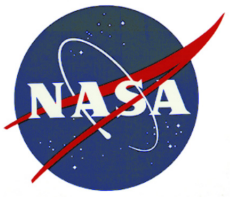
National Aeronautics and Space Administration



Education & Public Outreach

Explanatory Guide to Proposal Evaluation Factors for ROSES Program Element: Opportunities in Education & Public Outreach for Earth and Space Science (EPOESS)

Version 1.0
February 2009

The most current version of this document can be downloaded at

http://nasascience.nasa.gov/researchers/education-public-outreach/explanatory-guide-to-smd-e-po-evaluation-factors

If you have comments or questions, please send email to

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Change History

February 2009 Version 1.0	Initial Release of *"Explanatory Guide To Proposal Evaluation Factors for ROSES program Element: Opportunities in Education and Public Outreach for Earth and Space Science (EPOESS)"* It is based on updates of the *Explanatory Guide To The Office Of Space Science Education & Public Outreach Evaluation Factors Version 3.0, (April 2008)*

Preface

NASA's founding legislation directs the Agency to expand human knowledge of Earth and space phenomena and to preserve the role of the United States as a leader in aeronautics, space science, and technology. High achievement in STEM education is essential to the accomplishment of NASA's mission. The NASA Science Mission Directorate is a major contributor to the overall NASA education and outreach effort through a portfolio of investments in Higher Education, Elementary and Secondary Education, Informal Education, and Outreach.

NASA continues 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.

In 2006 and beyond, NASA will pursue three major education goals:

- Strengthen NASA and the Nation's future workforce—NASA will identify and develop the critical skills and capabilities needed to ensure achievement of the Vision for Space Exploration. To help meet this demand, NASA will continue contributing to the development of the Nation's science, technology, engineering, and mathematics (STEM) workforce of the future through a diverse portfolio of education initiatives that target America's students at all levels, especially those in traditionally underserved and underrepresented communities.
- Attract and retain students in STEM disciplines—NASA will focus on engaging and retaining students in STEM education programs to encourage their pursuit of educational disciplines and careers critical to NASA's future engineering, scientific, and technical missions.
- Engage Americans in NASA's mission—NASA will build strategic partnerships and linkages between STEM formal and informal education providers. Through hands-on, interactive educational activities, NASA will engage students, educators, families, the general public, and all Agency stakeholders to increase Americans' science and technology literacy.

NASA delivers a comprehensive education portfolio implemented by the Office of Education, the Mission Directorates, and the NASA Centers. Through the portfolio, NASA contributes to our Nation's efforts in achieving excellence in STEM education. Three Outcomes serve to align all Agency education activities:

Outcome 1: Contribute to the development of the STEM workforce in disciplines needed to achieve NASA's strategic goals through a portfolio of investments.

Outcome 2: Attract and retain students in STEM disciplines through a progression of educational opportunities for students, teachers, and faculty.

Outcome 3: Build strategic partnerships and linkages between STEM formal and informal education providers that promote STEM literacy and awareness of NASA's mission.

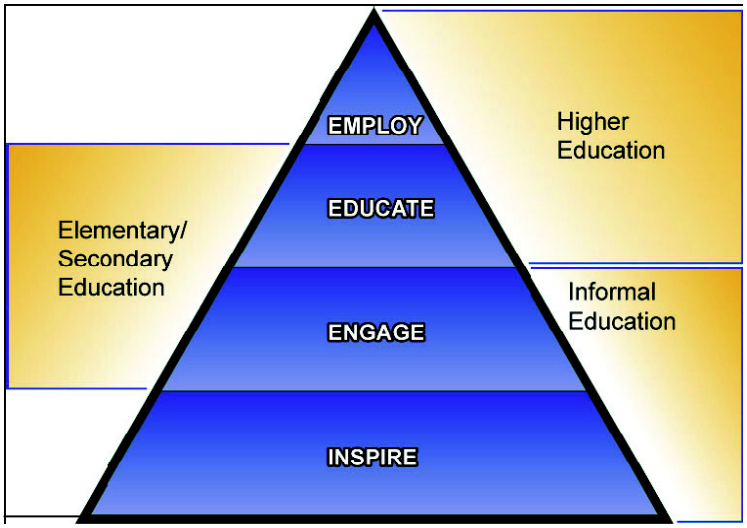


Figure 1

The Education Strategic Framework depicted in Figure 1 provides a conceptual basis for examining, guiding, and coordinating the NASA education portfolio.

The Education Strategic Framework is a strategic management tool that allows the Agency to monitor participant movement through education activities, with each category leading to the next. Education programs and projects draw from the category below them – as a key source for participants – and they connect participants to the category above them – providing a more experienced and focused group and creating a measurable pipeline. If a participant's imagination is captured by an inspirational activity, it will be far easier to interest that individual in more interactive engagement activities. As that individual becomes more engaged, he or she may search for opportunities to learn and eventually become employed in the aerospace industry - either in the private or public sector (e.g., NASA). Student opportunities at NASA include internships, scholarship programs, and student education employment programs (e.g., cooperative education). No matter where the individual decides to pursue their career, the goal is to direct a subset of the original audience through the pipeline to pursue a career in science, technology, engineering, or mathematics while drawing in new participants along the way.

Outreach is also an essential aspect of the SMD program. It directly connects to many aspects of NASA Public Affairs and NASA education efforts. It often provides an inspirational spark for participants to seek out education opportunities. The SMD Outreach Goal is to stimulate interest in science, engineering, and technology relevant to NASA SMD. There are four objectives:

1. Increase interest in careers that use science, engineering, and/or technology relevant to NASA SMD
2. Increase understanding by the general public of SMD science, engineering, and technologies
3. Increase participation of citizen scientists in SMD education opportunities
4. Increase public engagement in improving science, mathematics, engineering, and technology education in the United States.

Outreach can be directed at any audience including students, teachers, citizen scientists, and the general public.

The Factors discussed in this guide serve as the basis for evaluating E/PO proposals solicited in the **Opportunities In Science Mission Directorate Education And Public Outreach** portion of the annual **Research Opportunities In Space And Earth Sciences** (ROSES) solicitation.

This Guide is meant to provide assistance to investigators in aligning their proposed efforts with the goals and objectives of NASA and SMD education. It also provides the means for proposers, partners and facilitators, and reviewers to have a common understanding of what these factors mean in practice.

The Guide provides an elaboration of each of the SMD E/PO proposal Factors and includes "Indicators" that may be used by both proposers and reviewers to assess how well a proposal segment meets the Evaluation Factors.

The information contained in this document is intended to give a flavor of what exemplary Education can be rather than a prescription for what to do. It is based on experience to date and thus the contents of the Guide will evolve over time with regular updates. For the latest version, please link to http://nasascience.nasa.gov/researchers/education-public-outreach/explanatory-guide-to-smd-e-po-evaluation-factors

If you have comments or questions, please send E-mail to HQ-SMD-ROSES-EPO@hq.nasa.gov

Glossary

A. STEM – The disciplines associated with Science, Technology, Engineering, and Mathematics.

B. NASA Education Program – NASA has established five overarching Education program areas under which NASA education efforts are undertaken. These are 1) Higher Education; 2) Elementary & Secondary Education; 3) Informal Education; 4) Minority Programs; and 5) e-Education.

Higher Education projects – beneficiaries are college/university faculty, undergraduate, graduate students, or postdoctoral researchers.
Elementary & Secondary Education projects – beneficiaries are educators and/or Kindergarten through grade 12 students.
Informal Education projects – beneficiaries may be of any age.

C. Science Mission Directorate Education Project –The Science Mission Directorate has 10 education projects. These projects reflect ongoing SMD contributions to the NASA Education program.

The four SMD Higher Education projects are:

(1) Early Career Scientists & Pre-Service Faculty Development
(2) Research Experiences for Students Underrepresented in Earth and Space Science
(3) Earth and Space Science Student Collaborations
(4) Earth and Space Science Resources for Higher Education

The three SMD Elementary and Secondary Education projects are:

(1) Earth and Space Science: Building Elementary and Secondary Teacher Skills
(2) Earth and Space Science: Elementary and Secondary Resources
(3) Earth and Space Science: Elementary and Secondary Student Opportunities

The three SMD Informal Education projects are:

(1) Earth & Space Science: Informal Education Resources
(2) Earth & Space Science: Building Informal Educator Skills
(3) Earth & Space Science: Informal Education Opportunities

D. Public Outreach – A term used to identify activities and projects whose intent is to raise awareness of, or interest in, NASA, its goals, missions and/or programs, and to develop an appreciation for and exposure to science, technology, research and exploration. The term is usually associated with outreach to the public but may also be used in relationship to activities targeting specific groups/individuals such as those underserved and underrepresented in the scientific, engineering, technology, and mathematics professions. It also includes efforts to engage members of these professions in NASA education and outreach efforts such as training of scientists and engineers in effective techniques for conducting education and outreach. *SMD has four Outreach Projects:*

(1) Outreach: STEM Careers Opportunities for SMD
(2) Outreach: Public Understanding of SMD STEM

(3) Outreach: SMD Opportunities for Citizens Scientists
(4) Outreach: Public Engagement in STEM Education

E. Science Mission Directorate Education Project Activity – an Education Project Activity is an identifiable component contributing to at least one of the ten Science Mission Directorate Education Projects.

F. Science Mission Directorate Outreach Project Activity – an Outreach Project Activity is an identifiable component contributing to at least one of the four Science Mission Directorate Outreach Projects.

G. NASA Research Announcement (NRA) – An NRA is used to announce research interests in support of NASA's programs, and, after peer or scientific review using factors in the NRA, select proposals for funding. Unlike an RFP containing a statement of work or specification to which offerors are to respond, an NRA provides for the submission of competitive project ideas, conceived by the offerors, in one or more program areas of interest. NRAs may result in grants, contracts or cooperative agreements.

Project Activities proposed to the Science Mission Directorate are required to make a valuable contribution to Higher Education, Elementary/Secondary Education, Informal Education and/or Public Outreach.

SMD E/PO Evaluation Factors

The principal elements considered in evaluating an E/PO proposal are its intrinsic merit, relevance to NASA's objectives, and its cost. **The failure of a proposal to be rated highly in any one of these elements is sufficient cause for the E/PO proposal to be declined.** [Intrinsic Merit and Relevance are equally weighted and approximately twice that of Cost.] NASA also has a strong interest and commitment to meeting the needs of underserved and underrepresented groups in STEM. As part of this commitment SMD will use the Program Balance Factors in selecting among E/PO proposals of essentially equivalent overall rating based on the Intrinsic Merit, Relevance, and Cost Factors noted above.]

Sub-factors indicate areas of evaluation where strengths and weaknesses will be identified. The collection of strengths/weaknesses under each principal element will determine the rating for that principal element.

Intrinsic Merit

1. Quality, Scope, Realism, and Appropriateness: Project Activities are clearly organized, consistent with the requested budget, have clear lines of management responsibilities, and demonstrate a high probability for successful implementation.

2. Connectivity/Continuity: Project Activities draw from audiences that have demonstrated interest in NASA and connect participants to the next level of engagement or to other NASA Education or Outreach Activities.

3. Partnership Leverage/Sustainability: Project Activities 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 Project Activities are replicable, scalable, and demonstrate potential for continuation beyond the period of direct NASA funding.

Science Mission Directorate E/PO Project Activities require the active involvement and participation of partners with appropriate expertise.

4. Evaluation: Project Activities document their intended outcomes and use metrics to demonstrate progress toward and achievement of these outcomes and annual performance goals. Evaluation is appropriate to the content and scale of the targeted activity or product.

Relevance to NASA's Objectives

5. Customer Needs Focus: Project Activities have been designed to respond to a need identified by the education community, a customer, or a customer group.

6. Content: Project Activities have a clear intellectual linkage to SMD science/technology, use NASA content, people or facilities to involve educators, students, and/or the public in NASA science, technology, engineering, and/or mathematics.

Proposals that include Elementary/Secondary education must demonstrate alignment with appropriate educational standards.

Cost

7. Resource Utilization: The adequacy, reasonableness, and realism of the proposed budget including demonstration of effective use of funds.

Program Balance Factors

8. **Pipeline:** Through the use of NASA Earth and space science, Project Activities and/or products make a demonstrable contribution to attracting diverse populations to careers in science, technology, engineering, and mathematics (STEM).

9. Diversity: Through the use of NASA Earth and space science, Project Activities and/or products reach identified targeted groups. They contribute to the involvement, broad understanding, and/or training of underserved and/or underutilized groups in science, technology, engineering, and mathematics (STEM).

APPENDIX A

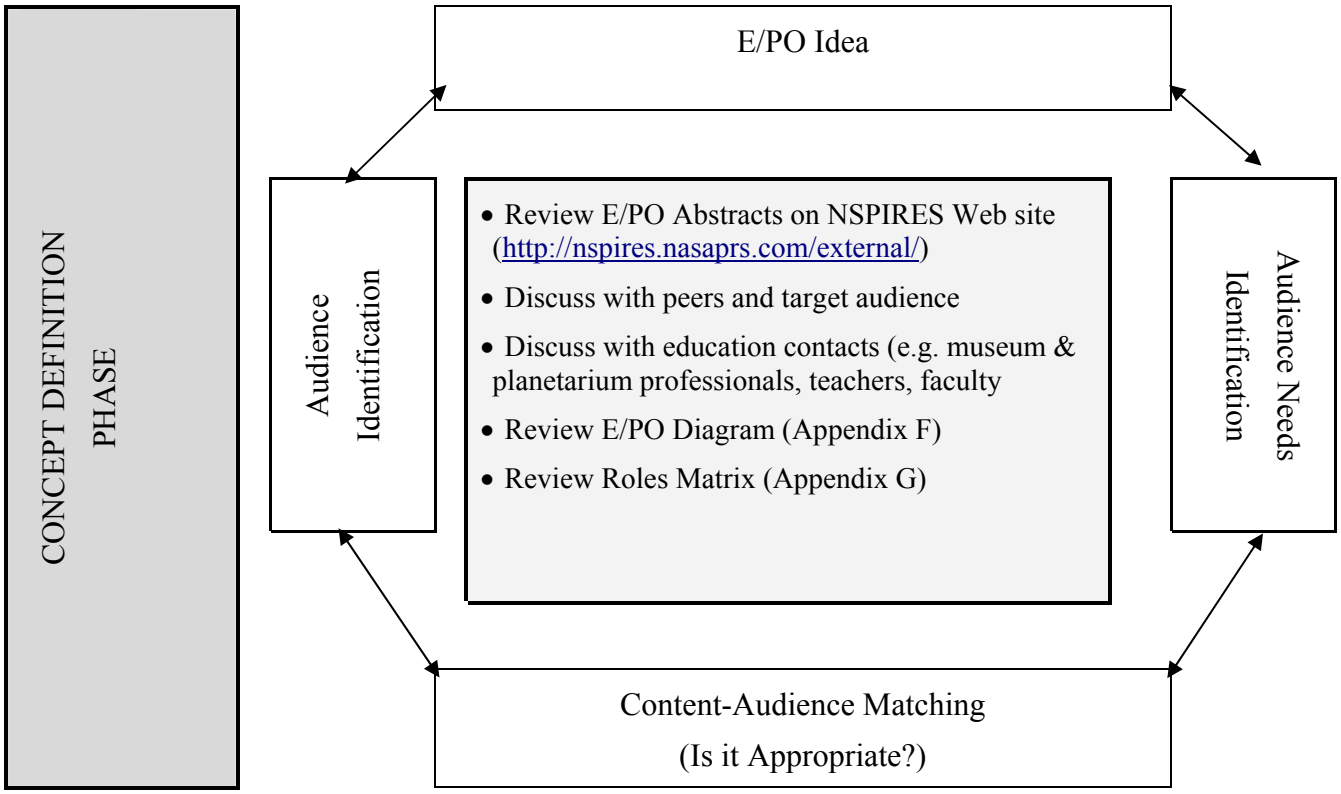
Science Mission Directorate
Education And Public Outreach Proposals
Quick Start Help

Developing a Science Mission Directorate (SMD) Education And Public Outreach (E/PO) proposal is a significant undertaking. Getting started in E/PO is fairly straight forward – you need an E/PO idea that the SMD E/PO program can fund, you need a team of people with the expertise to carry the idea out, and you need to write it all down in a concise proposal.

SMD recognizes that many researchers are not experts in education and public outreach and has prepared this Explanatory Guide to help them understand what SMD is looking for in a proposal, suggest roles and ideas that they might consider, and resources they can consult.

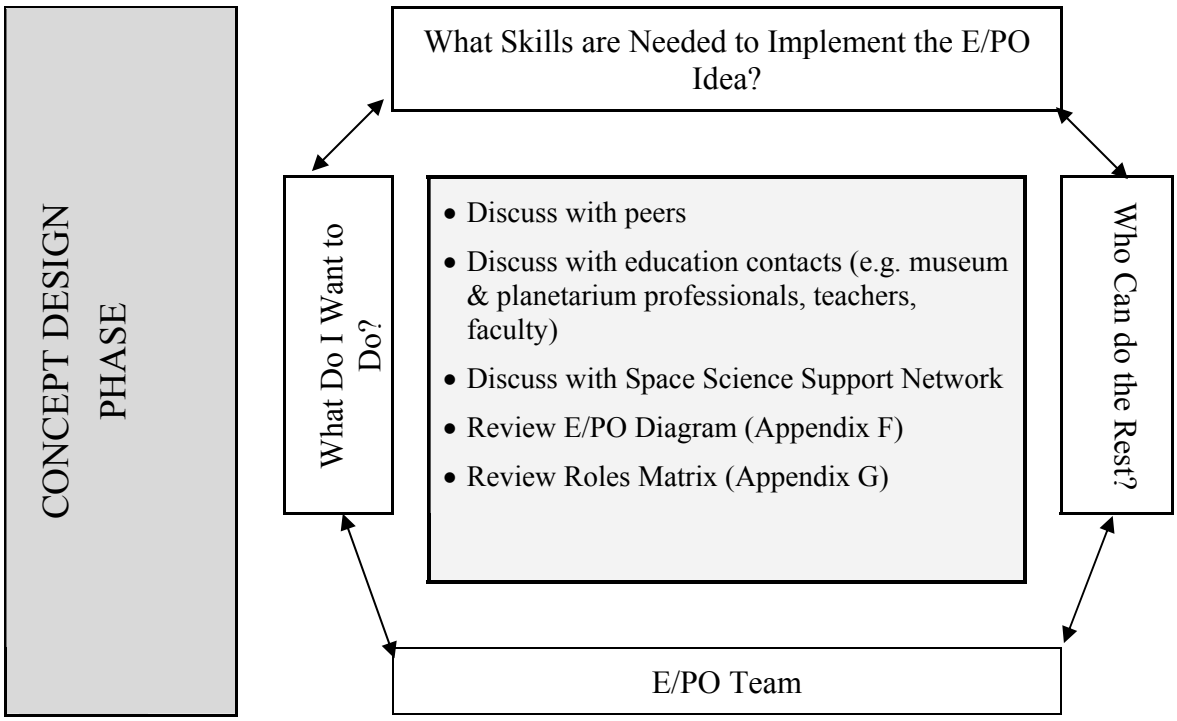
Step 1: Review the SMD E/PO Evaluation Factors (Section 1 and Appendix B of Guide). Understand what types of E/PO ideas can be funded by the SMD E/PO program.

Step 2: Generate an E/PO idea—this is usually an iterative process of identifying potential audiences and their needs and matching them against the SMD STEM content you are considering.



Step 3: Review the SMD E/PO Indicators of Alignment (Appendix B of Guide) and FAQs. Understand the details of SMD E/PO projects/activities and what the review panel will be looking for.

Step 4: Put Together Your E/PO Team—this is usually an iterative process to evaluate the skills needed for the project and then to identify who has them. Budget considerations can come into play.



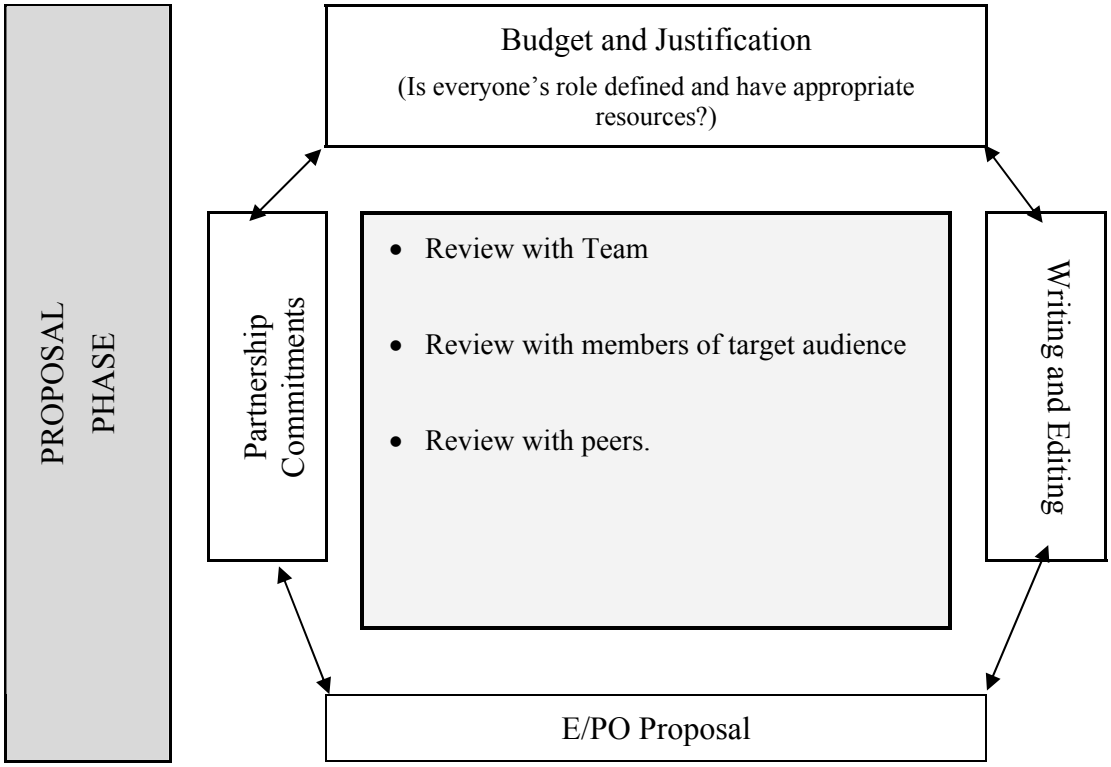
Don't overlook program evaluation—If there are several different elements within the effort, each needs to be evaluated, in addition to the overall effort. Evaluation should be geared to the scale and type of the proposed E/PO efforts. Some might use simple, informal approaches, while others very specific evaluation methods like pre- and post-tests, questionnaires, or a focus group. The person doing the evaluation should be knowledgeable in the use of the selected evaluation approach.

The Space Telescope Science Institute IDEAS program provides an excellent primer on evaluation that is relevant to NASA SMD E/PO programs. The URL is: http://ideas.stsci.edu/Evaluation.shtml

Step 5: "Sanity Check" – discuss your E/PO Idea and Partners with a representative of the target audience and/or your peers.

Step 6: Prepare Your Proposal—this is usually an iterative process between the team members. Reviews by the target audience and an evaluator can help clarify goals and objectives. They can also help ensure that sufficient detail is provided for reviewers who may

be unfamiliar with the science or particular approach to implementing the E/PO project/activity.



Step 7: The Review Process

To ensure quality and consistency in the review process, review panels for the E/PO segment include both educators and researchers.

The process of handling E/PO proposal segments follows the known best and fair practices for proposal review in current use throughout SMD. (See the *Guidebook for Proposers Responding to NASA Research Announcements*, Appendix C, which is available at http://www.hq.nasa.gov/office/procurement/nraguidebook/.)

The panel reviews are conveyed to proposers along with the funding decision.

APPENDIX B

Indicators of Alignment with the SMD E/PO Evaluation Factors

To aid proposers in the preparation of their proposals, as well as to ensure that reviews are carried out on a consistent basis aligned with the NASA Education Goals and SMD implementation, this section offers further elaboration of each of the Evaluation Factors. Note that although creativity and innovation are certainly encouraged where appropriate, the factors do not focus on the originality of the proposed effort. This is a fundamental departure from standard scientific review factors and allows Earth and space scientists to become actively involved in the kinds of education and public outreach activities that have already proven to be meaningful, effective, and credible.

INTRINSIC MERIT

1. Quality, Scope, Realism, and Appropriateness: Project Activities are clearly organized, consistent with the requested budget, have clear lines of management responsibilities, and demonstrate a high probability for successful implementation.

Indicators of alignment include:

- Individuals (researchers, scientists, engineers, technologist, etc.) involved in Earth and/or space science are engaged in meaningful and appropriate roles (see Appendix G). [Active involvement of these individuals is required on SMD Project Activities.]

- Essential information about each proposed activity and product is provided (e.g., who, what, when, where, why, how).
    - Objectives are clearly and succinctly described. Implementation is feasible and appropriate for the specified intended audiences.
    - There is a schedule and/or timeline for proposed activities or other clear indication of how activities will be phased that is clearly aligned to the budget request.
    - Members of the target audience are actively involved in the design and execution of the Project Activity.
    - The management is clearly defined with clear lines of authority. Areas of responsibility are defined and specified. All key personnel are identified and have institutional authorization to participate.
    - Partners have well-defined roles, specific tasks, and relevant expertise that are substantively related to the design, development, dissemination, implementation, or evaluation of activities and/or products.
    - There are clear plans for dissemination of the product(s) or results of the activities.

2. Connectivity/Continuity: Project Activities draw from audiences that have demonstrated interest in NASA and connect participants to the next level of engagement or to other NASA Education or Outreach Activities.

Indicators of alignment include:

- Methods are identified that will draw Project Activity participants from other NASA educational and/or outreach opportunities.
- Methods are identified that will connect Project Activity participants to other NASA educational and/or outreach opportunities.

3. Partnership Leverage/Sustainability: Project Activities 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 Project Activities are replicable, scalable, and demonstrate potential for continuation beyond the period of direct NASA funding.

Active involvement of appropriate and qualified partners is required for Science Mission Directorate E/PO Project Activities.

Indicators of committed, qualified, and capable partnerships include:

- E/PO partners are specifically identified; letters of partnership intent, specific support, or other evidence of partnership is included or attached to the proposal. [This evidence may be included in the text of commitment/support letters.]
- The proposal clearly defines the terms of the partnership and the nature of the collaboration between researchers and partnering E/PO organizations or individuals is clearly stated. (See FAQ 17).
- The proposal clearly demonstrates that the proposer and partners have relevant and appropriate experience applicable to the proposed effort.

Indicators for High Leverage and/or Sustainability include:

- A Project Activity can achieve high leverage by having an impact beyond the direct beneficiaries, reaching large audiences, being suitable for replication or broad dissemination, or drawing on resources beyond those directly requested in the proposal. (see FAQ 14 for specific examples).
- A Project Activity is sustainable beyond initial NASA funding by showing the potential for continuation, adoption by the target audiences, and/or incorporation into institutional programmatic efforts.
- A Project Activity is replicable in other educational institutions.

4. Evaluation: Project Activities document their intended outcomes and use metrics to demonstrate progress toward and achievement of these outcomes and annual performance goals. Evaluation is appropriate to the content and scale of the targeted activity or product.

Indicators of appropriate evaluation include:

- Evaluation methods provide useful information on the effectiveness of the proposed project and the project implements improvements based on evaluation evidence.
- There is evidence that the evaluation is based upon reputable models and techniques or are designed and applied by a project partner who is knowledgeable in research and evaluation methods applicable to outreach efforts. Where appropriate, the evaluation plan includes field-testing and modifications before broad dissemination.

Evaluation efforts should reveal lessons learned, and whether the proposed E/PO Project Activity meets the stated goals and objectives and/or had other unanticipated effects. The formality and comprehensiveness of the evaluation will depend on the scope of the proposed activity. *All SMD Project Activities must include an evaluation plan and all components of a project activity must be evaluated.*

The proposed evaluation should be appropriate for the scale and type of each project activity component; for instance, a small outreach effort might measure web page views, or audience attendance on an event; a larger effort might include an online survey for a website, viewer tracking, or audience feedback from an event. A small education effort might use pre-test/post-tests at a workshop or web surveys; a larger effort might include an educator survey conducted by education students at a local university to determine longer-term impact. It is useful to follow standard methods or consult an individual trained in research and evaluation methods when designing an evaluation procedure, even when the evaluation is to be done informally by the proposer(s).

All NASA-sponsored awardees are required to submit their Earth and space science education products and resources for review and potential broader dissemination. This review does not take the place of formative evaluation of education materials and it is expected that products have been reviewed for scientific accuracy and educational value, as well as field-tested by teachers and/or students as appropriate. Earth and Space Science products should be submitted to http://www.strategies.org/nasareviews

The project must collect, analyze, and report output and outcome data to a common NASA database to determine project effectiveness and meet the requirements of stakeholders. It is anticipated that this will be nominally a one person-day effort to format and submit the data. Directions are provided in award documentation.

RELEVANCE TO NASA OBJECTIVES

5. Customer Needs Focus: Project Activities have been designed to respond to a need identified by the education community, a customer, or a customer group.

Indicators of alignment include:

- The project is based on a clearly expressed, compelling mutual need between NASA and the audience. [**Evidence of target audience need is required for SMD E/PO projects**]. (See FAQ 12)
- NASA funded researchers can make an effective content contribution.

The specific interest and needs of the target audience can be documented through a variety of approaches including published documents, surveys, interviews, letters of interest, etc. from members of the target audience.

Interest and need by NASA may be established by reference to appropriate portions of the NASA strategic plan or similar SMD documents.

6. Content: Project Activities have a clear intellectual linkage to SMD science/technology, use NASA content, people or facilities to involve educators, students, and/or the public in NASA science, technology, engineering, and/or mathematics.

Indicators of alignment include:

- The Project Activity is based upon and has a clear intellectual linkage to SMD science/technology. (see FAQ 4)
- The Project Activity ensures that the content is technically accurate.
- Elementary/Secondary Education Project Activities are aligned (as described below) with education standards.

Any proposed effort that includes elementary/secondary education via use of a curricular product, data analysis, or educator workshop must demonstrate a substantive and informed alignment with educational standards (see FAQ 5) appropriate to the target audience and scale of the project/activity. National or regional (multi-state) projects/activities should align with the National Research Council's *National Science Education Standards* and/or the American Association for the Advancement of *Science's Benchmarks for Science Literacy,* and/or the mathematics education standards provided by the National Council of Teachers of Mathematics, and/or *Technology Foundation Standards for All Students* from the International Society for Technology in Education (see Appendix H for links to these and other relevant education standards). **This is done by providing specific reference to at least one of the standards publications cited above, citing specific standards to be addressed, and as appropriate providing evidence of use of standards for professional development.** Similarly local (single state) projects/activities may choose to align with national or appropriate state standards by providing the same level of documentation. Indicators of appropriate alignment with elementary/secondary education efforts include the following:

- Descriptions of the content of curricular products and/or educator training opportunities explicitly demonstrate alignment with education standards in one or more of the following educational fields: science (Earth and space science or physical science), mathematics, or technology.
- Evidence that the partners engaged in developing and evaluating curricular products or educator training are knowledgeable about how to align products and activities with relevant education standards (see FAQ 5).

COST

7. Resource Utilization: The adequacy, reasonableness, and realism of the proposed budget including demonstration of effective use of funds.

Indicators of alignment include:

- Budget details are provided. This includes the amount of individual labor effort, details of travel, supplies, and subcontractor expenses. These must be clearly connected to the described effort.
- The overall Project Activity budget (including in-kind contribution and other funds leveraged from E/PO partners' resources) is cost-effective and provides cited or estimated figures for the fiscal contribution of each partner. Overall project cost, costs of project deliverables, and the relationship of proposed budget to available funds are each realistic and reasonable (see FAQ 2, 11, and 14). For example, a $1.5 million E/PO Project Activity is multifaceted and reaches an appropriately large and diverse audience (statewide, regional, or national scope); and a $50,000 E/PO Project Activity is appropriately focused and does not propose unrealistic outcomes that are clearly beyond Project Activity resources.
- Adequate funds are included for E/PO partners commensurate with their level of involvement in proposed activities.

Program Balance Factors

NASA has a strong interest in attracting and retaining students in STEM disciplines. NASA also has a strong interest and commitment to meeting the needs of underserved and underrepresented groups in STEM. As part of this commitment SMD will use these program balance factors in selecting among EPO proposals of essentially equivalent overall rating based on Intrinsic Merit, Relevance, and Cost Factors noted above.

8. **Pipeline:** Through the use of NASA Earth and space science, Project Activities make a demonstrable contribution to attracting diverse populations to careers in science, technology, engineering, and mathematics (STEM). (See FAQ 6)

Indicators of alignment include one or more of the following:

- The program promotes careers in STEM.
- The program promotes improvement of STEM skills.
- The program creates linkages to other STEM opportunities.
- The program/product addresses diverse populations of students.
- Members of the target audience are involved in the development and execution of the effort.

Approaches include:

- Teacher and student use of NASA data, research experiences for students and teachers, exposure to career options through hands-on participation in STEM enrichment projects/activities.
- Engaging students in participatory activities, such as hands-on learning, research, the use of innovative technology, peer support groups, and mentoring relationships with professionals and college students; involving teachers in effective and extensive staff

9. Diversity: Through the use of NASA Earth and space science, Project Activities and/or products reach identified targeted groups. They contribute to the involvement, broad understanding, and/or training of underserved and/or underutilized groups in science, technology, engineering, and mathematics (STEM).

Engaging more minorities and women in careers and greater interest in science and engineering has become an increasingly critical need in America. Indicators that the proposed projects/activities contribute to underserved and/or underutilized groups (see FAQ 13) may include one or more of the following:

- The program serves individuals from underrepresented groups and ensures accessibility to people with disabilities.
- The program has been or will be developed in consultation with members of the underserved and/or underutilized communities it is intended to serve.
- The program provides awareness and understanding through culturally appropriate materials to targeted underserved and/or underutilized communities of how NASA's research and innovations affect and improve the quality of life for all citizens.
- Members of the underserved and/or underutilized target audience are involved in the development and execution of the effort.
- The program promotes opportunities for faculty at minority-serving institutions to engage in research consistent with NASA's requirements. Approaches include utilization of partnerships or having substantive linkage with one or more minority universities such as: Historically Black Colleges and Universities (HBCUs), Hispanic Serving Institutions (HSIs), Tribal Colleges and Universities (TCUs).
- The program supports closing identified gaps in STEM proficiencies among underserved and/or underutilized populations.

APPENDIX C

Frequently Asked Questions

E/PO Proposal Preparation and Review

1. What is the E/PO proposal review process?
2. What kind of E/PO should I emphasize in my E/PO proposal?
3. What is the difference between "Informal Education" and "Public Outreach"?
4. At what level does my Project Activity have to be linked with SMD?
5. What are Science Education Standards, and what does it mean for an effort or product to align with them?
6. What is the difference between “Connectivity/Continuity”, “Pipeline” and “Diversity”?
7. Are there any restrictions on what can be funded in an E/PO budget?
8. Can SMD E/PO funding be used for Public Affairs or Public Relations?
9. How can SMD E/PO funds be used to support efforts directed towards higher education?
10. What format should be used for E/PO proposal budgets?
11. What is evaluation and how important is it to include as a funded part of my E/PO program?
12. How do I demonstrate a Customer Needs Focus?
13. What is meant by "underutilized" and "underserved" groups in science and technology?
14. How can I expand the scope of my E/PO program in order to get the most out of proposed funding?
15. How can I disseminate products developed by our E/PO program?
16. What attributes should I look for in an E/PO partner?
17. In the context of an AO that has advanced to the Concept Study Report phase, what specific requirements must be satisfied for the involvement of E/PO partners, (encompassing partnerships between both individuals and organizations)?
18. What specific requirements apply when partnering with a for-profit organization?
19. What attributes should I look for in an E/PO lead?

SMD E/PO Policies

20. What is NASA's Science Mission Directorate (SMD) commitment to Education and Public Outreach (E/PO)?
21. How does the SMD E/PO program relate to the NASA Education Program?
22. Why has NASA's Science Mission Directorate (SMD) made a major commitment to Education and Public Outreach (E/PO)?
23. Why is SMD placing an emphasis on outreach to underserved and/or underutilized groups?

APPENDIX D

Answers to Frequently Asked Questions

1. What is the E/PO Project Activity proposal review process?

The process of handling Education proposals follows the known best and fair practices for proposal review in current use throughout SMD. (See the *Guidebook for Proposers Responding to NASA Research Announcements*Appendix C, which is available at http://www.hq.nasa.gov/office/procurement/nraguidebook/.)

Appropriately qualified scientific, and education/outreach personnel evaluate proposals using the SMD E/PO Evaluation Factors. To ensure quality and consistency in the review process, experience to date has demonstrated that review panels for E/PO proposals must include both scientists and education/outreach professionals. The substance of these reviews is conveyed to proposers as part of their usual debriefings.

In order to avoid "Conflict of Interest" during the review process, it is essential that all key personnel are identified and names and addresses of all current institutions of employment be provided.

A sample Review Form is provided in Appendix J.

2. What kind of E/PO should I emphasize in my E/PO proposal?

There is no single answer to this question as there are a wide spectrum of acceptable products and activities (see Appendix F), some of which may be of greater value for a particular locale or region. There may also be geographically convenient partnership opportunities—such as with a nearby science museum or planetarium that can serve to motivate particular types of education activities. The SMD E/PO effort recognizes that various audiences have different needs, and that impact manifests itself differently within each group of users. (See OSS E/PO Evaluation Report (2007), Lesley University http://nasascience.nasa.gov/educators/program-evaluation/NASA%202007%20Summative%20report.pdf)

There are two primary sources for information on SMD sponsored programs and products. The first is the 2006 NASA Education Portfolio Data Call Report [http://www.strategies.org/Portfolio/FinalReport.html]. The second source is the SMD EPO report [http://ossim.hq.nasa.gov/ossepo/index.html].

3. **What is the difference between "Informal Education" and "Public Outreach"?**

Both informal education and public outreach are essential elements in engaging and inspiring the public and each plays a critical role in increasing their understanding of NASA. The

following is intended to define informal education's role and distinguish it from public outreach.

The First Criteria is the Intent

In trying to distinguish whether something is informal education or public outreach the first consideration is – what is the primary intent or goal of the activity?

Outreach:

The **intent** is to raise awareness of, or interest in, NASA, its goals, missions and/or programs, and to develop an appreciation for and exposure to science, technology, research and exploration.

Education:

The **intent** is to increase learning, to educate students, educators and the general public on specific science, technology, engineering or math (STEM) content areas, and to expand the nation's future STEM workforce.

Additional Criteria

Having an educational 'intent' is not a sufficient condition to be an informal education effort. In order to qualify as 'Informal Education', as opposed to 'Public Outreach', a project has to additionally meet at least two of the following criteria:

1. **Supplemental Materials/Handouts:** Standards based education materials are used to supplement and enrich the experience, visual, or activity. [This includes adaptation of standards-based materials that were developed for formal education.]

2. **Staffing:** Staff/facilitators, trained or qualified in STEM/education fields, actively work with participants to further enhance their understanding and increase the educational value of the experience, visual, or activity.

3. **Content:** Educational standards and/or learning objectives play a key role in developing content and/or design and explore topics in-depth

Depending on their design, many products and services, such as Web sites, videos, and CD-ROMS, may be structured as informal education, or tailored more toward formal education or toward public outreach. For example, a CD-ROM might contain an interactive, standards-based curriculum for use in the classroom (formal education), or it might be an archive of captioned images for use on home computers (public outreach), or it might serve an interactive kiosk in a science museum exhibit (informal education). A website may also be cast across the E/PO spectrum. A Web site can be used to deliver a standards-based distance learning course (Formal Education), or to provide the public with a description of the latest images from another planet (Public Outreach).

Note that there are other classes of Public Affairs or Public Relations products and services that do not generally fall into the domain of E/PO as defined above (see FAQ 8). While such activities are important avenues for reaching the public, they are outside the scope of the SMD E/PO program.

4. At what level does my Project Activity have to be linked with SMD?

SMD E/PO projects must be connected to SMD science and technology. SMD desires that SMD project science be represented in the E/PO Project Activity to greatest extent practical. However, the details of a particular research area may too focused and/or too complex to be valuable for general use in K-14 education or public outreach.

The details of a particular research area may be too focused and/or too complex to be valuable for general use in education or outreach. A knowledgeable assessment of the needs of the audience, such as age-appropriateness, and/or the unique interests or special needs of the particular targeted audience should determine the focus of product or activity design.

5. What are Education Standards and what does it mean for an effort or product to align with them?

This FAQ focuses on the National Academy of Science's National Research Council science education standards. There are also educational standards in science, technology, mathematics, and geography that have been developed by a variety of scientific and educational organizations such as the AAAS Project 2061 Benchmarks. Prospective proposers and their partners should also be aware of these other disciplinary standards, as well as State Education Standards (that may be relevant when focusing on a particular geographic region) that may be pertinent to their proposed E/PO activities (see Appendix H).

The National Academy of Science's National Research Council published the National Science Education Standards (NSES) in 1995. This document is based on a nationwide collaboration of educators and scientists and is an important ingredient in modern science education reform efforts. It offers a coherent vision of what it means to be scientifically literate and how best to achieve such literacy.

The NSES content standards describe what all students – regardless of background or circumstance --should understand and be able to do at different grade levels from kindergarten through high school. The content standards are differentiated by grade level (K-4, 5-8, and 9-12) in concert with the best research on what is developmentally appropriate for students at various ages. The content standards are organized under the following headings: Unifying Concepts and Processes in Science, Science as Inquiry, Physical Science, Life Science, Earth and Space Science, Science and Technology, Science in Personal and Social Perspective, and History and Nature of Science. The way science works and evolves is at least as heavily emphasized as the actual facts and specific ideas in science, and thus scientists can offer perspective on this as well as content knowledge. For Earth and space scientists, a good place

to begin gaining familiarity is with the content standards in Unifying Concepts and Processes and in Earth and Space Science (see Appendix H for links to Standards).

A common misconception is that Standards involve content only, as if they were solely a list of facts students should know in science. It is *essential to recognize* that alignment with Standards involves much more than curricular content. There are also standards that articulate best practices in how to teach and assess student learning, how to train and professionally develop teachers, and how school districts and states can support implementation of exemplary curricular materials in an ongoing manner. Thus, aligning an educational product or activity with the *national science education standards* is a challenging prospect that is often underestimated. This points to the value of and need for effective partnering with institutions and/or personnel in the field of education who have studied the Standards carefully and who are knowledgeable and experienced in developing and implementing standards-based instructional materials and practices. Almost any scientific research project can be intellectually linked to the fundamental science concepts and processes articulated in the Standards, but *linking is not the same as aligning*.

A commonly proposed element of an education project is a curriculum or educator guide. An educator guide that is aligned with Standards has several important attributes: 1) the lesson's content is suitably fundamental and age-appropriate, 2) best instructional practices are built into the lessons, and 3) adequate teacher training is available to support the implementation of the Guide's lessons. These attributes are discussed further below.

The focus of a standards-based lesson or educational experience is on a fundamental concept rather than on details associated with a mission or research project. However, missions and research projects may be used as real-world, inspirational *contexts* for teaching fundamental concepts, say about gravity, or energy, or how scientific inquiry is done. For example, NASA's Cassini mission focuses on the study of the Saturn system. There are no science education standards that say students should learn all about the research conducted by the Cassini mission. However, there *are* Earth and space science education standards that call for the study of the Solar System in general, and the planets in particular. Standards also say students should learn about Systems, Order, and Organization, about Science as a Human Endeavor, and about the relationship between technology and scientific discovery. Cassini's exploration of the Saturn system can provide a motivational context for such standards-based learning.

Another aspect of alignment with Standards is age-appropriateness. It is not realistic to propose producing a standards-based lesson or educator guide that serves *all* grade levels *unless* special consideration is given to how the needs and expected cognitive capabilities of students at different grade levels would be addressed. A standards-based lesson will readily fit into or enhance the existing curriculum of a school devoted to science education reform.

A standards-based lesson also offers the educator/user a sound approach to instruction based on the best available research about how students learn and what teaching practices facilitate that learning. This often involves the use of what is commonly called "hands-on" activities,

but this in itself is insufficient to make the lesson pedagogically sound. Sound, standards-based lessons are very similar in structure to the way scientists do science: 1) they raise a fundamental question of interest; 2) they identify what they already know or think they know about the question; 3) they plan and implement an experiment ("hands-on activity") to address the question; 4) they examine what they learned from the experiment and reflect on how it relates to what they thought they knew; and 5) others test them out on what they have learned.

Educator guides are best disseminated in conjunction with educator workshops that include appropriately tailored background on the pertinent science and instructional practices, as well as direct hands-on experience with the standards-based lessons of the guide. Workshops aligned with standards model standards-based instruction and explicitly address both science and best teaching practices. Scientists can be effective contributors in workshop settings, both because of their depth of understanding of basic science and their experience in applying this knowledge to inspirational, real-world explorations.

6. What is the difference between "Connectivity/Continuity", "Pipeline", and "Diversity"?

Projects that address the *Pipeline* factor are primarily concerned using NASA Earth and space science as a means of increasing the number of students that develop high proficiency in those skills suitable to successful pursuit of STEM careers. This could include programs focused on retention of students in STEM subject areas and/or efforts to increase the students in STEM subject areas. Approaches include:

- Teacher and student use of NASA data, research experiences for students and teachers, exposure to career options through hands-on participation in STEM enrichment projects/activities.

- Engaging students in participatory activities, such as hands-on learning, research, the use of innovative technology, peer support groups, and mentoring relationships with professionals and college students; involving teachers in effective and extensive staff development opportunities to improve their content knowledge in STEM areas; increasing teacher participation in STEM enrichment projects/activities; and increasing parent awareness of and involvement in student academic progress in STEM activities to strengthen family support of STEM education.

- Utilization of partnerships and/or having substantive linkage with national or state education programs or involvement of community groups, corporations, research laboratories, museums, and educational/professional organizations in STEM activities.

The Connectivity/*Continuity* subfactor of *Intrinsic Merit* is directed at the means of either attracting participants to the Project Activity and/or informing participants about other NASA education and outreach opportunities. The objective is to assist participants in connecting to

other NASA education and outreach projects – providing "continuity" of experience in the "*education pipeline*".

Projects that focus on *Diversity* are primarily concerned with using NASA Earth and space science as a means of engaging of individuals from groups that are underutilized and/or underserved in science and technology (see FAQ 13).

"Pipeline and Diversity" are areas of special interest to the SMD E/PO program.

7. Are there any restrictions on what can be funded in a Project Activity budget?

All costs must be allowable under Federal Regulations. Beyond that there are some recommended guidelines in keeping with the spirit and purpose of the SMD funding:

Salaries and Wages: Salaries and wages must be connected to the effort and justified. Adequate funds should be included for partners commensurate with their level of involvement in proposed activities.

Equipment: It is not the intent of the program to purchase equipment for general use in schools, museums, planetariums, or other institutions. There must be a detailed justification for any equipment, including how it will be incorporated as an essential component into a large-scaled educational activity. Any requests for equipment must also be accompanied with certification that it will be used strictly for educational purposes both during the program and once the program is completed. Hardware such as computers, telescopes, and so on should be ancillary to the E/PO activities being proposed rather than the primary use of funding. Requested items must be essential to the successful of the project. In any event, no more that 50% of the total budget (including cost sharing and in-kind contributions) may be used for this purpose.

Travel: Travel for investigators is acceptable if it is for the purpose of disseminating information about the activities or for the purpose of attending E/PO training for scientists.

Meals and Coffee Breaks: When certain meals are an integral and necessary part of a conference (e.g., working meals where business is transacted), grant funds may be used for such meals. Grant funds may also be used for furnishing a reasonable amount of hot beverages or soft drinks to conference participants and attendees during periodic coffee breaks.

Indirect Costs: SMD requests (but does not require) that the institutional overhead for the budget be reduced or waived by the submitting organization, since such activities in many cases will be of direct value to local educational and/or public science institutions and the

budget available for this SMD E/PO program is extremely restricted.

8. Can SMD E/PO funds be used for Public Affairs or Public Relations?

In general, no. Public Affairs or Public Relations (PR) products and activities are important to public awareness, but they are not appropriate for funding by the SMD E/PO program.

PR products may include press conferences, press releases, video clips, mission-related brochures, posters, lithographs, and toys. Some of these products can be tailored or modified for E/PO uses. For example, a poster or toy could be packaged with an educational guide or insert that takes advantage of the interest and learning opportunity stimulated by the poster image or the playful appeal of the toy. A video clip and text from a press release might be adapted for use in a teacher guide or workshop. Such tailoring or development of educational products to accompany PR products is potentially fundable with SMD E/PO funds, but it should not dominate an E/PO proposal. In particular, SMD resources for E/PO should not be used for "give-away" souvenirs like coffee mugs, lapel pins, patches, T-shirts, mouse pads, and other items of limited educational value.

E/PO funds may be used to support workshops or similar types of learning experiences for journalist/media when focused on deepening their understanding of SMD science and technology.

9. How can SMD E/PO funds be used to support efforts directed towards higher education?

SMD has education and research opportunities for faculty, researchers, and post-postdoctoral fellows, and students through many competitive solicitations such as Research Opportunities in Space and Earth Science (ROSES), NASA Earth and Space Science Fellowships (NESSF), and flight mission Announcements of Opportunities. Historically SMD has placed a premium on training the next generation of scientists via the support of graduates and postgraduates in their usual scientific roles on research proposals. Science and engineering undergraduates have also become increasingly involved in SMD mission operations and scientific research. SMD support for future scientists and engineers is important and ongoing.

The list below offers some of the ways SMD E/PO funds could be used unless otherwise restricted in the solicitation. This list is not meant to be comprehensive, but to convey the spirit of the SMD E/PO interest in higher education:

- Collaboration between Earth and space science departments and schools of education to enhance the science literacy of students preparing to become K-12 teachers
- Employing a graduate student in education to work on the design and development of educational products and materials or the evaluation of an E/PO activity
- Enhancing introductory undergraduate courses in Earth or space science for non-science majors at community colleges as well as 4-year colleges and universities

- Workshops on how to do successful classroom outreach for science and engineering graduates and undergraduates involved in SMD research and development efforts
- Developing and/or enhance courses for science majors in SMD research fields
- Collaborations with minority institutions to develop undergraduate coursework and/or experiential opportunities that promote increased minority interest and participation in science and engineering (see FAQs 13, 21)
- Development and/or enhancement of research opportunities for undergraduates in SMD research areas, such as "Student Collaborations" for development of ground and/or flight software/experiments and data analysis in connection with SMD missions

10. What format should be used for proposal budgets?

The proposals through NSPIRES and grants.gov use budget forms similar to the sample in Appendix K. The proposal must reflect the entire cost of the effort including cost sharing and in-kind contributions. The budget should indicate the amount (if any) of cost sharing and in-kind contributions.

Cost Sharing includes items such as wavier or reduction of overhead expenses, personnel costs, and/or other direct charges.

In-kind contributions includes the value of services rendered, goods donated, facilities provided.

11. What is evaluation and how important is it to include as a funded part of my E/PO Project Activity?

Evaluation of project efforts is required. The evaluation is primarily designed to determine if the objectives of the project have been achieved. Clear definition of project objectives will point to the way to determining what needs to be measured. Discussions with experienced evaluators can assist in the clarification of the project objectives and can be valuable even in the proposal development phase.

Methods of evaluation include focus groups, surveys, observations, follow-up interviews, pre- and post-testing, and many other techniques.

Evaluation should be geared to the scale and type of a proposed effort. The proposed evaluation should be appropriate for the scale and type of the activity; for instance, a small education effort might use pre-test/post-tests at a workshop or web surveys; a larger effort might include an educator survey conducted by education students at a local university to determine longer-term impact. It is useful to follow standard methods or consult an individual trained in research and evaluation methods when designing an evaluation procedure, even when the evaluation is to be done informally by the proposer(s).

There are generally three stages of evaluation. "Front End" evaluation, done very early in the planning stages, can help determine where there is need, interest, or potential confusion

regarding an envisioned product or activity and its intended audience. "Formative" evaluation improves the effort while it is being developed: pilot testing is a good example of formative evaluation. "Summative" evaluation looks at the results of an effort: how effective it was, whether it met the stated intentions, whether it had other unanticipated effects, and so on. Summative evaluation tends to be the most formal and is often done to publish the lessons learned so they can be used for future projects.

12. How do I demonstrate a Customer Needs Focus?

NASA education and public outreach activities are undertaken to benefit the agency and the target audience. It is necessary to establish that both the target audience(s) and NASA have an interest and need for the products and opportunities that would be made available through the E/PO activities. The interest/need should be specific to the proposed efforts and products. The interest and needs of the target audience are established by published documents, surveys, interviews, letters of interest, etc. from members of the target audience. For example, the NASA Explorers Institute program report documents the output of focus groups related to informal education needs. This report is available through this URL http://education.nasa.gov/divisions/informal/overview/F_pathfinder_explorer_institute.html

Interest and need by NASA may be established by reference to appropriate portions of the NASA strategic plan or similar SMD documents.

13. What is meant by "underutilized" and "underserved" groups in science and technology?

The terms "underutilized" and "underserved" have special meaning in this context. In Equal Opportunity organizations, the operative phrase is "underrepresented in science and engineering" which is currently defined as individuals of Hispanic, African American, Pacific Islander, and Native American origins. In particular, all federal agencies, including NASA, have legislative and White House mandates to increase their support to minority universities. Such universities include Historically Black Colleges and Universities (HBCUs), Hispanic Serving Institutions (HSIs), Tribal Colleges and Universities (TCUs), and other institutions certified by the Department of Education as having more than 50% combined minority undergraduate enrollment. A complete list of all accredited minority institutions is available from the Department of Education at http://www.ed.gov/about/offices/list/ocr/edlite-minorityinst.html (also see Appendix H).

The terms "underutilized" and "underserved" encompass "underrepresented," but also include more. Use of the term "underutilized" recognizes that there are groups of people who have the talent and ability to participate in the SMD program and thus should be involved, but for one reason or another, they are not now involved. Such groups obviously include minorities but also include women and the physically challenged.

Use of the term "underserved" recognizes that there are people in areas where goods or services are in short supply. For example, this term is usually applied to individuals in small towns, rural communities, or in economically depressed areas where key services are

frequently not available. The usage of "underserved" in this context is also intended to include groups with which NASA has not historically had a significant relationship, such as students at community colleges.

14. How can I expand the scope of my Project Activity in order to get the most out of proposed funding?

There are many strategies for enhancing the value or cost-effectiveness of a project including the creative use of existing Earth and space science community resources (e.g., scientists and engineers, observatories, mission operations facilities, computers, science imagery and other data). Some general strategies to expand the scope of a project are listed with examples below:

- Having a substantive impact beyond the direct beneficiaries (e.g. having a "waterfall effect" where a program trains master teachers e.g. Solar System and Astrophysics Educator projects.)
- Capitalizing on dissemination techniques and infrastructures that can reach relatively large audiences (e.g. science museums, planetariums, radio, television, Internet, traveling exhibits – see FAQ 15).
- Drawing on (or leveraging) resources beyond those directly requested (e.g. partners provide cost sharing, in-kind contributions, or existing capability and infrastructure that would be cost ineffective to recreate from scratch)

15. How can I disseminate products developed by our Project Activity?

All NASA-sponsored awardees are required to submit their Earth and space science education products and resources for review and potential broader dissemination. This review does not take the place of formative evaluation of education materials and it is expected that products have been reviewed for scientific accuracy and educational value, as well as field-tested by teachers and/or students as appropriate. Earth and Space Science products should be submitted to http://www.strategies.org/nasareviews

Once a product or resource has passed the review, it may be disseminated broadly through NASA assets such as the NASA Space Grant Consortia, NASA CORE, and NASA Aerospace Education Specialists. In addition materials may be posted online at the NASA Education portal Web site, the SMD education Web site, or the SMD Science Education Resource Directory (http://teachspacescience.stsci.edu/).

16. What attributes should I look for in an E/PO partner?

Desirable qualities to look for include:

- substantial experience in managing the development of Earth/space science-related E/PO products and activities
- significant experience in presenting SMD science effectively to a large and diverse public audience

- a history of positive professional association with both the science and education communities
- credible expertise relevant to the assigned project element, openness and ability to engage scientists in meaningful and efficient ways in outreach efforts
- geographical or institutional desirability in terms of access to scientists and/or to underserved or underrepresented populations
- willingness to contribute the use of existing infrastructures, capabilities, or programs that could be leveraged for dissemination or evaluation of products and events (e.g., museum and planetarium programs, an ongoing series of educator workshops, a distance learning infrastructure, a national network of outlets for educational resources, or a radio/television/Internet broadcast capability)
- willingness to provide matching funds or in-kind contributions.

17. What specific requirements apply when partnering with a for-profit organization?

NASA policies prohibit offering a grant, contract or subcontract for the sole purpose of generating a potentially marketable (retail/for profit) educational end product such as a book, video, CD-ROM, slide set, poster, computer software, or web-based activity/resource. Funds can be awarded for an activity that might incorporate the use and assessment of a developed product. Example: A proposed program may involve the development of a product, but this product would be part of a larger activity and would be distributed either for free or at cost, and be subject to all SMD E/PO Evaluation Factors.

In addition, it is strongly encouraged that any co-investigator or partner/individual with a salaried position in a for-profit company sign a non-disclosure agreement to avoid potential conflicts of interest directly related to the intellectual property rights of other E/PO team members and partnering institutions. If an individual or company is unwilling to comply with this request, it is usually not advisable to proceed with the proposed partnership.

FAQs: SMD E/PO Policies

18. What is NASA's Science Mission Directorate (SMD) commitment to Education and Public Outreach (E/PO)?

Historically NASA has placed a premium on training the next generation of scientists via the support of graduates and postgraduates in their usual scientific roles on research proposals. Such support for future scientists is important and ongoing. The SMD E/PO program expands the SMD role in education to meet national needs for improving pre-college science education and enhancing general literacy in science, mathematics and technology. This means supporting the involvement of the science community in partnership with the education community to enhance science, technology, engineering, and mathematics (STEM) education and the public understanding of science. SMD devotes a substantial level of resources toward its E/PO program. Every NASA Science Mission Directorate (SMD) flight project proposal (AO) is *required* to include a meaningful segment on E/PO.

19. How does the SMD E/PO program relate to the broader NASA Education Program?

There is only one NASA Education program. It is coordinated by the Office of Education. Management of various programs is vested in several organizations including the Office of Education, NASA Directorates (such as the Science Mission Directorate), and the NASA Field Centers.

20. Why has NASA's Science Mission Directorate (SMD) made a major commitment to Education and Public Outreach (E/PO)?

The NASA science research and development community has earned an international reputation for outstanding scientific achievement. Discoveries are abundant as scientists probe into the depths of a familiar night sky or our own home planet. This discovery-rich quality also makes Earth and space science an inspirational context for science education and public outreach (E/PO). The SMD E/PO strategy reflects the conviction that with key partnerships and cleverly leveraged efforts, the Earth and space science community can take greater advantage of its inspirational assets to have a powerful, positive impact on education in America.

Successful science education produces a science literate public who appreciates the nature of science; science literate educators, journalists, artists, politicians and business leaders who can recognize and articulate the value of science in society; and a diverse, high-quality technical work force. It is clearly in the enlightened self-interest of the space science community to bring the power of its inspirational endeavors more deliberately to bear in support of these outcomes.

21. Why is SMD placing an emphasis on outreach to underserved and/or underutilized groups?

Profound changes in the composition of the population of the United States are now taking place. According to projections by the Bureau of the Census:

> By 2030, the total elementary school age population of the United States will be equally divided between non-Hispanic whites and all other racial/ethnic groups combined.
>
> From 2030 to 2050, Native Americans, Asian/Pacific Islanders, Hispanics, and African Americans will together far outnumber non-Hispanic whites in elementary schools, high schools, and new entrants into college and the workforce.
>
> By 2050, non-Hispanic whites will decline to 53 percent of the total US population (all ages).

Thus, meeting the future needs of a society based on science and technology will require the involvement of individuals from groups who, at the current time, are not as effectively utilized as they should be in science and technology. In addition, these underserved and/or underutilized groups are significantly more underrepresented in space science than they are in science and technology as a whole. SMD is committed to playing a substantive role in addressing the need for outreach to these underrepresented groups to help ensure the future supply of scientists and engineers, and educate all people about the important role that science and technology plays in their lives).

APPENDIX E

Key NASA Links

NASA Strategy and E/PO Implementation Documents

(1) NASA Office of Education Strategy
http://education.nasa.gov/about/strategy/index.html

(2) 2006 NASA Strategic Plan
http://www.nasa.gov/pdf/142302main_2006_NASA_Strategic_Plan.pdf

NASA Information

(1) NASA Science Mission Directorate
http://nasascience.nasa.gov/

(2) NASA Office of Education
http://www.nasa.gov/offices/education/about/index.html

Resources for Researchers and Educators

(1) SMD E/PO information for researchers
http://nasascience.nasa.gov/researchers/education-public-outreach

(2) Overviews of SMD Missions and their E/PO projects
http://nasascience.nasa.gov/missions

(3) Earth Science Education Catalog
http://nasascience.nasa.gov/educators/earth-science-education-catalog

(4) NASA Space Science Education Resource Directory
The Education Resource Directory provides Internet access to top-quality educational resources produced by NASA's Space Science Education and Public Outreach programs
http://teachspacescience.stsci.edu

(5) NASA Reviewed Collection
The NASA Science Reviewed Collection provides educators and students with a direct line of access to quality products reviewed through the NASA product review. The resources have been rigorously reviewed by an independent peer review of teachers, curriculum and design specialists, teacher trainers, and Earth system scientists. The review of the learning resources is based on their scientific accuracy, educational value, documentation, ease of use, their power to engage or motivate students, their robustness/sustainability as a digital resource, and ability to foster mastery of significant understandings or skills. Resources in the collection support the NASA Science Mission Directorate: Earth and Space Science education missions.

http://www.dlese.org/dds/histogram.do?group=subject&key=eserev

(6) Educators' Resources for Earth and Space Science: Teacher's guides, education programs, and learning resources
http://nasascience.nasa.gov/educators

(7) Space Science Is for Everyone: Creating and Using Accessible Resources in Educational Settings
The brochure is offered as a tool for science, technology, engineering and mathematics educators who are working with students with disabilities. Some activity descriptions are supplemented with case study examples addressing a particular disability. In addition, contributing educator-authors have provided a variety of lessons learned from formal education (Pre-K through 12th-grade), home school education, and informal or "free-choice" education learning venues, such as science centers, museums and planetariums.
http://www.nasa.gov/pdf/259240main_Space_Science_Is_for_Everyone.pdf

(8) NASA Science Mission Directorate Education and Public Outreach Annual Reports
http://ossim.hq.nasa.gov/ossepo/

(9) *Voyages in Education and Public Outreach*: A NASA Space Science Newsletter
Voyages served as a vehicle for sharing the NASA Space Science's latest events and accomplishments in Education and Public Outreach. Past issues are available here.
http://nasascience.nasa.gov/researchers/education-public-outreach/voyages-in-education-and-public-outreach

(10) Abstracts of SMD proposals selected for Education and Public Outreach Opportunities in Earth and Space Science (2006)
http://nasascience.nasa.gov/researchers/sara/library-and-useful-links/EPOESS06_Selections.pdf

(11) Resources For Scientists In Education And Public Outreach These resources include several papers and presentations by authors who have significant experience at the interface between the realms of scientific research and K-12 education and public outreach (E/PO). The resources fall into 6 Categories: 1. Making the Case for Scientist Involvement in Education and Public Outreach 2. The Roles of Scientists in Education and Public Outreach 3. Guidance for E/PO Program and Proposal Planning 4. Guidance for E/PO Product Development 5. Professional Development Opportunities for Scientists and E/PO Leaders in Education 6. Access to the E/PO Community
http://www.spacescience.org/education/extra/resources_scientists_cd/

(12) Roles Matrix for Scientists in Education and Public Outreach
http://www.spacescience.org/education/extra/resources_scientists_cd/Source/Roles.pdf
The Roles Matrix is designed to raise awareness about the great diversity of education and public outreach roles scientists can play. The Matrix offers a framework that describes the different levels of involvement in a variety of activities that contribute to improving science education in both formal and informal settings.

(13) Space Science Media Needs of Science Center Professionals
http://cse.ssl.berkeley.edu/spacescience.pdf
The Sun-Earth Connection Education Forum interviewed twenty-nine science center professionals to explore ways to better meet their media needs. ("Media" refers to images, animations, simulations, and videos, etc.) Key recommendations are discussed.

(14) NASA Educational Resources In Other Languages

http://www.teresakennedy.com/NASALanguageMaterials2.htm
A comprehensive list of over 50 NASA programs and resources in Spanish and many other languages.

(15) Trends in International Mathematics and Science Study (TIMSS)
http://nces.ed.gov/TIMSS/
TIMSS responses to the need for reliable and timely data on the mathematics and science achievement of our students compared to that of students in other countries. The TIMSS provides trend data on students' mathematics and science achievement from an international perspective.

Archives

(1) History of OSS E/PO Program
http://nasascience.nasa.gov/researchers/education-public-outreach/strategy/Cospar_Manuscript.pdf

(2) "Partners in Education: A Strategy for Integrating Education and Public Outreach into NASA's Space Science Programs"
http://spacescience.nasa.gov/admin/pubs/edu/educov.htm

(3) "Implementing the Office of Space Education & Public Outreach Strategy"
http://spacescience.nasa.gov/admin/pubs/edu/imp_plan.htm

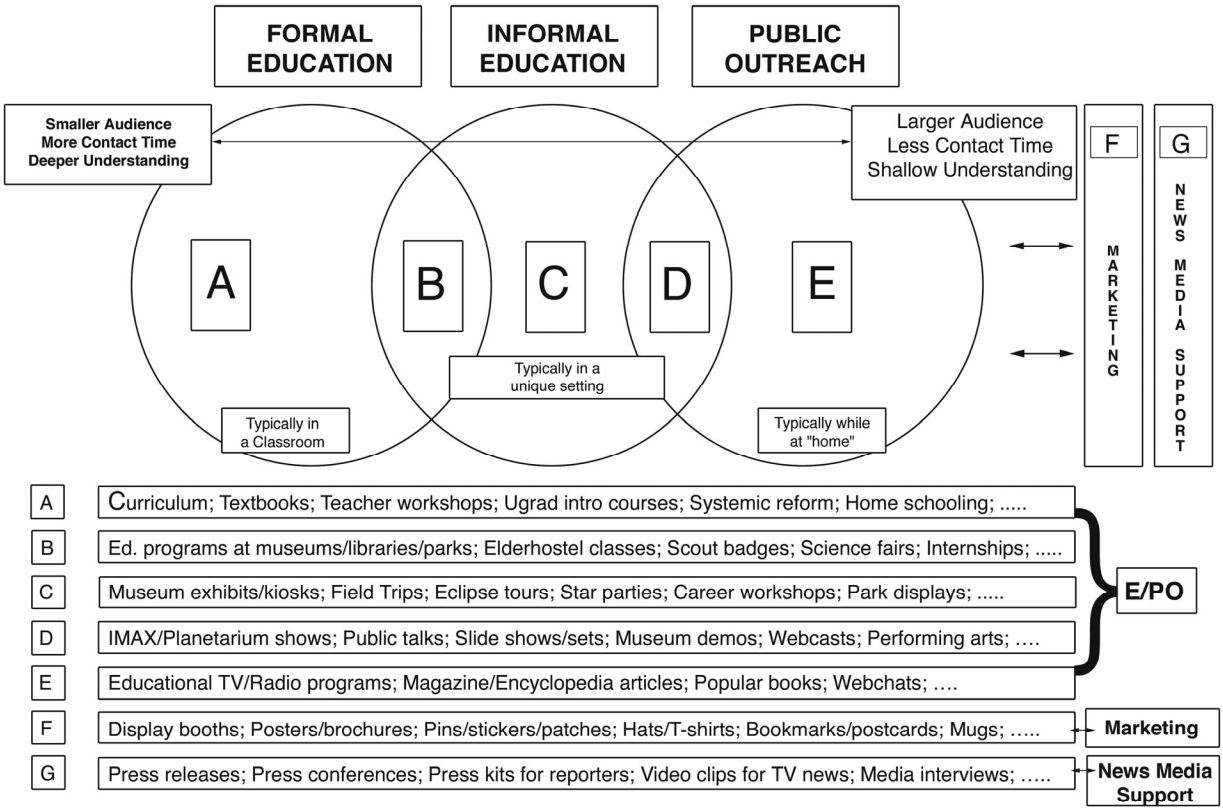
(4) "Implementing the Office of Space Science Education/Public Outreach Strategy: A Critical Evaluation at the Six-Year Mark"
http://nasascience.nasa.gov/educators/program-evaluation/OSS_EPO_Task_Force_Report.pdf

(5) NASA Space Science E/PO Summative Evaluation Report (2007), Lesley University
http://nasascience.nasa.gov/educators/program-evaluation/NASA 2007 Summative report.pdf

(6) Earth Science Education Roadmap 2005
http://nasascience.nasa.gov/about-us/science-strategy/past-strategy-documents/OutreachPlan.pdf

APPENDIX F

Education and Public Outreach Venn Diagram*



A two page white paper entitled, "A Framework for Planning Education and Public Outreach Programs Associated with Scientific Research Programs" (C.A. Morrow, 2000) offers a more complete description of this diagram. It is available online from http://www.spacescience.org/education/extra/resources_scientists_cd/Source/Venn.pdf

APPENDIX G:

A SAMPLE of ROLES for Scientists, Technologists, Engineers, and Mathematicians in EDUCATION and PUBLIC OUTREACH (E/PO) (adapted from C. A. Morrow, 2000)

		Nature of E/PO Involvement		
Entry Point		**ADVOCATE**	**RESOURCE**	**PARTNER**
	K-12 STUDENTS	• Participate in PTA	• Judge a science/technology fair • Answer student E-mail • Give tour of a research facility	• Mentor a student • Tutor a student
	IN-SERVICE K-12 TEACHERS	• Speak out in support of appropriate professional development opportunities for teachers.	• Answer teacher email • Present in teacher workshop	• Work with a teacher to implement curriculum. • Hire a teacher intern.
	INTRO UNDERGRADUATE SCIENCE TEACHING	• Speak out in a faculty meeting in favor of attention to educational research that supports the reform of undergraduate STEM teaching. • Support the teaching profession in your classroom.	• Teach a segment of a STEM or STEM methods course for preservice teachers.	• Teach an intro science course that applies innovative inquiry-based methods • Develop a STEM course or curriculum in your department for teachers-to-be.
	SCHOOLS OF EDUCATION (Science Courses for Preservice Teachers, Graduate Students, Faculty Members)	• Speak out in your department or organization in favor of closer ties with Colleges of Education • Support the teaching profession in your classroom	• Teach a segment of a STEM course or science methods course for preservice teachers. • Collaborate with education faculty to improve courses on teaching science	• Hire a graduate in education as evaluator of an education project • Work with an Education professor to develop a new "STEM methods" course for teachers-to-be.
	SYSTEMIC CHANGE (District, State, National)	• Speak out at professional meetings about the importance and value of involvement in systemic change.	• Review STEM standards for accuracy.	• Collaborate on writing or adapting STEM standards.
	EDUCATION MATERIALS DEV. (NSRC, EDC, Lawrence Hall)	• Speak out at a school board meeting for adopting exemplary educational materials.	• Review STEM educational materials for science accuracy.	• Collaborate to create exemplary STEM education materials.
	INFORMAL EDUCATION (e.g., Science Centers, Scouts, After-school Programs, Planetaria, Elderhostels, Amateur Astronomy Groups)	• Participate on the board of a science center or planetarium.	• Review scripts for science exhibit or planetarium show. •Serve as a science advisor for an exhibit or program.	• Create content for a museum science exhibit or planetarium show. • Serve as science coordinator for a scout troop
	PUBLIC OUTREACH (e.g., NPR, PBS, popular magazines/ books/ encyclopedias, lectures, public Web sites)	• Advocate that quality science and technology news be covered by your local newspapers and television stations	• Give a public lecture • Review an article or Web site on science for accuracy and currency	• Collaborate in the production of a PBS television show • Write an article for a popular science magazine

APPENDIX H

Links to Science, Math and Technology Education Standards

Academic content standards describe what every student should know and be able to do in the core academic content areas (e.g., mathematics, science, geography). Content standards should apply equally to students of all races and ethnicities, from all linguistic and cultural backgrounds, both with and without special learning needs.

Science Standards
NRC National Science Education Standards
http://www.nap.edu/books/0309053269/html/index.html)
Describes the science standards created by the National Research Council.

AAAS Project 2061 Benchmarks
(http://project2061.aaas.org/tools/
Describes the science standards created by the American Association for the Advancement of Science.

Mathematics Standards
http://standards.nctm.org/
Describes the mathematics standards created by the National Council of Teachers of Mathematics.

Technology Standards
http://cnets.iste.org/
Describes the technology standards created by the International Society for Technology in Education.

State Standards
http://www.academicbenchmarks.com/search/

APPENDIX I

Links to Organizations Serving Underserved/Underutilized Populations

NASA Minority University Research and Education Programs
http://www.nasa.gov/audience/foreducators/postsecondary/features/F_MUREP.html

American Indian Higher Education Consortium (AIHEC)
http://www.aihec.org/

American Indian Science and Engineering Society (AISES)
http://www.aises.org

National Organization for the Professional Advancement of Black Chemists and Chemical Engineers (NOBCChE)
http://www.nobcche.org

National Society of Hispanic Physicists (NSHP)
http://www.hispanicphysicists.org/

National Society of Black Physicists (NSBP)
http://www.nsbp.org

Society for the Advancement of Chicanos and Native Americans in Science (SACNAS)
http://www.sacnas.org

Coalition to Diversify Computing (CDC)
http://www.cdc-computing.org/

National Federation of the Blind (NFB)
http://www.nfb.org/nfb/Default.asp

Association for Women in Science
http://www.awis.org/

APPENDIX J
Sample E/PO Proposal Evaluation Form

NASA SCIENCE MISSION DIRECTORATE
EDUCATION AND PUBLIC OUTREACH PROGRAM

E/PO Proposal Evaluation Form

Proposal Number:	**PI Name:**	**Version:**
Proposal Title:		
Submitting Organization/Institution:		

Brief Summary of Proposed Project:

FACTORS:	**EXCELLENT**	**VERY GOOD**	**GOOD**	**FAIR**	**POOR**
1. **Intrinsic Merit** - Quality, Scope, Realism, and Appropriateness - Connectivity (Continuity) - Partnership Leverage/Sustainability - Evaluation					
2. **Relevance to NASA** - Customer Needs Focus - Content					
3. **Cost** - Resource Utilization					

FACTORS:	**EXCELLENT**	**VERY GOOD**	**GOOD**	**Not Addressed**
4. **Program Balance Factors** - Pipeline - Diversity				

Strengths:

Weaknesses:

Overall Comments:

Appendix K

Budget Summary for Proposed E/PO Activity

	Year 1	Year 2	Year 3	Cum
A. Direct Labor - Key Personnel				
B. Direct Labor - Other Personnel				
Total Number Other Personnel				
Total Direct Labor Costs (A+B)				
C. Direct Costs - Equipment				
D. Direct Costs - Travel				
Domestic Travel				
Foreign Travel				
E. Direct Costs - Participant/Trainee Support Costs				
Tuition/Fees/Health Insurance				
Stipends				
Travel				
Subsistence				
Other				
Number of Participants/Trainees 0				
F. Other Direct Costs				
Materials and Supplies				
Publication Costs				
Consultant Services				
ADP/Computer Services				
Subawards/Consortium/Contractual Costs				
Equipment or Facility Rental/User Fees				

Alterations and Renovations				
Other				
G. Total Direct Costs (A+B+C+D+E+F)				
H. Indirect Costs				
I. Total Direct and Indirect Costs (G+H)				
J. Fee				
K. Total Cost (I+J)				
Total Cumulative Budget				

APPENDIX L

Mission E/PO Lead Sample Position Description

The E/PO manager will be responsible for the overall planning, management and coordination of all formal and informal education activities.

Position duties and requirements:

1. In collaboration with the science and technology team members design and develop a suite of formal education materials/products and resources aligned with the Mission science objectives. (15%)
2. Alignment and coordination of formal and informal education activities. Develop and coordinate a series of informal education activities, products and events aligned with key Mission milestones. (15%)
3. Assume overall responsibility for the management and reporting of the Mission E/PO budget expenditures and assume all NASA HQ reporting requirements. Develop an end-to end schedule of activities, events and deliverables appropriately aligned with the Mission E/PO budget. (10%)
4. Insure all partner institutions/organizations, and co-investigators (museums, universities, and all other sub-contracting organizations) are compliant with NASA Guidelines and have formal institutional authorization for participation. Insure adherence to SMD E/PO policies and guidelines as they pertain to various partner/collaborative organizations as well as all other general legal requirements for federally funded research activities. (5%)
5. Function as representative for the Mission E/PO Program at appropriate professional society meetings and various NASA education events. (5%)
6. Responsible for insuring all educational products developed for the Mission E/PO program (including curricular materials, and all on-line activities and products) align with Mission science objectives as well as appropriate national education standards, are <u>independently</u> evaluated and are made available to the education community in accordance with NASA SMD policies and requirements. (15%)
7. Coordinate participation of Mission Scientific and technical team members for various Mission Public Events. (15%)
8. Participate in other programs, and activities such as workshops, events, and Public Presentations as required. Various other duties relevant to Mission E/PO effort as required. (20%)

Educational Requirements, Skills and Experience:

1. Understanding of SMD Education and Public Outreach and the current Exploration Programmatic goals.
2. Terminal degree in relevant area of scientific expertise or in science, mathematics, or technology education with a minimum of five years of relevant experience leading large, preferably national scale education programs that focus on content relevant to NASA Science Mission Directorate content areas. A minimum of 10 years of relevant experience in a Formal Science/Mathematic/Technological Education setting with increasing duties that demonstrate successful progression into a leadership/managerial role may be considered in lieu of a terminal degree.
3. Candidates without terminal degree in science/math/technology must demonstrate experience and understanding of relevant science, math, and technical content areas and ability to communicate and work effectively with scientific and technical staff.
4. Candidates without significant K-12 educational expertise must demonstrate experience and ability to interact effectively with formal/informal education community and address current National Science, Mathematics and Technology Education requirements.
5. Significant experience working effectively with underserved communities and awareness of the unique educational needs of these communities.
6. Excellent oral and written communication skills and formal presentation skills. Ability to work effectively as a team member and diverse national audiences with a wide range experience, interests and abilities.
7. Flexibility and ability to adapt and function effectively in a fast-paced working environment.