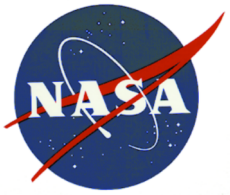
National Aeronautics and Space Administration



Explanatory Guide to the NASA Science Mission Directorate Education & Public Outreach Evaluation Factors

Version 3.0
April 2008

The most current version of this document can be downloaded at

http://science.hq.nasa.gov/research/guide.htm

If you have comments or questions, please send email to

HQ-SMD-ROSES-EPO@mail.nasa.gov

Contents

Appendices

Change History

October 2006 Version 1.0	*Explanatory Guide To The NASA Science Mission Directorate Education & Public Outreach Evaluation Factors* was released. It is based on update of the *Explanatory Guide To The Office Of Space Science Education & Public Outreach Evaluation Factors Version 3.0, (March 2004)* to account for the merger of the Office of Space Science and the Office of Education. Changes from the OSS Guide were to replace Office of Space Science with Science Mission Directorate throughout the text, to insert Earth science in places where only space science had been cited, update URLs, and to add reference materials from the Earth Science program.
December 2006 Version 2.0	Updated the *Explanatory Guide To The NASA Science Mission Directorate Education & Public Outreach Evaluation Factors* to Version 2.0. Evaluation Criteria were updated to align the evaluation factors with education policies as of December 2006. Additional Frequently Asked Questions were added.]
April 2008 Version 3.0	Deleted references to Broker/Facilitators and supplemental E/PO awards throughout. Added detail on Outreach goals. Clarified language in Evaluation Factors concerning linkage to SMD Science and target audience needs. Revised FAQ 13 to include discussion of "Continuity" Factor. Added links to new projects. Revised/deleted outdated links.

Preface

NASA's founding legislation, the Space Act of 1958, 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 has a portfolio of investments in Higher Education, Elementary and Secondary Education, Informal Education, and Outreach. It is a major contributor to the overall NASA education and outreach effort.

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 Agency 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. The NASA Science Mission Directorate is a major contributor to the overall NASA education and outreach effort. The Directorate's Education and Public Outreach (E/PO) efforts are rooted in the efforts of its predecessor organizations, the Office of Space Science and the Office of Earth Science, that were merged in 2004 to become the Science Mission Directorate.

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.

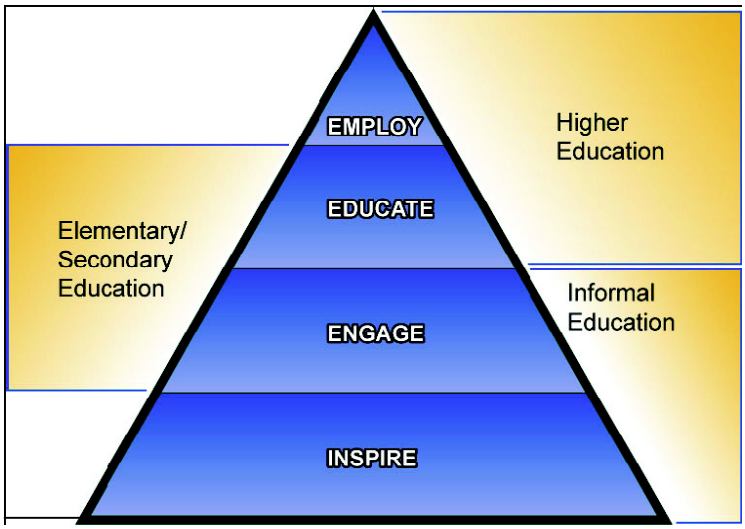


Figure 1

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.

In addition to education, outreach is 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. Outreach can be directed at any audience including students, teachers, citizen scientists, and the general public.

The Evaluation Factors discussed in this guide are the means by which NASA SMD evaluates its education and outreach investments. They guide investigators in aligning their proposed efforts with the goals and objectives of NASA and SMD education and outreach. These Factors serve as the basis for evaluating proposed E/PO activities. It is vital that everyone concerned (i.e., proposers, E/PO partners and facilitators, reviewers) have a common understanding of what these factors mean in practice. This Explanatory Guide to the SMD E/PO Evaluation Factors is intended to support the development of such a common understanding. The Guide provides a brief elaboration of each of the SMD E/PO Evaluation Factors. These descriptions include references to pertinent information in the next section of the Guide that addresses Frequently Asked Questions (FAQ), and they also include "Indicators" that may be used by both proposers and reviewers to assess how well an E/PO proposal segment meets the Evaluation Factors.

The Guide provides answers to questions frequently asked (FAQ) by members of the NASA SMD science community who are preparing an E/PO segment to an SMD proposal.

The information contained in this document is intended to give a flavor of what exemplary E/PO 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 through *E/PO Opportunities* at the NASA SMD Web site

http://science.hq.nasa.gov/index.html

If you have comments or questions, please send E-mail to

HQ-SMD-ROSES-EPO@hq.nasa.gov

Glossary

Announcements of Opportunity (AO) - This is generally used to solicit proposals for unique, high cost research investigation opportunities that typically involve flying experimental hardware provided by the proposer on one of NASA's Earth-orbiting or free-flying space flight missions. Selections through AO's can be for periods of many years, involve budgets of many millions of dollars for the largest programs, and usually are awarded through contracts, even for non-profit organizations, although occasionally grants are also used.

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.

Cooperative Agreement Notice (CAN) - This is used to solicit ground-based research opportunities in which a fairly high degree of cooperation and interaction is expected between NASA and the selected institutions for completion of proposed research activities that further one of NASA's strategic objectives (e.g., to develop a research institute, an extensive educational/public outreach activity or provide technology transfer to develop a capability to enhance U.S. competitiveness). Further, the announced program intends a level of sponsorship, in the form of cost or resource sharing from both parties of the agreement. A CAN results in the award of a cooperative agreement.

TMCO Panel – A group of highly qualified subject area experts utilized by NASA to evaluate the Technical, Cost, Management, and Other Factors associated with major flight mission projects.

NASA Education Program – NASA has established five overarching Education programs 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.

Science Mission Directorate Education Project – Science Mission Directorate education project are an identifiable component of a Science Mission Directorate education program. These contribute to the NASA Education programs.

Science Mission Directorate Education Activity – an education activity is an identifiable component of a Science Mission Directorate education project.

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.

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.

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

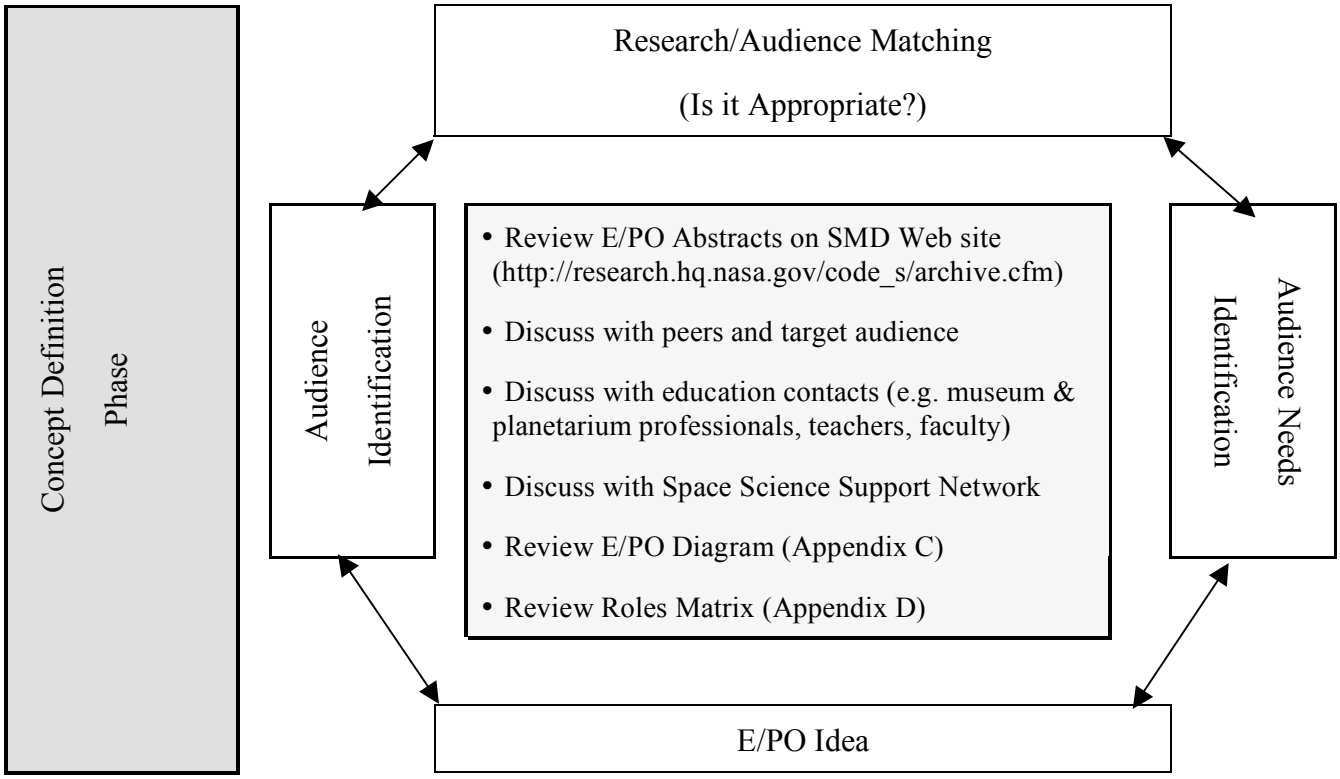
Science Mission Directorate
Education And Public Outreach Proposals
Quick Start Help

Developing a Science Mission Directorate (SMD) Education And Outreach (E/PO) proposal for the first time 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, resources they can consult, and provided a network of people (the Space Science Support Net – see FAQs 5-8) around the country to assist them.

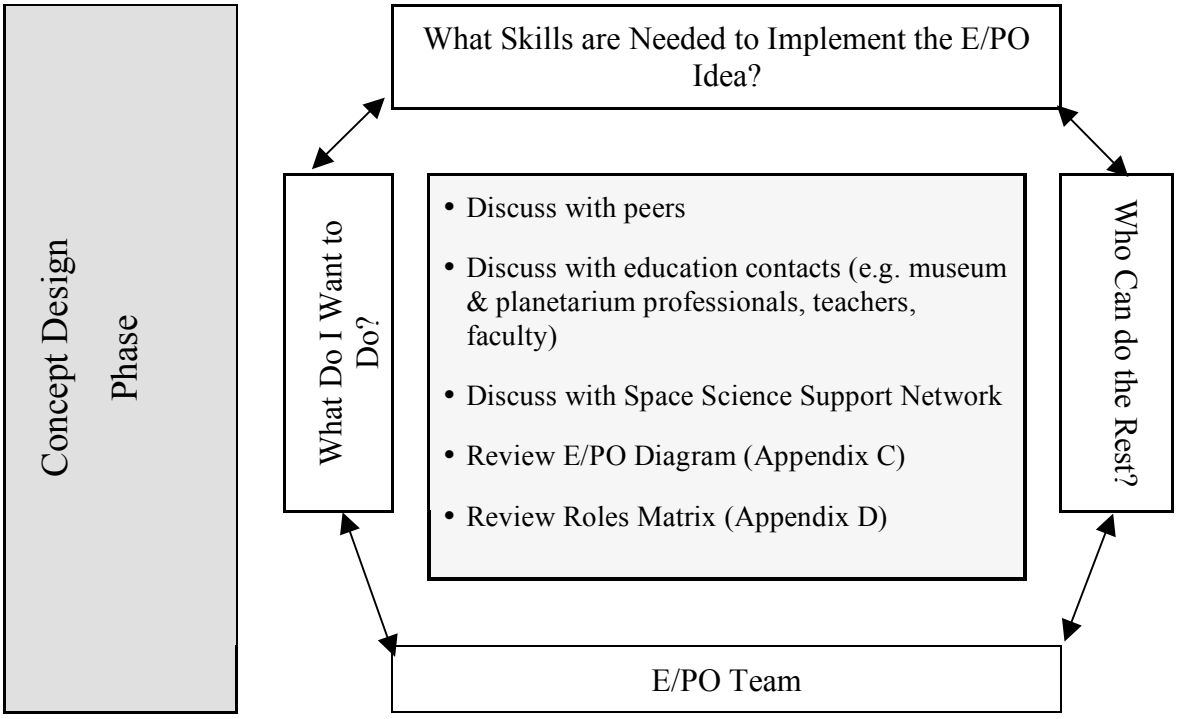
Step 1: Review the SMD E/PO Evaluation Factors (Section 1 of Guide). Understand what types of E/PO ideas can be funded by the SMD E/PO program.

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 science you are doing.



Step 3: Review the SMD E/PO Indicators of Alignment (Section 2 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.



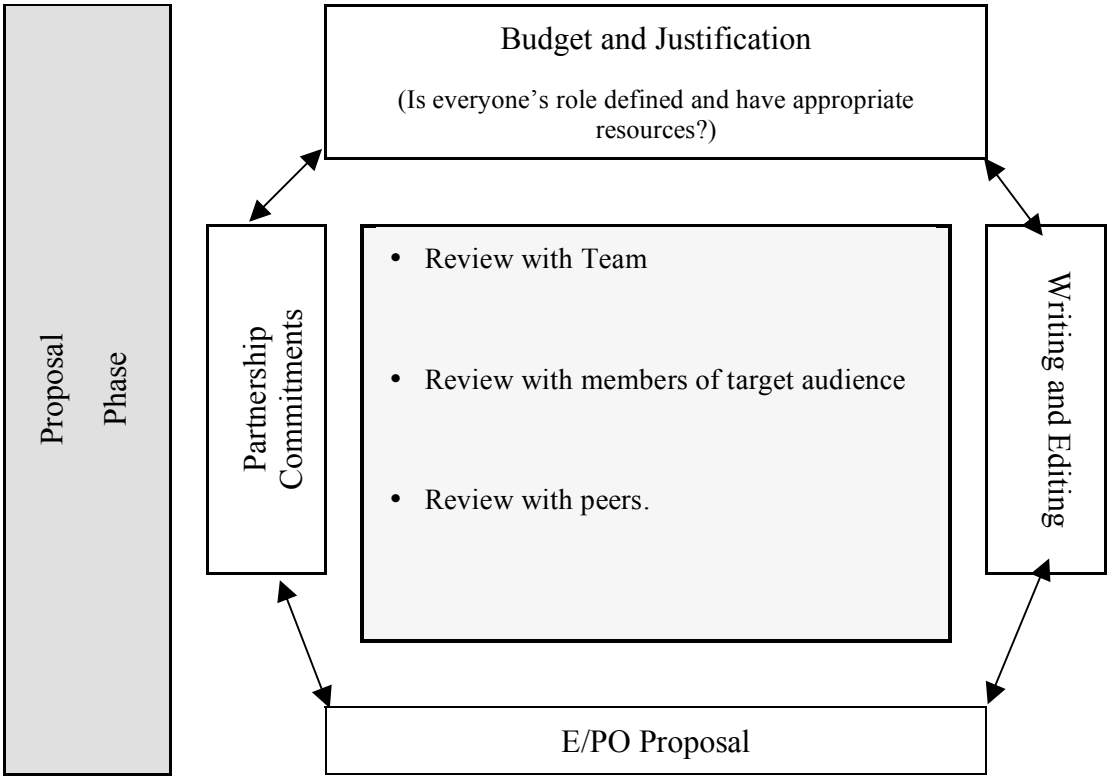
Don't overlook program evaluation—Evaluation should be geared to the scale and type of a proposed E/PO effort. Smaller E/PO activities, such as those responding to an NRA, might use simple, informal, or very specific evaluation methods like pre- and post-tests, questionnaires, or a focus group. The person doing the evaluation should be knowledgeable in the use of the selected evaluation approach. Space Science E/PO Support Network members can assist in identifying potential reviews.

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 the Space Science Support Network.

Step 6: Prepare Your Proposal—this is usually an iterative process between the team members.

Reviews by the target audience 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.

E/PO projects/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.

The financial scope of E/PO segments submitted in response to Announcements of Opportunity (AO) will be significantly greater than that of NASA Research Announcements (NRA). Because of the limited financial scope of NRA projects/activities, a sound, well posed, and focused effort that will clearly be effective in reaching its intended target audience is preferable to an unrealistically broad effort.

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 EPO proposals of essentially equivalent overall rating based on 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.

Individual solicitations may have alternative evaluation factors as appropriate to the solicitation. For example "Student Collaborations" are a Higher Education opportunity introduced in the 2006 solicitations for the Discovery and Mars Scout programs. An additional requirement was that the Student Collaboration activity had to be separable from baseline science investigation and performance floor science investigation of the mission.

Intrinsic Merit

1. Quality, Scope, Realism, and Appropriateness: Projects and activities have a clear intellectual linkage to SMD science/technology and the science/technology of any associated research effort, are clearly organized, consistent with the requested budget, have clear lines of management responsibilities, and demonstrate a high probability for successful implementation.

2. Continuity: Projects and activities draw from audiences that have demonstrated interest in NASA and connect participants to the next level of engagement.

3. Partnerships/Sustainability: Projects and 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 projects and activities are replicable, scalable, and demonstrate potential for continuation beyond the period of direct NASA funding.

Science Mission Directorate E/PO projects/activities require the active involvement and participation partners with appropriate expertise.

4. *Evaluation:* Projects and activities document their intended outcomes and use metrics to demonstrate progress toward and achievement of these outcomes and annual performance goals. Evaluation methodology is based on reputable models and techniques appropriate to the content and scale of the targeted activity, product, or project.

Proposals to extend previously funded SMD E/PO efforts are required to provide evaluation results of the prior effort.

Relevance to NASA's Objectives

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

6. Content: Projects and activities 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, projects/activities/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, projects/activities/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).

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: Projects and activities have a clear intellectual linkage to SMD science/technology and the science/technology of any associated research effort, 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:

- Project objectives are clearly and succinctly described. Project activities clearly flow from the goals and objectives.
- There is a clear intellectual linkage between the E/PO project (objectives and proposed activities) and SMD science and the science of any associated research efforts. (see FAQ 9)
- Essential information about each proposed E/PO activity and product is provided (e.g., who, what, when, where, why, how).
- E/PO project implementation is feasible and appropriate for the specified intended audiences.
- The E/PO project management is clearly defined with clear lines of authority. Areas of responsibility are defined and specified. All key personnel (including the E/PO lead for AOs) are identified and have institutional authorization (FAQ 23, 25) to participate.
    - One or more science/research team members are directly involved in overseeing the proposed E/PO project (see FAQ 21).
    - One or more science/research team members are directly involved in meaningful and appropriate E/PO roles in addition to oversight (see Appendix D). [Active involvement of scientists and /or researchers is required on SMD E/PO projects]

- Members of the target audience are actively involved in the design and execution of the project.

• There is a schedule and/or timeline for proposed E/PO activities or other clear indication of how E/PO activities will be phased (with appropriate mission milestones in the case of AOs) that is clearly aligned to the budget request.

• There are clear plans for dissemination of the product(s) or results of the project/activities.

2. Continuity: Projects and activities draw from audiences that have demonstrated interest in NASA and connect participants to the next level of engagement.

Indicators of alignment include:

• Methods are identified that will draw project participants from other NASA educational and/or outreach opportunities.

• Methods are identified that will connect project participants to other NASA educational and/or outreach opportunities.

3. *Partnerships/Sustainability:* Projects and 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 projects and 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 projects/activities.

Indicators of committed, qualified, and capable partnerships include:

• There are well-defined roles and specific tasks that are substantively related to the design, development, dissemination, implementation, or evaluation of E/PO activities and/or products for the E/PO partners and members of the Earth and/or space science community that are sufficient to ensure successful program implementation (see FAQ 21, 22).

• E/PO partners are specifically identified; letters of partnership intent, specific support, or other evidence of partnership is included or attached to the proposal. [Given space restrictions in AO proposals, this evidence may be included in the text of commitment/support letters or in a brief summary of 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 24).

• 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:

• The E/PO 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 19 for specific examples).

• The program is sustainable beyond initial NASA funding by showing the potential for continuation, adoption by the target audiences, and/or incorporation into institutional programmatic efforts.

• The program is replicable in other educational institutions.

4. *Evaluation:* Projects and activities document their intended outcomes and use metrics to demonstrate progress toward and achievement of these outcomes and annual performance goals. Evaluation methodology is based on reputable models and techniques appropriate to the content and scale of the targeted activity, product, or program.

Proposals to extend previously funded SMD E/PO efforts are required to provide evaluation results of the prior effort.

Evaluation efforts should reveal lessons learned, and whether the proposed E/PO project 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 and will be different for responses to a NASA Research Announcement (NRA) and Announcement of Opportunity (AO) (see FAQ 16). 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. Directions will be provided upon selection. All SMD projects must include a project evaluation plan.

Indicators of appropriate evaluation include:

• Evaluation is based on models and techniques appropriate to the scale and type of E/PO products and activities that are a part of the E/PO project.

• 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 forms of evaluation are based upon reputable models and techniques or are designed and applied by a reputable project partner who is knowledgeable in research and evaluation methods applicable to education and outreach efforts. Where appropriate, the evaluation plan includes field-testing and modifications before broad dissemination.

• The project is evaluated regularly by credible sources following professionally accepted standards for educational evaluations.

RELEVANCE TO NASA OBJECTIVES

5. Customer Needs Focus: Projects and 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 10)
• NASA funded researchers can make an effective content contribution.
• Target audience participants will find the program valuable.
• The project is accessible and appropriate to its intended audience.

6. *Content:* Projects and activities use NASA content, people or facilities to involve educators, students, and/or the public in NASA science, technology, engineering, and mathematics.

Indicators of alignment include:

• The project is based on NASA's scientific and technical activities.
• The project ensures that the content is technically accurate.
• Public Outreach projects/activities engage the public in shaping and sharing the experience of exploration and discovery.
• Elementary/Secondary Education projects/activities are aligned (as described below) with education standards.

Any proposed E/PO product or activity that includes elementary/secondary education via a curricular product or educator workshop must demonstrate a substantive and informed alignment with educational standards (see FAQ 11) 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 E 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 E/PO partners engaged in developing and evaluating curricular products or educator training are knowledgeable about how to align E/PO products and activities with relevant education standards (see FAQ 11).

COST

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

Indicators of alignment include:

• The expected E/PO project/activity outcomes justify/are worth the total project/activity costs.

• Proposers provide evidence that the scale of E/PO activity is appropriate to project/activity funding. 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 $15,000 E/PO project/activity is appropriately focused and does not propose unrealistic outcomes that are clearly beyond project/activity resources (see FAQs 15, 29, and 30).

• 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 19 and 29).

• Adequate funds are included for E/PO partners commensurate with their level of involvement in proposed activities (see FAQ 30).

• 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.

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, projects/activities/products make a demonstrable contribution to attracting diverse populations to careers in science, technology, engineering, and mathematics (STEM).

Indicators of alignment include:

• The program promotes careers in STEM. 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.

• The program promotes improvement of STEM skills. Approaches include 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.

• The program creates linkages to other STEM educational opportunities. Approaches include utilization of partnerships or having substantive linkage with other federal and NASA education projects and involvement of community groups, corporations, research laboratories, museums, and educational/professional organizations in STEM activities.

• The program/product addresses diverse populations of students. The overall E/PO program reflects an atmosphere of equity, balance, and inclusiveness.

• Members of the target audience are involved in the development and execution of the effort.

9. **Diversity:** Through the use of NASA Earth and space science, projects/activities/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 (see FAQ 4). Indicators that the proposed E/PO projects/activities contribute to underserved and/or underutilized groups (see FAQ 18) 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 communities it is intended to serve.

- 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 diverse populations.

- The program provides awareness and understanding through culturally appropriate materials to targeted communities of how NASA's research and innovations affect and improve the quality of life for all citizens.

- Members of the target audience are involved in the development and execution of the effort.

Frequently Asked Questions

SMD E/PO Policies

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

The SMD E/PO Space Science Support Network

5. What is the SMD Education & Public Outreach Space Science Support Network?
6. Is there an SMD Education & Public Outreach Earth Science Support Network?
7. How can I use the SMD Education & Public Outreach Support Network?
8. What will the Forums do for me? In particular, will they write the E/PO segment to my SMD proposal?

E/PO Content of Proposal Segments

9. At what level does my E/PO program have to be linked with SMD?
10. How do I demonstrate a Customer Needs Focus?
11. What are Science Education Standards, and what does it mean for an educational activity or product to align with them?
12. What is the difference between "Informal Education" and "Public Outreach"?
13. What is the difference between “Continuity”, “Pipeline” and “Diversity”?
14. Can SMD E/PO funding be used for Public Affairs efforts to reach the media?
15. What kind of Education or Outreach should I emphasize in my E/PO proposal segment?
16. What is evaluation and how important is it to include as a funded part of my E/PO program?

17. Can SMD E/PO funds be used to support efforts directed towards higher education?

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

19. How can I expand the scope of my E/PO program in order to get the most out of proposed funding?

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E/PO Proposal Preparation and Review

21. Can E/PO just be delegated or contracted out to somebody else so that the science investigators don't have to worry about it?

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25. What attributes should I look for in an E/PO lead?

26. What is the E/PO proposal review process?

27. How will the E/PO segment affect whether or not my proposal is funded?

28. How can I realistically describe a high-quality AO E/PO effort in only a few pages?

29. What format should be used for E/PO budgets?

30. Are there any restrictions on what can be funded in an E/PO budget?

31. For proposals responding to AOs the budget for the E/PO segment is specified as a percentage of the mission cost. Is this a percentage of the full mission cost, including the launch vehicle?

32. Is E/PO funding added on to a proposal or considered part of the research program funding?

Answers to Frequently Asked Questions

FAQs: SMD E/PO Policies

1. **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 is devoting 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 (see FAQ 31).

   A national space science E/PO Support Network of organizations, including educational "Forums" is in place to help investigators and flight projects use the available resources to create and disseminate effective, well coordinated E/PO products and activities (see FAQs 5,6,7,8). The support network works in close collaboration with NASA's Office of Education as a part of NASA's overall Education effort.

2. **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.

3. **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.

4. **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 (see FAQ 17, 18).

FAQs: Using the SMD E/PO Space Science Support Network

5. **What is the SMD Education & Public Outreach Space Science "Support Network"?**

   The "Support Network" is a nationwide infrastructure of space science education/outreach groups whose purpose is to aid space science investigators in identifying and developing high-quality E/PO opportunities. This infrastructure fosters partnerships between the space science and E/PO communities, and provides the services needed to establish and maintain a vital national, coordinated, long-term SMD E/PO program. Of particular interest to SMD proposers are the “Forums” whose general aim is to help scientists turn results from space science missions and programs into educationally appropriate activities suitable for regional and/or national dissemination:

   - Educational "Forums" are oriented toward one of the SMD space science research areas (Astrophysics, Heliophysics, and Planetary). The Forums are co-located with

prominent research institutions and are national in scope. The Forums support, help organize, and disseminate the E/PO efforts of SMD missions and research programs related to their area.

Points of contact and addresses for the Forums may be found by opening *E/PO Opportunities* from the menu on the SMD homepage at http://science.hq.nasa.gov/index.html.

6. Is there a SMD Education & Public Outreach Earth Science "Support Network"?

At present there is no Earth Science Education & Public Outreach "Support Network". Earth Science researchers should contact the SMD EPO contacts indicated in the research solicitation.

7. How can I use the Education & Public Outreach Space Science "Support Network"?

Every prospective or funded space science E/PO proposer may choose to consult with any or all Support Network Forum members.

Before consulting a Forum, it is helpful for investigators to prepare answers to the following questions:

- What is the name of the NRA or AO to which you are responding?
- When is the proposal due date?
- Who are the Co-Is on your proposal and where are they located?
- Who are the primary contractors (if any) on your proposal and where are they located?
- What is the basic science content of your proposal and to which SMD area(s) is it linked [Astrophysics, Heliophysics, Planetary]?

The Support Network member will likely want to discuss the following with you:

- What is the education and outreach experience or interest of proposal team members?
- Are you aware of, or particularly interested in, any major education & outreach facilities accessible in your area (e.g. School Districts, School of Education, science museum, planetarium, observatory, minority institution, educational TV, etc.) with which you could create a partnership or with which you have existing connections?
- How much funding will your proposal devote to education and public outreach?
- Over what time period will E/PO funds be spent?

This set of questions does not constitute an exhaustive list but is intended to stimulate dialogue and the flow of fruitful ideas.

8. What will the Forums do for me? In particular, will they provide funding or write the E/PO segment to my proposal?

It is not the function of the Forums to provide E/PO funding or to prepare E/PO proposal segments. The proposer has the responsibility for developing the E/PO program and writing the proposal. However, existing and prospective investigators are strongly encouraged to make use of Forums to help identify E/PO opportunities and arrange appropriate alliances between the space scientists and E/PO partners. The integrity of this process is important and is at the heart of the successful implementation of the approach SMD is taking to E/PO. Thus the Forums have adopted a set of Operating Principles to ensure that they will provide fair and equitable services to the space science and education communities (see Appendix B).

FAQs: E/PO Content of Proposal Segments

9. At what level does my E/PO program 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 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. 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. A public outreach product like an educational TV program might include more specific information about a particular flight project than would an educational product like a middle school Educator Guide. Educational products and services should make use of flight projects or research topics in a different way — more as a motivational *context* for learning fundamental standards-based content in Earth and space science, physical science, mathematics, and technology (see FAQ 11). A more detailed discussion of the distinction between "education" and "public outreach" is made in answer to FAQ 12.

If there is an associated SMD research project or mission, the proposed E/PO activities must have an intellectual linkage with the objectives of the research effort. The E/PO project must stay within the same science area (Astrophysics, Heliophysics, Planetary, Earth Science), as the research. (*A project that only has linkage at the level of Earth Science or astronomy is inappropriately broad.*)

10. 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 NASA and the target audience(s) have an interest and need for the products and opportunities that would be made available through the E/PO activities. Interest and need by NASA may be established by reference to appropriate portions of the NASA strategic plan or similar SMD documents. 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 at http://education.nasa.gov/divisions/informal/overview/F_pathfinder_explorer_institute.html

11. What are Education Standards and what does it mean for an educational activity 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. Prospective proposers and their partners should also be aware of these other disciplinary standards that may be pertinent to their proposed E/PO activities (see Appendix E).

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 F 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 E/PO program 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.

12. **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?

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.

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.

Additional Criteria
However having an informal educational 'intent' is not a sufficient condition to be informal education. 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.
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

The overlap between Education and Public Outreach [see Appendix C for E/PO Venn diagram] is sometimes overlooked, but it is a significant area of endeavor called "Informal Education". Informal education engages students, educators, and the general public in settings away from the classroom (e.g. school field trips to science centers). Informal education products combine educational substance with the excitement of successful public outreach, but without the pressure of examinations and assessment. Opportunities for informal education usually require a person to travel to a place outside the home like a nature center, museum, or planetarium – a place that can be revisited. Informal education includes things like museum exhibits, science center programs, and planetarium shows. It also can include educational activities carried out by community organizations such as scouts, girls and boys clubs, 4H, and other youth groups. The intention of Informal Education is both to provide a learning opportunity and to motivate further learning and life-long interest.

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 14). While such activities are important avenues for reaching the public, they are outside the scope of the SMD E/PO program.

13. What is the difference between "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 in general, who 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 *Continuity* subfactor of *Intrinsic Merit* is directed at the means of either attracting participants to the project and/or informing project participants about other NASA education and outreach opportunities. The objective is to assist participants in connecting to other NASA 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 18).

"Pipeline and Diversity" are areas of special interest to the SMD E/PO program. Projects should identify how they support these areas and may wish to focus project elements on them.

14. Can SMD E/PO funding 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.

15. What kind of Education or Public Outreach should I emphasize in my E/PO proposal?

There is no single answer to this question as there are a wide spectrum of acceptable E/PO products and activities (see FAQs 12,14), 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 E/PO 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 (2004), Lesley University.)

The answer to the question also depends strongly on the amount of funding being

proposed for E/PO. Because of the modest financial scope of NRA projects/activities, an educationally sound, well-posed and focused effort that will be clearly effective in reaching its intended target audience is preferable to an unrealistically broad effort. On the other hand, E/PO projects/activities associated with AOs have a much larger financial scope and thus are expected to have a breadth and depth commensurate with these greater resources. These larger projects/activities should have a more balanced portfolio of activities and intended audiences with state, regional, or national scope. This general guidance is not meant to discourage the development of a novel E/PO idea that is more focused on a particular activity or target audience so long as the scope of the idea clearly merits the proposed funding.

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].

Abstracts of previously selected SMD E/PO projects/activities can be found by selecting a year at
http://research.hq.nasa.gov/code_s/archive.cfm

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

Evaluation[1] of E/PO efforts is essential, particularly for larger scale projects/activities. The general goal of all E/PO efforts is to accomplish something (e.g., teach, inform, excite, etc.). While it is possible to accomplish something without realizing it, it is also possible to believe falsely that there have been accomplishments in the absence of validating evidence. It is thus necessary to investigate how well the outcomes of E/PO efforts actually match with their intended effectiveness and impact. Just as scientific claims must be testable and tested before they are accepted, so must claims about E/PO accomplishments be substantiated with evaluation.

Evaluation should be geared to the scale and type of a proposed E/PO effort. Smaller E/PO projects/activities, such as those responding to an NRA, might use simple, informal, or very specific evaluation methods like pre- and post-tests, questionnaires, or a focus group. 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).

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

Larger E/PO projects/activities, such as those responding to an AO, should integrate a more formal, comprehensive, and structured approach to evaluation. Missions typically devote 5-10% of the E/PO budget for evaluation and usually hire an independent professional evaluator to conduct a more substantial assessment and to produce a more formal and objective report on the program as a whole as well as on its component E/PO activities. Missions are also encouraged to seek out evaluators who are familiar with the unique SMD Education and Public Outreach objectives and requirements.

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 E/PO product or activity and its intended audience. "Formative" evaluation improves the E/PO effort while it is being developed: field-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. Methods of evaluation include focus groups, surveys, observations, follow-up interviews, pre- and post-testing, and many other techniques.

17. 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.

SMD solicitations may identify additional opportunities and areas of interest in higher education. The list below offers some of the ways SMD E/PO funds could be used if specified 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 (see FAQ 3)
- 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 4,18)
- 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

Individual solicitations will indicate if graduate and undergraduate students and post-docs can be supported by the SMD E/PO funds.

18. 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 Science Mission Directorate has funded a group of minority university institutions around the country to support undergraduate curriculum development, faculty enhancement, and K-12 educational outreach. Contact a Forum if you are interested in exploring a suitable partnership opportunity with one of these institutions. See FAQ 5 for the Forums leads.

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.

19. How can I expand the scope of my E/PO program in order to get the most out of proposed funding?

This is an important aspect of the SMD E/PO Evaluation Factors (see EF 3) and addressing it is a central consideration in the overall approach SMD has taken towards E/PO. The SMD-supported Earth and space science community is quite small (approximately 10,000 to 20,000 including aerospace contractors). The education community is enormous by comparison. In 2004, there were over 54 million precollege students with over 3.5 million teachers in about 125,000 schools nationwide. To have a significant national impact, SMD must leverage its E/PO resources carefully to get the most out of every dollar invested. The products and activities must be highly valued and worthy of broad dissemination and use in the education and outreach communities.

There are many strategies for enhancing the value or cost-effectiveness of an E/PO program including the creative use of existing Earth and space science community resources (see FAQ 20) in support of E/PO (e.g., scientists and engineers, observatories, mission operations facilities, computers, science imagery and other data). Some general strategies to expand the scope of an E/PO program or activity are listed with examples below:

- Having a substantive impact beyond the direct beneficiaries (e.g. having a "waterfall effect" where a program trains master educators who in turn train other K-12 teachers, or where scientists partner with an education graduate student who will in turn teach future teachers)
- Capitalizing on dissemination techniques and infrastructures that can reach relatively large audiences (e.g. science museums, planetariums, radio, television, Internet, traveling exhibits – see FAQ 22).
- Making the case that the design of a proposed product or activity qualifies for replication or broad dissemination by organizations and programs with established and reputable means for doing so (e.g., an Educator Guide qualifies for dissemination in the Web-based Eisenhower Clearing House of educator resources or is suitable for distribution via NASA's national network of Educational Resource Centers; an educator workshop qualifies to be presented at the National Science Teachers Association convention)
- Drawing on (or leveraging) resources beyond those directly requested (e.g. E/PO partners provide cost sharing, in-kind contributions, or existing capability and infrastructure that would be cost ineffective to recreate from scratch)

20. How can I disseminate products developed by our E/PO program?

All NASA-sponsored grantees are invited to submit their Earth and space science education products and resources for review and broader dissemination. All products developed or funded by NASA's SMD are eligible to enter the review process. 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

Dissemination routes include utilization of the SMD Space Science Support Network, and other NASA resources 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 or the SMD education Web site.

The Space Science Education Resource Directory **(**http://teachspacescience.stsci.edu/) is another a convenient way for you to make your educational product available for use in classrooms, science museums, planetariums and other settings. The directory allows prospective users to do a quick search by Grade, Subject or Topic.

FAQs: E/PO Proposal Preparation and Review

21. Can E/PO just be delegated or contracted out to somebody else so that the science investigators don't have to worry about it?

No. The deliberate intention of the SMD E/PO strategy is to increase the degree to which the SMD-funded Earth and space science community is active and effective in support of public outreach and education. While some scientists have had significant experience in E/PO, many have not, and thus it has proven an effective strategy to form partnerships with organizations or individuals in the E/PO communities who can identify efficient ways for scientists to play valuable roles.

While a proposal team may select an E/PO partner institution or qualified E/PO Co-Investigator to lead the implementation of an E/PO program, it is expected that one or more science team members will be directly involved in overseeing and carrying out the proposed E/PO program. The essential idea is that attention to E/PO becomes an integral part of the Earth and space science community's professional activities. It may be useful for SMD investigators to participate in workshops that offer training for scientists on E/PO.

There are a variety of roles that can be played by Earth and space scientists besides the most easily imagined one of public or classroom presenter. (See Appendix D for a chart depicting a sampling of roles scientists can play in support of education and public outreach). The key is to combine roles that fit the interests and abilities of participating scientists with partners who can provide further expertise in E/PO and opportunities for enhancing the scope of the proposed activities (see FAQs 19, 22).

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

Desirable qualities to look for may 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 E/PO program element (e.g., a curriculum guide would require an E/PO partner who is intimately familiar with what it means to align with science education standards [see FAQ 11])
- openness and ability to engage scientists in meaningful and efficient ways in E/PO efforts (see FAQ 21)
- geographical or institutional desirability in terms of access to proposal 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 E/PO 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.

23. 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)?

An E/PO Partner is defined as individual or organization who plays a necessary role in the proposed Education and Public Outreach Program and whose services are either funded by NASA or are contributed by his/her employer. If funded by NASA, costs must be accounted for in the NASA SMD Cost. If contributed, the costs must be accounted for in the Total Mission Cost and an endorsement letter from the proposed E/PO partner's home institution with full legal authority to approve the terms of the partnership must be provided with the proposal or Concept Study Report in the case of an AO. In addition, the role of each E/PO partner must be adequately described in the proposal or concept study report to demonstrate the nature of the partner contribution and the associated costs. Note that the identification of an unjustified number of E/PO partner(s), partner(s) without a clearly defined role or contribution, or partner(s) without adequate legal authorization to participate may result in downgrading of an investigation and/or the offer of only a partial selection by NASA.

24. 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 educational activity that might incorporate the use and assessment of a developed product. Example: A proposed program may involve the development of an educational 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 E/PO 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.

25. What attributes should I look for in an E/PO lead?

Personnel leading E/PO projects should be suited to the scope and content of the proposed program and qualified by education, training, and experience to manage such projects/activities. E/PO mission leads are key personnel and their selection should be made with as much rigor as science team members. Appendix I provides as sample position description and qualifications actually used by a mission to select an E/PO lead. The E/PO lead plays a similar role to that of the mission system engineer – they ensure that all the E/PO pieces come together for a successful E/PO effort for the mission.

26. What is the E/PO proposal review process?

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/.)

Appropriately qualified scientific, education, and outreach personnel evaluate E/PO proposal segments using the SMD E/PO Evaluation Factors. Proposers should consult individual AOs and NRAs for further specific requirements and information.

To ensure quality and consistency in the review process, experience to date has demonstrated that review panels for E/PO proposals must include both educators and scientists. The substance of these reviews is conveyed to proposers as part of their usual debriefings (see FAQ 27).

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

A sample Review Form is provided in Appendix H.

Student Collaborations are a part of the E/PO effort of missions and are evaluated according to the evaluation factors specified in the AO. For example the SMEX 2007 AO specified that "Student Collaborations will be evaluated for overall merit. Overall merit of an SC is a combination of 1) the science/engineering merit of the proposed SC investigation; 2) implementation merit of the SC based on technical, management, and cost feasibility of the SC, including cost risk, as expressed in terms of specific major and minor strengths and weaknesses; and 3) and educational merit of the SC. The SC educational merit will be evaluated in four education merit areas: 1) quality, scope, realism and appropriateness, 2) continuity, 3) evaluation, and 4) diversity. These areas are discussed in detail in the *Explanatory Guide to the NASA Science Mission Directorate Educational Merit Evaluation Factors for Student Collaborations in the Explorer Program Library."*

27. How will the E/PO segment affect whether or not my proposal is funded?

E/PO projects are a required component for AOs. The SMD Selecting Official takes into account proposed E/PO tasks and their review ratings when deciding on final selections and in particular when discriminating between research proposals having otherwise comparable merits. In the case of AOs, E/PO can play a significant role in discriminating among closely competing proposals. However, for mission proposals (e.g. Discovery, MIDEX) or major instrument proposals, other factors beyond both science and E/PO — such as risk, cost, and programmatic considerations also play a major role in the selection process.

28. How can I realistically describe a high-quality AO E/PO effort in only a few pages?

Admittedly, a few pages is a very small space to devote to describing how a proposed flight project will spend hundreds of thousands or even millions of dollars on E/PO in a manner that meets all SMD E/PO Evaluation Factors (EF). There is not room to provide a great deal of programmatic or budgetary detail in a flight project proposal. However, proposers can use the space allotted very effectively to provide key information to reviewers. Listed below is one possible strategy for making efficient use of space in providing this key information:

- A brief opening statement of how the proposed program will help achieve the goals of the SMD E/PO strategy and implementation plans
- A clear and succinct statement of program goals and objectives (see EF 1)
- A paragraph to indicate the proposal team's commitment to E/PO, including a brief description of which science team member will have overall E/PO oversight, how scientists' will be involved with E/PO partners, and how E/PO implementation will be managed and coordinated (see EF 3, and FAQ 21)

- Substantiation of capability and commitment of E/PO partners via support letters that may be attached at the end of the proposal (see EF 3)
- A collection of brief paragraphs (1-2 pages) introducing the basic "Who, What, When, Where, Why, and How," for each E/PO activity or product that will serve to fulfill program goals and objectives (see EF 1 and FAQs 12, 14, 15). The descriptions for each E/PO activity should emphasize:
    a. what audience and educational needs are being addressed and why this is important (see for example EF 5, 8, 9 and FAQ 4, 18);
    b. the substantive involvement of appropriate and demonstrably capable partners (with reference to any support letters, see EF 3, 5, and FAQ 22);
    c. how the E/PO activity aligns with science education standards (if relevant, see EF 6, FAQ 10); and
    d. how the E/PO activity will expand its scope (see EF 3, and FAQ 19).
- A table to summarize E/PO activities, including partners/leads, estimated costs and timing (0.5 –1 page). Table headings could include "E/PO Activity or Product", "E/PO Partner/Lead", "Estimated Cost", and "Schedule" (see EF 1,3 and FAQ 29)
- A short section to describe what approaches will be used to evaluate E/PO activities and the overall E/PO program (see FAQ 16, EF 4).
- A paragraph to mention general dissemination strategies and to summarize the expected impact of the proposed E/PO program (see EF 1and EC 3).

29. What format should be used for E/PO budgets?

The E/PO proposal must reflect the entire cost of the E/PO 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.

For AOs it is important to refer to the specific Announcement for guidelines on budget formatting. In general, AO proposers should integrate the E/PO budget into the *Budget Summary* of the parent proposal. Proposers may find it useful to provide a summary table in the text of the E/PO segment that lists "ball-park" costs for each E/PO product or activity (citing clearly any cost sharing or in-kind contributions). This table offers reviewers a useful way of assessing whether the proposed E/PO program and the proposed

budget are a realistic and cost-effective match.

30. Are there any restrictions on what can be funded in an E/PO 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 E/PO funding:

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

Equipment: It is not the intent of the E/PO 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 E/PO activities, or for the purpose of attending an E/PO training or workshop for scientists. In the case of AOs, travel money for investigators may be used to support participation in E/PO planning and/or implementation of E/PO activities.

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 an E/PO 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.

Reserves: E/PO for a mission can be a large and complex undertaking. There are many things that may impact the cost of delivering the proposed E/PO effort. Proposers should include sufficient reserves at the outset of the project to enable them to adapt to programmatic needs just as the mission is required to include reserves.

31. For proposals responding to AOs the budget for the E/PO segment is specified as a percentage of the mission cost. Is this a percentage of the full mission cost, including the launch vehicle?

The operational policy is that the E/PO budget is percentage of the mission cost, NOT including the launch vehicle. So E/PO funding should be percentage of the total mission cost for spacecraft, operations, and science. The percentage is based on the fixed year dollar basis specified in the AO.

32. Is E/PO funding added on to a research proposal budget or considered part of the research program funding?

For AOs the E/PO budget is considered integral to the overall mission cost (see FAQ 31).

Appendices

Appendix A

Key NASA Links

NASA Strategy and E/PO Implementation Documents

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

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

NASA Information

NASA Science Mission Directorate
http://science.hq.nasa.gov/

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

Resources for Researchers and Educators

SMD E/PO News
http://science.hq.nasa.gov/research/sara_epo.html

Overviews of SMD Missions and their E/PO projects
http://science.hq.nasa.gov/research/overviews/index.html

Earth Science Education Catalog
http://www.science.hq.nasa.gov/education/catalog/index.html

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

Educators' Resources: Teacher's guides, education programs, and learning resources
http://science.hq.nasa.gov/education/index.html

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

Voyages in Education and Public Outreach: A NASA Space Science Newsletter

http://science.hq.nasa.gov/research/newsletters.htm
Voyages is a newsletter that serves as a vehicle for sharing the NASA Space Science's latest events and accomplishments in Education and Public Outreach. Past and current issues are available here.

Abstracts of Space Science NRA E/PO Proposals
http://research.hq.nasa.gov/code_s/archive.cfm
E/PO proposal abstracts for 2000-2004 are available. Select the year of interest from this URL.

Abstracts of SMD proposals selected for Education and Public Outreach Opportunities in Earth and Space Science (2006)
http://science.hq.nasa.gov/research/sara_docs/EPOESS06_Selections.pdf

Earth Explorers Awards (2004)
http://research.hq.nasa.gov/code_y/nra/current/NNH04ZYO006N/winners.html

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/index.html - 2

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.

Space Science Access: Bringing the Universe to Museums and Planetariums
http://mo-www.harvard.edu/spacescienceaccess/
NASA's Science Mission Directorate recognizes that planetariums, science centers, and museums are vital venues for astronomy and space science education. This Web site aims to support the efforts of these informal science education organizations.

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., available via the web.) Key recommendations are discussed.

NASA Educational Resources In Other Languages
http://www.uidaho.edu/ed/nasa_rerc
A comprehensive list of over 50 NASA programs and resources in Spanish and many other languages. Click on the link *Materials in Other Languages*.

Trends in International Mathematics and Science Study
http://nces.ed.gov/TIMSS/
Trends in International Mathematics and Science Study (TIMSS, formerly known as the Third International Mathematics and Science Study) resulted from the American education community's need for reliable and timely data on the mathematics and science achievement of our students compared to that of students in other countries. TIMSS is the most comprehensive and rigorous assessment of its kind ever undertaken. Offered in 1995, 1999, and 2003, TIMSS provides trend data on students' mathematics and science achievement from an international perspective.

Archives

History of OSS E/PO Program
http://science.hq.nasa.gov/research/Cospar_Manuscript.pdf

"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

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

"Implementing the Office of Space Science Education/Public Outreach Strategy: A Critical Evaluation at the Six-Year Mark"
http://spacescience.nasa.gov/education/resources/evaluation/OSS_EPO_Task_Force_Report

OSS E/PO Evaluation Report (2004), Lesley University
http://science.hq.nasa.gov/research/OSS_EPO_Phase_III_Report.pdf

Earth Science Education Roadmap 2005
http://science.hq.nasa.gov/research/ES-Education-Roadmap.pdf

Appendix B

Operating Principles of the NASA Space Science E/PO Support Network (Updated 15 March 2000)

[Note: SMD discontinued the Broker/Facilitator component of the Support Network in 2007.]

1. Education Forums and Broker/Facilitators will provide fair and equitable services to all customers of the Space Science Education Support Network. Such services include: advice on proposal preparation; ideas on Education and Public Outreach (E/PO); and information on partnership opportunities with a wide variety of E/PO institutions and programs within and outside of NASA.

2. Forums or Broker/Facilitators, in their capacity as members of the Support Network, will not write E/PO segments of SMD AO or NRA proposals. In all cases, the responsibility for formulating the E/PO program and preparing a proposal is that of the proposer.

3. Forums and Broker/Facilitators will treat E/PO proposals prepared by support Network customers - who respond to NASA SMD AOs and NRAs - as proprietary information.

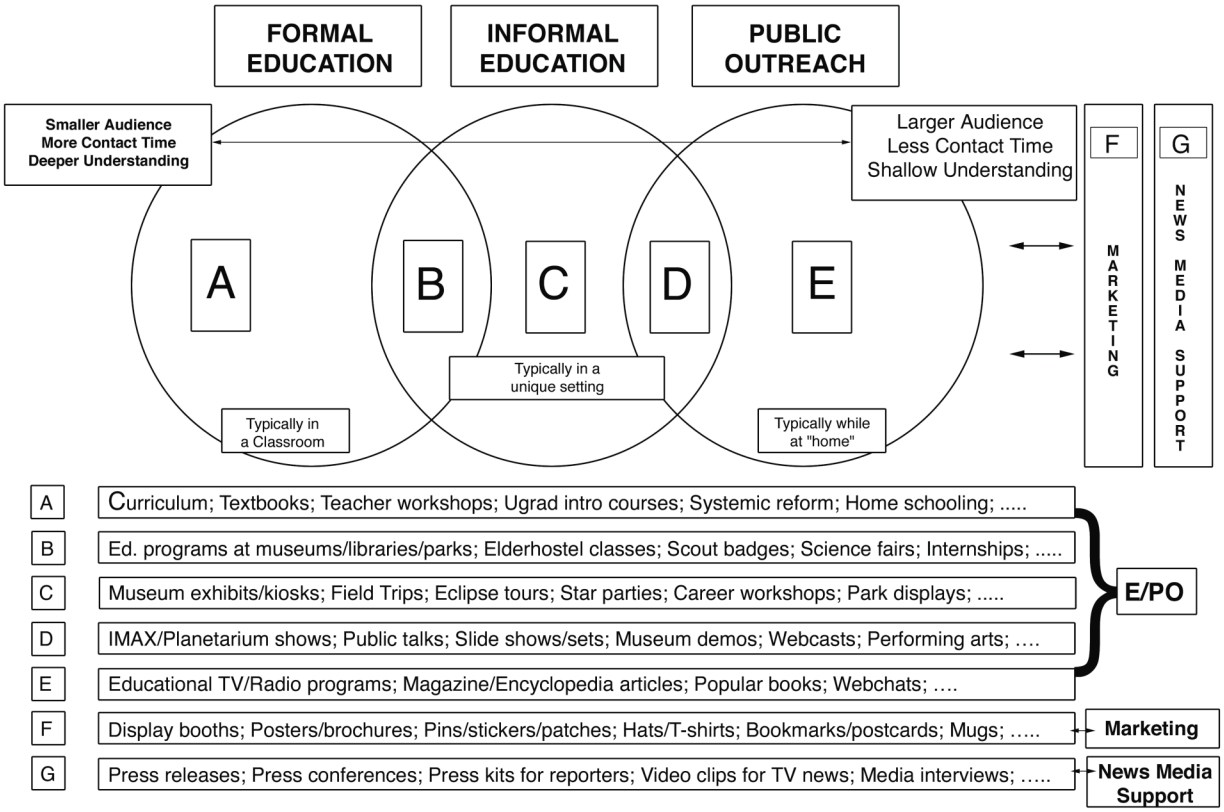
4. Forum and Broker/Facilitators are, in some cases, embedded in larger host organizations that have ongoing E/PO programs. To ensure fair and equitable services, Support Network members and their host organizations will follow existing best and fair business practices and good faith measures used by NASA and the space science research community regarding pre-proposal information dissemination, proposal creation, peer review, and proposal selection.

5. Forums and Broker/Facilitators will provide information to Space Science Support Network customers about options for partnership that feature competing possibilities and capabilities other than those of their host organization.

6. Space Science Support Network personnel will not participate in the review of E/PO segments of SMD proposals for which they have directly rendered services, or in which they or their host institutions are listed as partners.

Appendix C

Education and Public Outreach Venn Diagram*
(Explained in FAQ 12)



* 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 D: 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/	• Advocate that quality science and technology news be covered by your local newspapers and	• Give a public lecture • Review an article or Web site on	• Collaborate in the production of a PBS television show

	encyclopedias, lecture circuits, public Web sites)	television stations	science for accuracy and currency	• Write an article for a popular science magazine
	E/PO PROGRAM MANAGEMENT	• Advocate the involvement of STEM professionals in education and public outreach	• Assist a scientist with matching their talents and interests to an E/PO project	• Design E/PO programs with effective partnerships between scientists and educators.

The far left column constitutes various entry points into the E/PO realm. The subsequent columns represent the nature of the E/PO involvement. An **advocate** inspires, encourages, gives permission, and generally empowers others in their E/PO efforts; a **resource** helps when called upon, and generally makes resources and facilities available to others in support of their E/PO efforts, and a **partner** works "shoulder-to-shoulder" with E/PO specialists to create new products or opportunities.

For a more detailed description of this matrix, please see the white paper "The Diversity of Roles for Scientists in Education and Public Outreach," at http://www.spacescience.org/education/extra/resources_scientists_cd/Source/Roles.pdf
C.A. Morrow, 2000.

An evolving on-line matrix of profiles describing the roles of scientists involved in Education and Public Outreach can be found at http://ssibroker.colorado.edu/Rolesmatrix/

Appendix E

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/

Appendix F

Links to Organizations Serving Underserved/Underutilized Populations

NASA Minority University Research and Education Programs
http://mured.nasaprs.com/

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

Appendix G

Sample E/PO Program Manager

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.

Appendix H
Sample E/PO 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:		
Reviewers Name Printed:		
Reviewer Signature:		

Brief Summary of Proposed Project:

FACTORS:	**EXCELLENT**	**VERY GOOD**	**GOOD**	**FAIR**	**POOR**
1. **Intrinsic Merit** - Quality, Scope, Realism, and Appropriateness - Continuity - Partnerships/Leverage/Sustainability - Evaluation					
2. **Relevance to NASA** - Customer Needs Focus - Content					
3. **Cost** - Resource Utilization					
4. **Program Balance Factors** - Pipeline - Diversity					

Strengths:

Weaknesses:

Overall Comments: