8</td>
<td>Students will conduct investigations to gain knowledge on the role wind plays in Earth’s climate. Interpretation of TRMM images and other data are used by students to find answers.</td>
</tr>
<tr>
<td>Investigating the Climate System - Precipitation</td>
<td><a href="https://www.nasa.gov/pdf/62321main_ICS_Precipitation.pdf">https://www.nasa.gov/pdf/62321main_ICS_Precipitation.pdf</a></td>
<td>5-8</td>
<td>Students conduct investigations to gain knowledge on how precipitation affects Earth. Interpretation of TRMM images and other satellite data are used by students to find answers.</td>
</tr>
<tr>
<td>Investigating the Climate System - Energy</td>
<td><a href="https://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/ICS_Energy.html">https://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/ICS_Energy.html</a></td>
<td>5-8</td>
<td>Students conduct investigation to gain knowledge of Earth’s energy budget. Interpretation of TRMM images and other satellite data are used by students to find answers.</td>
</tr>
</tbody>
</table>

### International Space Station: We’re Working Off the Earth, for the Earth

<table>
<thead>
<tr>
<th>Name</th>
<th>Link</th>
<th>Grade Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Why Do We Really Need Pressure Suits</td>
<td><a href="https://www.nasa.gov/sites/default/files/atoms/files/dressing_for_altitude.pdf">https://www.nasa.gov/sites/default/files/atoms/files/dressing_for_altitude.pdf</a></td>
<td>5-12</td>
<td>Guide is focused on student investigating human survival within temperature, pressure, and density parameters.</td>
</tr>
<tr>
<td>The Brain in Space</td>
<td><a href="https://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/The.Brain.in.Space.html">https://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/The.Brain.in.Space.html</a></td>
<td>5-12</td>
<td>The study of the ways in which the body’s brain, spinal cord and network of nerves control the activities of animals and humans is called neuroscience.</td>
</tr>
<tr>
<td>Life Support Systems</td>
<td><a href="https://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/Life_Support.html">https://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/Life_Support.html</a></td>
<td>4-12</td>
<td>Students will design and build models of nine life support systems that are crucial to successful human settlement of the moon.</td>
</tr>
<tr>
<td>Waste Limitation Management and Recycling Design Challenge</td>
<td><a href="https://www.nasa.gov/pdf/396719main_WLMR_Educator_Guide.pdf">https://www.nasa.gov/pdf/396719main_WLMR_Educator_Guide.pdf</a></td>
<td>6-8</td>
<td>A design challenge where students create a practical and vital system for complete water recycling system for future use on an outpost off the Earth.</td>
</tr>
<tr>
<td>A Breath of Fresh Air Lab Activity</td>
<td><a href="http://www.nasa.gov/audience/foreducators/mathandscience/research/Prob_BreathFreshAir_detail.html">www.nasa.gov/audience/foreducators/mathandscience/research/Prob_BreathFreshAir_detail.html</a></td>
<td>9-12</td>
<td>A chemistry lab activity using electrolysis to simulate the Oxygen Generator System used on the International Space Station.</td>
</tr>
<tr>
<td>Mass vs. Weight Educator Guide</td>
<td><a href="https://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/Mass_vs_Weight.html">https://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/Mass_vs_Weight.html</a></td>
<td>5-8</td>
<td>Students study the difference between mass and weight by comparing students' results with the results of astronauts aboard the space station. The activities focus on Newton's second law of motion.</td>
</tr>
</tbody>
</table>
**Technology: Technology Drives Exploration**

<table>
<thead>
<tr>
<th>Name</th>
<th>Link</th>
<th>Grade Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NASA's BEST Solar Sail</td>
<td><a href="https://www.nasa.gov/audience/foreducators/best/activities-technology.html">https://www.nasa.gov/audience/foreducators/best/activities-technology.html</a></td>
<td>5-8</td>
<td>Students design a solar sail, pack the sail for launch to space, and unfurl the sail without damaging it. Students also maintain a budget.</td>
</tr>
<tr>
<td>NASA's BEST: CPST (Cryogenic Propellant Storage and Transfer)</td>
<td><a href="https://www.nasa.gov/audience/foreducators/best/activities-technology.html">https://www.nasa.gov/audience/foreducators/best/activities-technology.html</a></td>
<td>5-8</td>
<td>Students design a storage container to keep a propellant cold. They also design a transfer system to move the propellant safely from one container to another. Students measure the evaporation that takes place during the experiment.</td>
</tr>
<tr>
<td>NASA's BEST: GPIM (Green Propellant Infusion Mission)</td>
<td><a href="https://www.nasa.gov/audience/foreducators/best/activities-technology.html">https://www.nasa.gov/audience/foreducators/best/activities-technology.html</a></td>
<td>5-8</td>
<td>Green Propellant Infusion Mission, or GPIM -- Students design a spacecraft and an effective green propellant. They also keep a budget for material and testing facility rental costs.</td>
</tr>
<tr>
<td>Suited for Spacewalking</td>
<td><a href="https://www.nasa.gov/audience/foreducators/tnav/materials/listbytype/Suited_for_Spacewalking_Educator_Guide.html">https://www.nasa.gov/audience/foreducators/tnav/materials/listbytype/Suited_for_Spacewalking_Educator_Guide.html</a></td>
<td>5-12</td>
<td>Guide focuses on the technology behind spacesuits. Briefly discussed are the space environment, the history of spacewalking, NASA's current spacesuits and the work that astronauts do during spacewalks.</td>
</tr>
<tr>
<td>Reflection of Light with Two Plane Mirror</td>
<td><a href="https://www.nasa.gov/audience/foreducators/tnav/materials/listbytype/Reflection_Light_Number_Angles.html">https://www.nasa.gov/audience/foreducators/tnav/materials/listbytype/Reflection_Light_Number_Angles.html</a></td>
<td>K-8</td>
<td>Students experiment to find that as the angle between two mirrors is increased or decreased, the number of reflected images increases or decreases.</td>
</tr>
<tr>
<td>BEST: Build a Satellite to Orbit the Moon</td>
<td><a href="https://www.nasa.gov/pdf/630753main_NASAsBESTActivityGuide3-5.pdf">https://www.nasa.gov/pdf/630753main_NASAsBESTActivityGuide3-5.pdf</a></td>
<td>3-5, 6-8</td>
<td>Design and build a satellite that meets specific size and mass constraints. It must carry a combination of cameras, gravity probes, and heat sensors to investigate the Moon's surface.</td>
</tr>
<tr>
<td>Name</td>
<td>Link</td>
<td>Grade Level</td>
<td>Description</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>----------------------------------------------------------------------</td>
<td>-------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Rover Races</td>
<td><a href="https://www.nasa.gov/pdf/392975main_Rover_Races_Activity.pdf">https://www.nasa.gov/pdf/392975main_Rover_Races_Activity.pdf</a></td>
<td>5-9</td>
<td>Students experience the processes involved in engineering a communication protocol. To reach their goal, students must create a calibrated solution within constraints and parameters of communication with a rover on Mars.</td>
</tr>
<tr>
<td>Solar System and Beyond: Our Journey of Discovery</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Name</td>
<td>Link</td>
<td>Grade Level</td>
<td>Description</td>
</tr>
<tr>
<td>Using Light to Study Planets</td>
<td><a href="https://www.jpl.nasa.gov/education/teach/activity/using-light-to-study-planets/">https://www.jpl.nasa.gov/education/teach/activity/using-light-to-study-planets/</a></td>
<td>6-11</td>
<td>Students build a spectrometer using basic materials to observe the light emitted and absorbed by several sources. This will be used as a model for how NASA uses spectroscopy to determine the nature of elements found on Earth and other planets.</td>
</tr>
<tr>
<td>Space-Based Astronomy Guide</td>
<td><a href="https://www.nasa.gov/pdf/582775main_Space_Based_Astronomy.pdf">https://www.nasa.gov/pdf/582775main_Space_Based_Astronomy.pdf</a></td>
<td>5-8</td>
<td>Students build simple spectoscopes and telescopes to learn about Earth’s atmosphere, the electromagnetic spectrum and telescopes.</td>
</tr>
<tr>
<td>All About Ice</td>
<td><a href="https://solarsystem.jpl.nasa.gov/education/lessons&amp;Grade=35&amp;LessonLength=More%20Than%20an%20Hour">https://solarsystem.jpl.nasa.gov/education/lessons&amp;Grade=35&amp;LessonLength=More%20Than%20an%20Hour</a></td>
<td>3-8</td>
<td>Students investigate ice, learn about its properties and explore how it can change states to a liquid or a gas.</td>
</tr>
<tr>
<td>Exploring Meteorite Mysteries</td>
<td><a href="https://solarsystem.nasa.gov/docs/Building_Planets_508FC.pdf">https://solarsystem.nasa.gov/docs/Building_Planets_508FC.pdf</a></td>
<td>3-8</td>
<td>Students will observe and explore meteorites.</td>
</tr>
<tr>
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</tr>
<tr>
<td><strong>Mars Robotic Activities</strong></td>
<td><a href="https://solarsystem.jpl.nasa.gov/educ/lessons/1793">https://solarsystem.jpl.nasa.gov/educ/lessons/1793</a></td>
<td>4-9</td>
<td>Students learn the different elements necessary to design, build and support robotic missions to the Red Planet.</td>
</tr>
</tbody>
</table>

**Evaluation Plan Approach**

- **Proposed Evaluation Design and Methodology Narrative**
  Describe an appropriate evaluation plan approach/process to document outcomes and demonstrate progress toward achieving objectives of proposed education activities. The forms of evaluation should be based upon reputable models and techniques that are appropriate to the content and scale of the MAA. Identify the Independent Evaluator that will develop the comprehensive evaluation plan, develop or identify 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.

  - Proposed activity theory of change/logic model
  - Proposed program evaluation questions
  - Proposed program measurable goals, objectives, and outcomes
  - Proposed program data collection tools

- **Evidence-Based Research and/or Best Practice Supporting Evaluation Plan Approach Narrative**
  Describe evidence-base for MAA proposed program, evaluation plan approach. Include citations.
References:

- Junge, S., & Manglallan, S. (2011). Professional development increases afterschool staff's confidence and competence in delivering science, engineering and technology. In Advances in youth development programming: Research and evaluation from the
University of California cooperative extension 2001-2010 (pp. 70-78). Regents of the University of California.


APPENDIX G

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


Program Performance Assessment

Both the executive branch and congressional committees need extensive information to help them make decisions about the programs they oversee—from 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 recognized that executive and congressional decision-making was often hampered by the lack of good information on the results of federal programs and efforts. To promote improved federal management and greater efficiency and effectiveness, GPRA instituted a governmentwide requirement that agencies set goals and report measures of 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 information to track program milestones, but few seem to regularly conduct multiyear program evaluations to assess their programs’ impact. A need exists to improve results.

Individual evaluation studies are designed to answer specific questions about how well a program is working, and GPRA requires agencies to maintain a comprehensive pool of data about the goals and results of all their programs. The GPRA Reauthorization Act of 2010 aims to improve program performance by requiring agencies to identify priority goals, assign officials responsibility for achieving them, and evaluate program results. Complete and accurate information on how well programs are working and why will be key to its success.

This chapter describes and explains the relationship between two common types of systematic program assessment: performance measurements and program evaluations. Based on GAO publications and program evaluation literature, it was first prepared in 1996. Major contributors were Shoshana Shipman and Todd Whaley. Please address any questions to Shoshana Shipman at (202) 512-4641 or shipsman@gao.gov.

Nancy L. Kingbury
Managing Director
Applied Research and Methods

May 2011

PERFORMANCE MEASUREMENT AND EVALUATION

Definitions and Relationships
Types of Program Performance Assessment

Performance Measurement

Performance measurement is the ongoing monitoring and reporting of program accomplishments, particularly progress toward pre-established goals. It is typically conducted by program or agency management.

Performance measures may address the type or level of program activities, the direct products and services delivered by a program (outputs), or the results of those products and services (outcomes).

A “program” may be any activity, project, service, or policy that has an identifiable purpose or set of objectives.

Program Evaluation

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.

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. Findings from these evaluations can be used for many purposes to inform or influence policy decisions, improve programs, and so forth.

Different Use

Both forms of assessment aim to measure resource utilization and other operational outcomes 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 valuable tool for improving accountability to the public.

A program evaluation’s typical uses include in-depth examinations of program performance and context, along with overall assessments of whether the program works and identifies adjustments that may improve its results.

Relationship between Performance Measurement and Program Evaluation

Performance measurement focuses on whether a program has achieved its objectives, expressed in measurable performance standards. Program evaluation typically assesses a broader range of information on program performance and its context than is feasible to measure on an ongoing basis.

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 balance 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 true impact. Additionally, program evaluations may systematically compare the effectiveness of alternative programs aimed at the same objective.

Types of Program Evaluation

Process for Implementation Evaluation

This form of evaluation assesses the extent to which a program is implemented as intended, frequently including program activities, performance requirements, program designs, and professional standards and consumer expectations.

Outcome Evaluation

This form of evaluation assesses the extent to which a program achieves its intended objectives. It focuses on inputs and outcomes (including unmet needs) to judge program effectiveness but may also assess program processes to understand how outcomes are produced.

Impact Evaluation

Impact evaluation is a form of outcome evaluation that quantifies 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 complex when external factors are known to influence the program’s assessment, in order to isolate the program’s contribution to achievement of its objectives.

Cost-Benefit and Cost-Effectiveness Analyses

These analyses compare a program’s outputs or outcomes with the costs (resources expended) to produce them. When applied to selecting programs, they are often considered a form of program evaluation. Cost-effectiveness analysis measures the ratio 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.