

**NASA**  
**Science Mission Directorate**  
**Space Science E/PO Support Network**  
**Review Panel Report**  
23 December 2005

**Executive Summary**

After examining extensive written documentation provided by NASA Headquarters and by individual Forums and Broker/Facilitators, and following a three-day session that included presentations and discussions with Headquarters staff, Forum Directors and Broker/Facilitators, the Review Panel has the following findings and conclusions:

The Space Science Education and Public Outreach (E/PO) program and the Support Network (SN) in particular have made measurable progress and experienced documented successes with the approach used in this innovative and extensive program. This program could be considered as a model for the agency-wide educational effort. This unique, decentralized, non-uniform approach to E/PO with its embedded Support Network is designed to evolve over time (as an ecosystem does) and to adjust to the environment. There is evidence that this is occurring. The gains made over the first several years are cumulative and with nurturing and support in the years ahead, can lead to further significant progress for E/PO.

The SN has high quality personnel who are dedicated, enthusiastic and willing to go the extra mile to accomplish the needed tasks. They have built personal contacts with scientists, educators, professional organizations, community groups, etc. which are extremely valuable to the E/PO effort.

There are multiple expectations for the SN as expressed in the E/PO Implementation Plan, the B/F Core Functions, the Forum “provides” table, the language in their individual contracts, HQ requests (other duties as assigned), the OSS E/PO Task Force Report, etc. Expectations of the SN have been constantly changing. The recent evolution in leadership and direction at NASA has made it difficult to do meaningful long-range planning and has had an impact on the work being done by the SN.

The Panel found that the goals and objectives for the Broker/Facilitator (B/F) and Forums are not clear. These goals and objectives should be revisited to clarify the expected roles of both the B/Fs and of the Forums and to outline specific goals to which each of the B/Fs and the Forums can propose specific measurable objectives. In addition, the support functions that they perform for the SN should be identified and clearly listed in future announcements of opportunities. A minimal level of achievement for the goals and objectives should be specified. The Panel considered Core Function #6 relating to assisting product developers to

be inappropriate as a Core function for the Brokers. This directive is redundant to the Forum directives.

A uniform set of roles and goals expressed in measurable ways, coupled with uniform reporting procedures for the B/F and for the Forums, would be an improvement. Additional non-uniform functions that reflect the needs of various communities could be spelled out more clearly and then matched with the strengths and interests of the individual B/Fs and Forums.

Barriers have been identified that prevent increased effectiveness and sometimes cause things to 'fall between the cracks'. Not the least of these barriers is an insufficient number of HQ staff to provide needed planning, coordination, attention to detail and feedback. HQ staff has been reduced from four to one in two years at a time when the Task Force Report cited the need for increased staffing to realize the full potential of the E/PO program.

The System Network is at operating at capacity. As SN members (part-time jobs for many of them) encounter new projects, they must obtain increased support, prioritize and delay lower priority projects, develop planned exit strategies from some on-going projects, and/or not evolve into these new areas.

The Support Network provided the Review Panel with a list of weaknesses of and barriers faced by the Forums and the B/Fs in performing their work. Most are addressed in our Report, and while the communications weakness identified by the B/Fs may not have been adequately addressed, it merits further consideration.

This Review has been beneficial to the members of the SN, who stated that it made us think about, prepare and organize information about what we do (and why) in ways we've not done before, which has been very helpful.

## Background

The Space Science Education and Public Outreach (E/PO) program being conducted by the Science Mission Directorate (SMD) follows the Plan developed by the 1996 Space Science Advisory Committee (SScAC) Education/Public Outreach Task Force. It uses an innovative approach to planning and implementing education and public outreach, enabling the science and education communities to work together to bring scientific research and discoveries, along with educational products and activities associated with space science missions and research programs, to students and the public. This E/PO program is based on goals and strategies contained in *The Space Science Enterprise Strategic Plan 2000* and the 1996 Report *Implementing the Office of Space Science Education/Public Outreach Strategy*.

The Program is designed to achieve success in improving the quality of science, technology, engineering, and mathematics education in America through a long-term commitment requiring a sustained effort in education and public outreach. An E/PO Task Force was set up under the SScAC in 2001 to assess progress in implementing the space science E/PO program. In its March 2003 Report *Implementing the Office of Space Science Education/Public Outreach Strategy: A Critical Evaluation at the Six-Year Mark* the Task Force noted that significant progress had been made. The collection of activities being undertaken was, by design, highly leveraged and broadly distributed throughout the nation. The approach that space science has taken in implementing its E/PO Program provides a model that is unique to NASA, to the government, and to science education in general.

A central component in the E/PO Program is the Support Network of thematic educational Forums and regional Broker/Facilitators. A Program Review of the SMD E/PO Support Network is important and timely for several reasons: the Cooperative Agreements for the Broker/Facilitators will be ending in January 2007, and the Forum agreements in 2008; the Support Network needs to evolve to respond to the merger of the Offices of Earth Science and Space Science into the Science Mission Directorate and to the evolving NASA education landscape.

The Charter for this Review Panel is contained in Appendix A. Review Panel members (see Appendix B) were selected to represent a broad cross-section of stakeholder communities. The Panel met for three days at NASA Headquarters in Washington, D.C. during which it produced a draft report of its findings and conclusions. The meeting agenda is included as Attachment 1 in Appendix A. SMD provided the Panel with the set of background documents on the E/PO program and the Support Network shown as Attachment 2 in Appendix A. This Final Report resulted from the combined efforts of all the Panelists and addresses each of the five questions presented to the Review Panel.

### **Question 1: Do the Forums and Brokers have clear and appropriate goals and objectives?**

The answer required a complex assessment of many different documents. The Review Panel found that there are multiple sources of what could be considered goals and objectives for both the Forums and the Brokers. These documents and sources include: the E/PO Implementation Plan, the 2001 Broker/Facilitator solicitations, individual contracts and cooperative agreements, HQ requests (other duties as assigned), the 2003 E/PO Task Force Report, the Executive Summary of the 2005 Annual Reports NASA Science Mission Directorate E/PO Support Network, and the 2005 annual Reports of each of the Forums and Brokers. The goals and objectives are sometimes referred to as the B/F Core Functions and the Forum “provides” table.

In order to make progress towards answering this question, the Panel agreed that the information provided in the *Executive Summary of the 2005 Annual Reports* would be used as understood goals and objectives. That is, the Panel assumed that *Table 3 – Broker/Facilitator Core Functions* would be considered to be the Broker/Facilitators’ goals and objectives. Likewise, *Table 4* of the same document articulates what the Forums are expected to provide. (See below for copies of these two Tables.) The inconsistency in these terms (and the expectations they raise) makes comparison of goals and objectives across the Forums and the Brokers, and across the SN as a whole, rather cumbersome. More importantly, this inconsistency reveals a problem in that individual forum and Broker members do not always use the same set of goals and objectives in assessing and reporting on their progress.

Following is a description of the goals and objectives each group articulated for themselves and how they align with the expectations set out in either *Table 3* or *Table 4*.

#### Table 3 - Broker/Facilitator Core Functions [taken from the 2001 Broker/Facilitator solicitation]

1. Serve as a regional point-of-contact and clearinghouse for professional scientists and educators seeking information on and involvement in the NASA SMD E/PO program.
2. Foster, facilitate, and nurture partnerships between space scientists and educators for planning, developing, and carrying out E/PO projects and activities such as workshops, curricula, systemic improvements, on-line activities, museum exhibits, planetarium programs, and public outreach.
3. Assist space scientists in identifying and formulating E/PO projects and programs consistent with SMD guidelines (but not actually writing or participating in writing E/PO proposals for space scientists).
4. Inform educators about new E/PO materials developed under SMD sponsorship and assist them with locating SMD and other NASA space science-related educational materials.
5. Inform educators and educational and public outreach organizations about opportunities to work with the space science community and assist them in developing interfaces with scientists participating in SMD research programs and

missions.

6. Assist space science E/PO product developers in developing appropriate materials and in getting their materials evaluated and placed into the SMD Education Resource Directory and other NASA, regional, and national archives and distribution networks.

Table 4 - The Forums provide:

1. Context - The “story” that blends the research of each mission into the well articulated whole desired by the public
2. Continuity - Contacts and content that live beyond the lifetime of individual missions, providing the sustained effort required by the education community
3. Coordination - Services and infrastructure that streamline and integrate common mission activities, reducing duplication of effort and enhancing the quality of products and programs
4. Community - Opportunities to develop collaborations and high-leverage national partnerships, fostering innovation and amplifying individual mission efforts
5. Connections - Links between individual mission E/PO efforts and broader SMD and NASA E/PO programs (including those of other Forums and the Brokers), enabling missions to build on existing programs
6. Coherence - Logical relationships between products and programs that effectively integrate a decentralized system, facilitating access and increasing ease of effective use.

Due to the diversity of information provided in the annual Reports, the Panel requested some additional information on goals and objectives and how they are assessed from each of the B/Fs and the Forums. **The information provided in very brief presentations bestowed a level of confidence amongst the Panel that in fact each of the B/Fs and the Forums do operate with strategic directions, i.e. "goals and objectives" and that they self assess these directions in appropriate ways.** We suggest that the information they provided to the Panel be made available to other audiences including their customers because it is extremely useful in understanding the purpose, direction, and priorities of their work.

**Brokers:** The Broker/Facilitator annual Reports for 2005 are vastly different in format and content. Each of the Reports is structured uniquely, but they all provide some information about each program’s own goals and/or objectives, sometimes using those terms and other times simply referring back to the six “core objectives” outlined in the table.

The SERCH, S2N2, SCORE, and NESSIE Broker/Facilitators all refer to the Core Functions in their Report and map their activities to those functions. They do not identify specific goals and objectives beyond those functions in their annual Report documents.

SSI details five key objectives in the 2005 annual Report, which may be drawn from the Core Functions but are more specific: “Grow and maintain regional list-servs of educators and scientists,” and “establish and maintain a Help Desk that allows us to track our response to Broker queries.” The fifth objective does not map with a Core Function: “lead and participate in system-wide working groups according our strengths and interests.” This objective derives from guidance of both the Task Force Report and from NASA Headquarters directly. The appropriateness of the fifth objective will be addressed later in this Report.

The MARSSB annual Report refers to the Core Functions and identifies three specific objectives for the 2005 Reporting period including. The first, “identify and analyze... user needs and education practices” is not specifically described as a Core Function but could be read as a necessary step towards the accomplishment of Core Functions 2 & 3. It is understood that effective E/PO projects must begin with the identification of user needs, specifically where a particular region might differ from the larger education and science communities. The second, “measure growth in teacher and/or organizational and/or collective efficacy based on the educational services provided by the Earth and space science Support Network,” is not identified as a Core Function of the B/F, but may be a role served by the B/F for the SN as a whole. The final goal is aligned with Core Function #6.

DePaul University refers to four goals from their original proposal in their annual Report. Only one of these goals maps to a Core Function: “increase the quantity and quality of opportunities for scientist involvement.” The other three center on bringing space science to schoolchildren, increasing public exposure to space science, and involving students and faculty at minority institutions in space science, which are all consistent with the “guiding principles” of SMD E/PO, but are not Core Functions of the Brokers. One point of information is that these goals were present in DePaul’s B/F proposal and since the proposal was selected for funding, the Panel assumes that these activities were included in the Cooperative Agreement, even though they fell outside the Core Functions. The annual Report also presents a map of the B/F activities to Core Functions, although the specific alignments were not always obvious to the Panel.

It is the assessment of this Panel, that while the Core Functions were articulated to the B/Fs in the 2001 solicitation for proposals, they are either not clearly understood or not always followed. The fact that documentation also describes guiding principles of E/PO and that the B/Fs feel compelled to respond to those principles, even when response may take them outside of the articulated Core Functions, leads the Panel to conclude that the roles, and thus the goals and objectives, of the B/Fs are not clear. An example of this is the effort to target under-represented groups in their regions as called for in the guiding principles. Several of the B/Fs describe efforts towards underrepresented populations that do not relate to any of the Core Functions of brokering scientist-educator partnerships. That is not to suggest that targeting these groups is not a very worthwhile activity; it is simply used as an example of where the principles and priorities of overall

E/PO guidelines may be encouraging/requiring the B/Fs to step outside their defined roles as Brokers.

The B/F Core Functions cannot easily be translated into clear goals and objectives. In fact, the functions themselves are a combination of expected roles such as “serve,” and processes described by “foster and facilitate.” The Panel observes that these functions could be divided into expected roles and clear goals prior to any new solicitation for proposals, with careful wording to help proposers set objectives and priorities and to allow HQ to find balance among the activities across the SN, as well as to facilitate better evaluation and assessment of the efforts of the B/Fs.

In addition the B/Fs articulated several activities that they engage in at the request/encouragement of HQ, that clearly fall outside of the defined Core Functions, but which may be filling an important, though not a clearly articulated role, within the SN. If it is expected that the B/Fs will serve in this way for the SN and for HQ, this role should be articulated along with the other responsibilities, along with some guidance on the time/resources that might be required, so that other proposed activities are not negatively impacted. Further, the Panel notes that "Core Function #6" is not consistent with the other expectations and could be dropped from future B/F expectations.

**Forums:** While the Forums do not have solicitations to refer back to, they have been given a list of expectations that is described in *Table 4* as services and roles they are to “provide.” Like the B/Fs, these expectations are complicated by the “guiding principles” set forth for the overall space science E/PO, by the strategic goals for education set forth at the Agency level (described in the 2003 Strategic Plan,) and by direction and requests given to them by HQ staff. None of the expectations are contradictory, they are simply complex. As a result, it is difficult to determine clearly what roles the Forums should play and what objectives they should pursue. Each of the Forums is also an E/PO program and/or product provider, making it difficult to determine how these two sets of expectations should be combined to guide and assess their efforts.

The Origins Forum calls their objectives “core services” which are directly aligned with the *Table 4* definitions. They identify a five year strategic plan with four main points which include: to tell the Origins story, to lead cross-mission collaboration, to provide services to streamline mission functions, and to serve as a link between missions and SMD. The objectives derived from the plan are clear.

SECEF identifies 4 of their own objectives, the first and last of which do not clearly align with the *Table 4* definitions: “identifying user needs that relate to SEC research data” and “internal professional development,” though the former may be a necessary step towards preparing the story and the latter is in explicit response to the 2003 EPO Task Force Report and could be inferred from the SN definition to provide “coordination ... and enhancing the quality of products.”

SSE FY05 annual objectives are consistent with SN definitions though worded differently and narrowed for this particular year (i.e. “provide continuity and growth of the engagement of girls and women” and “explore the natural connections between Earth and solar system content.” Professional development is listed a specific objective and again it is explicit response to the 2003 EPO Task Force Report. SSE’s five-year objectives are audience driven focusing on “external customers” and the “NASA education community.” While two of the objectives listed under the NASA group are consistent with the *Table 4* definitions, “coherence” and “evaluation,” the others may not explicitly address the *Table 4* definitions. The details of these objectives are not explained enough in the Annual Report to see the relevance to *Table 4* though the Forum Lead presented additional data to the Panel, which illustrated additional connections.

SEU outlines three objectives in their FY05 Report, two of which can be put in the context of the *Table 4* definitions: “using the Einstein Centennial to involve the public in the Universe Exploration theme” and “strengthen the educational coherence of our collective activities.” The third, “developing strategic partnerships with underserved communities and key customers” is consistent with the E/PO “guiding principles,” but is not specific to what the Forums are asked to “provide.”

**Support Network Overall:** The Panel struggled with the identification of overall SN goals and objectives. Multiple expectations have been placed on the B/Fs and the Forums from a variety of sources including the Implementation Plan, the Announcements of Opportunity, the Forum contracts, the Task Force Report, and requests from HQ; they have wrestled with these and come up with a set of goals and objectives that each of them, uniquely and individually, have used to make progress, which seem mostly consistent with the intent of the Implementation Plan for the SN.

- It is the Panel’s assessment that the SN plans need a significant revision to provide much clearer sets of roles and goals for both the B/Fs and the Forums. Specifically, all of the roles to be filled by the B/Fs and by the Forums should be clearly identified and expressed including those that are in support of HQ activities or administrative in nature. When and how the B/Fs and Forums should respond to new directions from HQ, committees, or other input should be discussed and documented. Also, the relationship of the B/Fs and Forums to the overall E/PO program should be explained, clarifying the differences between the “guiding principles” for SMD E/PO and the roles of the B/Fs and Forums.
- Secondly, a clear set of Goals for each program should be identified, thus allowing each B/F or Forum to set their own objectives to address those goals. If the B/Fs and/or Forums are not to be producers of E/PO directly, this should be stated and enforced so that their efforts will be focused and measurable. Finally, the documentation for all of this should use consistent terms, be consistently reported out, and be consistently adopted by all participants. This will help build efficiency and efficacy, as well as accountability into the SN. Despite the muddy waters, the B/Fs and the Forums have been very productive in their work. This



assessment is to help refine the system, open it up to understanding and perception by outsiders, and to overall strengthen the Support Network.

**Question 2: Can progress toward achieving the E/PO Support Network goals and objectives reasonably be determined?**

As discussed in the response to Question 1, this Review Panel has not found the E/PO Support Network goals and objectives to be clearly defined. Thus, determining progress towards achieving them is problematic.

Information on progress towards achieving SN goals was not easily discernable from the documentation provided the Panel prior to the review session. We commend the Forums and the Broker/Facilitators for their efforts in better defining their goals and Core Functions and for describing the ways they measure their progress against these in response to our questions. However, we suggest that more straightforward Reporting would aid their efforts in collecting and analyzing data at the individual Broker and Forum level. The Support Network as a whole utilizes a diversity of assessment and evaluation approaches. Individual Forums and Broker/Facilitators have developed their own methods of assessment.

Some of the Support Network members have adopted the outcomes-based evaluation method recommended by the PERG evaluators (the Program Evaluation and Research Group/Lesley University, contracted by SMD for overall E/PO program evaluation). This approach focuses on a target audience, identifies the desired outcomes, collects evidence, interprets the evidence and uses this feedback to refine the process. Pre- and post- event surveys and other forms of evaluations are part of this process and are detailed below.

Other Support Network members use a partnership matrix representing the types of relationships (scientists, underrepresented populations, formal education, informal education) versus the phase of the relationship to track various stakeholder groups. The committee found these matrices to be useful and illuminating.

Each of the SN groups reported that they had acquired additional forms of evaluation, which they expressed as not easily included in their annual Reports, or in the NASA Education Evaluation Information System (NEEIS). This reporting difficulty may in part be due to the lack of uniformity in the annual report request.

During the Review Session, the Forum and Broker/Facilitator groups identified for the Panel a variety of ways in which they evaluate their progress. We note that this information is not included in the various annual Reports. Many of these data are simply counts of the number of contacts. These specifics follow, grouped either by Forum or Broker/Facilitator:

Forums as a whole utilize number counting as well as formative evaluations, as well as

- Independent outside evaluators Reports
- Formative evaluations, written and oral, including workshops
- Summative evaluations of products and programs conducted by collaborating institutions

- Analysis of statistics—number of users, on-line activities, source
- Planning- pre and post testing of students using material
- Annual planning process which develops timelines
- Surveys of groups to assess needs
- Number of NASA Explorer schools adopting modules in their curriculum
- Frequency with which web sites, programs receive recognition from peer groups
- Increase in participation in annual events
- Number of missions working together to do E/PO
- Number of products passing review, number ordered or downloaded
- Attendance at professional development workshops.

For the Broker/Facilitators the most common ways of measuring progress include recording web hits, collecting other web data, and collecting pre and post evaluation surveys at workshops. Other methods, which reflect the diverse approaches of the SN groups, include:

- Number of new Broker contacts, events
- Number of contacts initiated by scientists
- Number of articles distributed at educator events
- Number of papers published in refereed AER journal
- Number of small grants requested
- Number of requests for help with proposal development
- Number of phone calls, web site hits, personal interviews at workshops
- Numbers of interviews, contacts at state science teacher meetings
- Numbers of talks to science departments
- Interviews in depth with scientists: those involved in education
- Pre and post surveys at workshops
- Involvement of faculty from minority serving institutions
- Track E/PO submissions, document results, follow-up surveys
- Interview representative populations targeted
- Questionnaires for educators
- Telephone interviews with scientists, educators
- Survey on use of information and material
- Requests for products/material
- Counts of help desk queries: numbers and types.

When we examine the evaluation processes described by the individual Forums and Broker/Facilitators, there appears to be wide variation in the detail and thoroughness. This may in fact not be the case, but we do not have sufficient data to judge this.

#### Universe Forum

- Independent outside evaluators Reports
- Formative evaluations, written and oral, including workshops
- Summative evaluations of products and programs conducted by collaborating institutions
- Analysis of statistics –number of users, on-line activities, etc

- Number of requests, source of requests
- Planning- pre and post testing of students using material

#### Origins Forum

- Annual planning process which develops timelines
- Measure indicators:
  1. Product articulation, balanced activities
  2. Number of missions involved
  3. Mission content integrated into programs
- Surveys of groups to assess needs

#### Solar System exploration

- Conduct assessment and formative evaluation studies that increase effectiveness of projects

#### Sun -Earth Connection Education Forum

- Number of NASA Explorer schools adopting student Observing Network modules in their curriculum
- Frequency with which web sites, programs receive recognition from peer groups
- Annual increase in participation in Sun Earth day events
- Number of missions working together to do E/PO
- Number of products passing review, number ordered or downloaded
- Attendance at professional development workshops

We concluded that the Broker/Facilitators use the Core Functions to map to their own goals and objectives.

#### DePaul Broker/Facilitator:

- Number of new Broker contacts, events
- Number of website hits, contacts initiated by scientists
- Interviews in depth with scientists: those involved in education
- Number of articles distributed at educator events
- Pre and post surveys at workshops
- Involvement of faculty from minority serving institutions

#### MARSSB Broker/ Facilitator

- Document outcomes of contacts with scientists, educators
- Document Brokering efforts
- Track E/PO submissions, document results
- Follow-up surveys
- Interview representative populations targeted

#### NESSIE Broker/Facilitator

- Outcomes based evaluation – used to modify website, advise on E/PO proposals
- Questionnaires for educators
- Pre-post questionnaires

- Telephone interviews with scientists, educators
- Number of papers published in refereed AER journal

#### SCORE Broker/Facilitator

- Number of hits to web page, contacts who join database
- Number of small grants requested
- Survey on use of information and material
- Number of requests for help with proposal development

#### SERCH Broker/Facilitator

- Number of phone calls, web site hits, personal interviews at workshops
- Pre and post surveys at workshops
- Requests for products/material

#### S2N2 Broker/Facilitator

- Numbers of interviews, contacts at state science teacher meetings
- Numbers of talks to science departments
- Evaluations of workshops

#### SSI Broker/Facilitator

- Responses to website
- Counts of help desk queries: numbers and types
- Evaluations of workshops

### **Question 3: Is the current implementation approach a cost-effective method for achieving the Support Network goals and objectives?**

Assessment of the cost-effectiveness of the Space Science Support Network (SN) begins with understanding the system of which the SN is a part (e.g., E/PO Program); the relationship within (e.g., Broker to Broker) and across this Network (e.g., Broker to Forum); and then examining the resource utilization of allocated funds to the SN as measured in support of the E/PO Program and to the SN Core Functions.

For purposes of this review, the following criteria and indicators were applied towards evaluating cost-effectiveness:

#### Criteria:

- Resource Utilization – Programs demonstrate an effective use of funds through the adequacy, appropriateness, reasonableness, and realism of the budget.

#### Indicators: (Include one or more of the following as appropriate)

- The overall program budget (including in-kind contributions and other funds leveraged from partners' resources) is cost-effective. Overall project cost, costs of project deliverables, and the relationship of the proposed budget to available funds are each realistic and reasonable. The proposed/planned/ongoing program outcomes justify/are worth the total program costs.
- Evidence collected that demonstrates the scale of the activity is appropriate to/commensurate with program funding. For example, a \$5.0 million per year program is multifaceted and reaches an appropriately large and diverse audience (statewide, regional, or national scope) or provides an in-depth demonstration of a model program that is suitable for replication regionally or nationally; and a \$300,000 per year program is appropriately focused and does not propose unrealistic outcomes that are clearly beyond program resources.
- The program plan provides cited or estimated figures for the fiscal contribution of each partner, and those contributions are clearly commensurate with and support the activities to be undertaken by each partner in planning and implementing the program.
- The program uses Federal Funds in an appropriate manner to enhance education.

Data Sources - The findings and conclusions are based on the data available to the Review Panel, which included:

- Total value of budget for E/PO Program, Forums, and Broker/Facilitator
- Individual budget allocations to each Forum and Broker/Facilitator Projects
- 2004 and 2005 Annual Reports from each Forum and Broker Project
- Education and Public Outreach Annual Report: Fiscal Year 2003
- Support Network Implementation Plan: FY 1995
- Review Panel Project Office, Forum and Broker Presentations and Q&A.

#### Budget:

- The NASA Science Mission Directorate Education and Public Outreach (E/PO) Program embeds E/PO as an integral element of its flight missions and research program. Included within the E/PO is a Support Network (SN) consisting of four theme-oriented educational Forums, complemented by seven regional Broker/facilitators supports direct involvement of the space science community through nation-wide partnerships with the formal and informal communities.
- The total FY2005 Space Science E/PO Program funding was approximately \$43M and the SN allocation from the Program funding was approximately \$8M. The allocation within the Support Network was \$5.95M to Forums and \$2.10M to Brokers. The base cost per Forum was ~\$850K and ~\$300K per Broker. Funds above this base are allocated as special projects.

The reach of the SN is national with specific attention from the Forums on the national reach through activities that capture and tell the thematic story of the overall space science mission and the Brokers placing emphasis on regional, state, and local efforts in facilitating opportunities for educators and space scientists as captured in interest in research and education related to missions.

#### **Findings**

The Review Panel approach in responding to the question on cost-effectiveness is by first breaking down the parts making up the Support Network – Broker and Forum -- and then rolling up the review of the distinct parts and presenting findings from the perspective of the Support Network.

At the end of this section are the data extracted on the individual Broker and Forum projects as mapped back to cost information in order to draw some general conclusions regarding cost/resource utilization by the Support Network.

- Discerning the cost-effectiveness of the Support Network was challenging as the appropriate evidence was not readily accessible, or detailed enough, or in a format that allowed easy extraction of data. Both qualitative and quantitative data were reviewed.
- Minimal common quantitative measures exist across the entire portfolio. This limited the scope and depth of detailed assessment that could be made about the resource utilization adequacy, appropriateness, and reasonableness.

Forums and Brokers stated they have measures against which they assess how their objectives and goals are met. These are primarily limited to “counting noses”, the numbers are not always provided, because outcomes are not clearly stated – e.g. Y% affected by X activity. A principal barrier to understanding cost-effectiveness of the Support Network is that uniform metrics have not been developed, or applied. Further, while the level of

activity is proportional to the funds provided to the Support Network, it is not clear how or when these are leveraged – i.e. the amplification effect was difficult to quantify from the data provided.

- Varying percentage of effort was observed from data sources to where each SN group prioritize their time/activities as measured back to Broker/Facilitator Core Functions (Table 3) and the Forums Provide list (Table 4) in the Executive Summary of 2005 Annual Reports NASA SMD E/PO SN. The exact percentage of time by the individual projects, overall by Forums or Brokers, or entire Network cannot be assessed since this does not appear to be something that has been systematically examined or collected in the past. Determining what would be types of data to count towards each tasks/functions would be a natural beginning for deriving percentages. Percentage of time and calculated then back to a cost as applied to activities might then provide further detail/evidence to support answering the question on effectiveness.

In summary, the collective impression drawn about the cost-effectiveness on the Support Network is:

- The scale of activity is appropriate for level of funding
- The SN is multifaceted and reaches an appropriately large and diverse audience (statewide, regional, and national in scope) that is commendable, yet to know what is the full-cost on any given activity has not been systematically captured and would therefore limit full knowledge necessary to determine what it might actually cost to potentially replicate or scale beyond the initial scope.
- The overall program budget (including in-kind contributions and other funds leveraged from partners' resources) could not be determined from available data, thereby limiting the assessment of the input to output ratio and impact from the stand-point of cost reasonableness and effectiveness

## Conclusions

Several suggestions are outlined, below

- The Support Network as a whole and the Forums and Brokers individually, should use uniform outcome and reporting processes, including common budget categories in their reports. Where amplification of efforts has resulted, these should be explicitly called out.
- Portfolio Management - Implementation of a portfolio management approach by the SN Project Manager would provide information necessary for decisions related to the reallocation of resources; sunsets to projects, if necessary; and further strengthen the coordination of non-duplicative set of projects within the Support Network that work together to achieve NASA's space science E/PO goals.

This approach includes:



- portfolio inventory
- establishment of strategic portfolio objectives and metrics
- regular review of projects and proposed activities
- periodic progress reports on performance metrics
- annual performance evaluations using common criteria
- access to information for the entire portfolio.

Other NASA Networks - There are several education-focused networks operating within NASA Education. SMD is encouraged to examine how these other networks structure the portfolio from a performance metrics and reporting standpoint to assess whether there are any applications or approaches that might be repurposed for SN. Examples of other NASA Education Networks include Space Grant and EPSCoR (Higher Education Division), Educator Resource Center Network (eEducation Program Office), Museum Alliance Network (Informal Education Division), Aerospace Educator Services Program (Elementary-Secondary Division), and Digital Learning Network (Elementary-Secondary Division).

### Measures and Reporting

A. Measures. Define strategic objectives and outcomes for the portfolio that would then naturally lead to the identification of common output, outcome and efficiency measures that the SN would be required to include and report as part of overall annual plans and performance goals. From a cost-effectiveness stand-point, the collection of data under these three category of measures would provide the individual projects, the network, and the Project Manager on an annual basis contribution of each partner, and those contributions are clearly commensurate with and support quantitative evidence of the cost-effectiveness of activities undertaken to support near-term planning and implementation. Measure definitions used by the Office of Management & Budget are given in Appendix C.

*A SAMPLE is offered in Appendix D.*

B. Reporting. In addition, in light of the question on cost-effectiveness and in line with portfolio management approach, a review of current reporting requirements is suggested to assess the uniformity of information that is collected, to identify whether revisions to what is collected is needed, and to how often it is collected.

For instance, it might be that Forums and Brokers would be requested to submit a mid-year status brief. The brief would provide explanation within four areas (Cost, Schedule, Performance, Management Issues) and using the “traffic light” color key (Red, Yellow, Green) and indicators to provide status.

*A SAMPLE is offered in Appendix E.*

C. Technology Infrastructure. Leverage existing technology infrastructure and capabilities to support SN operations in ways to include:

- NEEIS Support Network Dashboard. One-stop site by members of the Network where a designated area within this structure has been built specifically for the OSS Support Network. NEEIS has capabilities that have not been leveraged or fully explored that could address overall operations and management, including the necessary data to evaluate cost-effectiveness to inform current and projected program decisions. In short, the dashboard could enable more uniform data collection, enhance quality on the scope of network data collection captured (qualitative and quantitative), increase the efficiency and effectiveness of reporting burden and enable members to have heightened awareness and knowledge across the network on activities, to review and share across the network activities and communications.

Examples include: Customized and tailored Reporting tools and forms can be designated, including templates to support consistent Reporting of key fields as determined by management, capabilities such as automatic roll-up from submissions to support required reporting periods (e.g., semi-annual status; annual Report); and include list and links to other key Web sites to support the Network

**SN Contributions to SMD E/PO Program.**

Over 100 **Space Science Missions for Forums** to coordinate thematic stories for the program and for the **Brokers** to provide services across the space science research areas to scientists and educators in a specific geographical region.

***Brokers***

Where given, numbers of contacts (persons impacted) for each Broker are divided by the Broker budget as a rough guide of cost-effectiveness. Bearing in mind that reporting is non-uniform and that quality is not included and that the numbers are far from representative or even, quantitative, and therefore not weighted by importance or quality of the contact. Multiplicative effects are not possible to apply from the data given.

De Paul University counts new contacts, number of web hits, materials used and distributed against its stated objectives. It also conducts surveys – though the depth of the surveys is not known. The impression is that the surveys, e.g. direct interviews, is limited to 2-3 people. Total numbers given are 200 contacts, corresponding to \$1500 per person.

MARSSB has developed fairly sophisticated models for assessing impact, which is quite thorough. Their matrices should be adopted and promulgated throughout the Support Network. Listed were 1000 contacts, for \$300 per contact.

NESSIE is another Broker group with a strong focus on evaluation, though these are more focused on its direct E/PO projects. The Panel did discuss the appropriateness of Brokers engaging in the latter. One of the exception where numbers are given: 200,000 participants. Crudely, then, the cost per impact is \$1.50 per person in 2005 with involvement by 100 scientists. No quality criteria are applied by the Panel or given by the Broker.

SCORE has mapped its activities and objectives to the Core Functions and as evidence of impact uses numbers counts and surveys. From the numbers, 7000 contacts for \$42 per contact.

SERCH uses number counts and user surveys to measure progress in its objectives, also mapped to the Core Functions. 500 contacts explicitly given: \$600 per contact.

S2N2 has clear objectives and uses numbers and evaluation matrices, as well as user surveys to assess program effectiveness. In addition, they take advantage of the University of Washington's Education School – by hiring graduate students – to analyze their data. Identified contacts are 5200 for \$58 per contact.

SSI has a large geographical region that has encouraged their use of “e-Brokering”. In many ways, SSI has the most quantitative data and analysis of their effectiveness, which was reflected in its sophisticated figures presented in response to the Panel's questions. In the 2005 Report, 5000 contacts were identified – which by a rough measure is \$60 per contact. About half the budget goes to salary, and half to travel and projects.

***Forums –***

The Forums report the numbers of products, partnerships, and contacts. However, all Forums did not consistently do this and this is reflected below.

Origins - Allocated budget: \$850,000. Allocation of resources: 60% labor, 24% partnerships, 16% materials. As Reported: 200 partnerships, 36 products.

Universe – Allocated budget: \$1,600,000: 50% Labor, 10% materials and travel, 40% partnerships. Reported Activities: 9 products, 300 partnerships.

SECEF – Allocated budget: \$2,600,000. 16 products, 45 + partnerships, 450,000 contacts.

Solar System Exploration – Allocated budget \$850,000. 30% materials, 70% Labor (4 FTE) 14 products, 5 partnerships, 12,000 contacts.

The Review Panel did not find this data to be very useful. There should be other more meaningful data collected and analyzed in a more uniform manner in order to better measure cost-effectiveness.

**Question 4: The approaches taken by the Forums and Brokers have been non-uniform. Has their non-uniformity been effective or not?**

To answer this question the following resources were used:

- All documents supplied electronically in advance of the Panel
- All presentations provided during the Panel review
- All written documents provided during the Panel review
- Questions asked by Panel members
- First hand professional knowledge of the Support Network, Broker/facilitators, and each Forum

To answer this question the following process was used

- The Broker/facilitator work, the Forum work, and collective Support Network work was examined
- The allowance to each group to be non-uniform was examined
- The approach itself
- The resultant activities both related to Core Functions (Table 3, Executive Summary 2005) and the listing that the Forums provide (Table 4, Executive Summary 2005)

The Review Panel found that direct E/PO activities are currently a part of the continuing work of both the Brokers and Forums.

Wide ranging reasons exist for these E/PO activities, from Brokers only being part time employees, the nature of the Forum and Broker activities themselves, synergistic work, and when opportunities arise during other functions or activities of the location for the Forums or Brokers; as examples. While direct E/PO activities are not within the purview of the defined Core Functions or the Forum listing, there are times when direct E/PO work is advantageous. The Forums have the direct responsibility to “tell their Forum’s specific story; thus direct E/PO activities are a natural part of this responsibility. The Brokers have noted that direct E/PO work is only a temporary function of their operations and have developed a matrix for maturing this direct work into a sustainable independent enterprise. (Matrix example provided, slide 54, Broker Overview, November 8, 2005)

The review Panel has found the following about the Broker/Facilitators and Forums

- Non-uniformity provides the opportunity to recognize and support activities not generally supported within NASA
  - Special needs projects and products have been developed and distributed
  - Specialized groups (Girl Scouts) have been recognized and served
- Non-uniformity adds a rich and unique perspective to doing NASA business
  - Brokers are able to identify their primary E/PO audiences within their regions,
  - Forums are able to translate new space science understandings to a variety of audiences
- Non-uniformity allows for diversity of approach to doing NASA business
  - Brokers are able to respond to the needs of their regional audiences

- Forums are able to provide products, materials, and information specific to their Forum missions
- Non-uniformity allows for regional tailoring of work and activities
  - Broker/facilitators to assist and serve specific audiences within their own region
  - Non-uniformity allows each Broker/Forum to maximize their strengths.

Of special note is the entrepreneurial nature of Brokers and Forums. A number of them have leveraged their work into a more significant outcome, product, or process. Specific examples were provided that include the Girl Scouts project, activities for minority and underserved populations, and products as *GEMS*.

Various NASA citations support this non-uniform approach to doing business. For example in the 2005 Executive Summary the work in Chicago Public Schools being conducted by the DePaul Broker was cited. In the same publication e-Brokering strategies were referenced. In previous years the work being done in the area of special needs was exemplified. Broker/Forum work in the special needs area is unique. For the first time NASA photographs and activities are being translated into Braille. Each of these examples is representative of approaches and products that have developed because of the non-uniform approach. While it is not known if these activities would take place in other NASA efforts; clearly the ideas are the result of the creativity allowed in the non-uniform Broker and Forum approach to their work.

The Support Network is guided by a set of principals (Table 2, Executive Summary, 2005). It is from those principals that the work of the Support Network has emerged. Some examples of the Support Network include a listserv for the Brokers, the Education Council, Working Groups, and Broker/Forum integrated activities. This task force also recognizes that the Support Network is a valuable part of the OSS Broker/Forum work and finds the following contributions to be significant:

- The network serves as the conduit for Broker/Facilitator work
- The network provides coordination for the diverse activities of the Brokers/facilitators
- The network integrates the non-uniform activities of the Broker/Forums
- The network provides the opportunity for the Forums to integrate the science activities within each Forum
- The Brokers and Facilitators value the Support Network and willingly work toward a coherent approach to the Support Network.

This Review Panel recognizes that while this non-uniform approach to doing business at NASA can be beneficial, the system of checks and balances needs to be strengthened. The Review Panel finds that some uniformity could help the Brokers and Forums be more efficient, effective, and accountable. The following may lead to improvements in the SN:

- Clear and measurable articulation of goals and objectives for each Broker and Forum
- Uniform reporting mechanisms

- Uniform marketing activities, such as a common Web site and logo
- A mechanism to capture the corporate memory of this system
- Strategic planning
- A review and advising group to provide yearly guidance.

The Review Panel finds that changes at NASA Headquarters have led to some confusion as to the role of the Support Network. Additionally, the SN members have devoted significant effort to responding to the Knappenberger Task Force recommendations, without any increase in resources. These changing conditions coupled with special requests/assignments from HQ given to some of the Brokers and Forums have placed stress on the SN.

The Review Panel finds that not all of the B/F Core Functions are 'core' in nature and could be reexamined. Core Function # 6 should be considered for elimination.

The Review Panel finds that there should be a uniform set of roles and goals for which an expected level of achievement is established. That list should include:

- Provide information to both scientists and educators about new products, or events developed by Forums, E/PO leads, or fellow Brokers
- Provide information to scientists about new opportunities to participate in E/PO
- Seek and partner with local, state, and regional scientific societies or groups and organizations, and national organizations when appropriate
- Seek and partner with local, state, and regional education departments or groups and organizations
- Find high-leverage opportunities in the region to match NASA resources (scientists, NASA materials, etc. with educational needs that are clearly identified by the representative educational organizations in the region
- Form relationships in the region with institutions and individuals (both scientific and educational) to find out needs of the respective organizations
- Foster partnerships between scientists and educators proactively.

In summary, this Review Panel finds that there should be a uniform set of roles and goals (expressed in measurable terms) with uniform Reporting procedures for the B/F and for the Forums, with additional non-uniform pro-active functions that reflect the needs of various communities matched with the strengths and interests of the individual B/Fs and Forums.

## **Question 5: How can SMD improve the E/PO Support Network?**

Findings for Improvements:

I. The Review Panel finds that following changes could lead to improvement in the performance of the Support Network:

- **Organizational Structure:**
  - A SN strategic plan is needed to define the overall SN goals and objectives.
  - SMD should consider creating an Executive Director position [with commensurate staff support] for the network.
  - The network would benefit from an external Advisory committee that reviews the organizational structure and progress of the Support Network as a whole and advises on future directions.
- **Roles and Goals:**
  - The SN goals and objectives could be revisited to clarify the expected roles of both the Brokers and of the Forums and to outline specific goals to which each of the Brokers and the Forums can propose specific measurable objectives.
  - A uniform set of Core Functions should be created for which an expected level of achievement are established. Additional non-uniform functions that reflect the needs of various communities should clearly match NASA's needs and the strengths and interests of the individual B/Fs and Forums.
- **Distribution of regional effort:**
  - The current regional divisions do not necessarily lead to efficient and effective operation.
  - Consider defining the regions in advance of the next solicitation and include the definitions in the solicitation.
  - The workload for each region should be as equitable as possible, given regional differences, and/or funding levels should reflect the level of effort required for each region.
- **Budgets:**
  - Reasons for these disparities could not be determined given the budget information provided. The budgets of each Forum & Broker should be reviewed as part of the overall review of goals, roles and metrics, and tied to the strategic plan.

II. The Review Panel finds that the following changes may lead to improvements in operational practices:

- External Communication and Marketing:
  - The Network needs a better web presence, a better marketing plan, and a more consistent outreach message to the public. (The work of the Forums and Brokers is not always evident to users who are “outside NASA”).
  - A better marketing plan would include a uniform logo, uniform webpage design, better placement of web connections on the main NASA webpage, and better connections to national organizations and professional societies.
  - The SN members should make more effort to publish in a wider range of journals and other venues in order to publicize what they do and to explain how new partners can participate.
  
- Metrics and Reporting:
  - The SN needs better metrics for measurement of Broker and Forum impact. The measurement system should not be focused only on numbers of participants. Metrics should be focused on the level of *positive* impact and quality of the services and programs.
  - The SN as a whole, and the Forums and Brokers individually, should use uniform outcome and reporting processes, including common budget categories in their reports. Where amplification of efforts has resulted, these should be explicitly called out.
  
- Internal Communications:
  - Better communications among the SN members is desirable and might be facilitated by a variety of methods, including the use of improved technology. For example, a NEEIS Support Network Dashboard might be useful to the network for improved information flow.

III. Evaluation is a critical element of the overall success of the Support Network: The following changes may strengthen the evaluation efforts:

- Competition for overall Support Network evaluator contracts every few years will avoid too much familiarity with the programs on the part of the independent evaluators. Longitudinal studies, however, will require a long-term contract and should be performed by an external evaluator who is independent from the overall evaluator.
- The evaluator should be tasked to evaluate the SN as a whole and to help the individual Brokers and Forums evaluate their specific efforts.
- Potential Surveys and Longitudinal Studies: The Forums & Brokers should also consider some of the following evaluation efforts:
  - Survey of Mission E/PO’s on the value of the Forums in furthering the goals of the Missions.
  - Survey of individual scientists on the value and effectiveness of the Brokers in facilitating partnerships with educators.



- Longitudinal studies of curriculum changes in inner-city schools targeted by Brokers/Facilitators. Example: Chicago.
- Longitudinal studies of science-teacher partnerships and their impact on the teacher and curriculum.

An overarching strategic goal for NASA Education is inspiring and motivating students to pursue careers in STEM fields. How can progress toward achieving this goal be determined? Quantifying the number of students who have pursued STEM careers as a result of activities of the SN is not a task assigned to the Forums and Brokers, nor is it one with an obvious method of assessment. However, the Panel feels that NASA management might want to look at ways to measure the true success of all the activities of the SN. If the ultimate goal is to increase the number of students in STEM fields, evaluation methods that are beyond the scope of the Forums and Broker/Facilitators will have to be considered. This might include longitudinal studies of a student cohort.

## APPENDICES

### APPENDIX A      E/PO Support Network Review Panel Charter

To:     Program Review Panel Members  
        Broker/Facilitators  
        Education Forums

From:   NASA HQ/SMD/ C. Pilcher/ Science Mission Directorate Senior Official for Education and Public Outreach

Subject: Program Review 2005 of the SMD E/PO Support Network

NASA's Science Mission Directorate (SMD) periodically conducts reviews of its programs to maximize their return. NASA uses the findings from these reviews to give programmatic direction and/or refine implementation strategies.

NASA will host a Program Review of the SMD Education and Public Outreach (E/PO) Support Network November 8-10. The E/PO Support Network is defined as the regional Broker/Facilitators and the thematic Education Forums created under the former Office of Space Science. A Program Review of the SMD E/PO Support Network is especially important and timely for several reasons. The Cooperative Agreements for the Broker/Facilitators will be ending in January 2007 and the Forum agreements in 2008. The Support Network also needs to evolve to respond to the merger of the Offices of Earth Science and Space Science into the Science Mission Directorate and the evolving NASA Education landscape.

This letter describes the objectives and process for the review and contains instructions for the preparation of presentations by the Broker/Facilitators and Education Forums.

#### **The Program Review:**

The Program Review Panel, to be formed by NASA HQ, will evaluate the Support Network at a meeting of the Panel in Washington, D.C. The Panel will meet for three days during which it will produce a draft Report of their findings and conclusions. An agenda is provided in Attachment 1. SMD will provide the Panel a set of background documents on the E/PO program and the Support Network. The list of documents is provided in Attachment 2. SMD will use the results of this Program Review as input to its decisions regarding the future of the Support Network including rebalancing of resources and/or possible fundamental changes in the structure and/or responsibilities of the Support Network.

While the effectiveness of the parts naturally feeds into the effectiveness of the whole Support Network, this effort is intended to be a review of the overall E/PO Support Network concept and effectiveness and not the individual Brokers/Facilitators and Education Forums. There will be one combined presentation to the Program Review Panel from the Broker/Facilitators and one combined presentation from the Education Forums.

### **Instructions to the Program Review Panel:**

The Program Review Panel is expected to address the following questions:

1. Do the Forums and Brokers have clear and appropriate goals and objectives?
2. Can progress toward achieving the E/PO Support Network goals and objectives reasonably be determined?
3. Is the current implementation approach a cost-effective method for achieving the Support Network goals and objectives?
4. The approaches taken by the Forums and Brokers have been non-uniform. Has their non-uniformity been effective or not?
5. How can SMD improve the E/PO Support Network (with reallocation of resources, improved processes, etc.)?

Information to assist the Panel in its deliberations will be provided in background materials, presentations by SMD personnel, and the presentations by the Broker/Facilitators and Education Forums, but may include any other sources (e.g. interviews with users of the E/PO Support Network) as the Panel desires.

The Panel will be expected to complete a draft Report by the close of the Panel meeting and a final Report by three weeks thereafter.

### **Instructions for Presenters:**

There will be one presentation from the Broker/Facilitators and one presentation from the Forums. Each presentation will be allotted 45 minutes plus 45 minutes for questions and discussion.

The Broker/Facilitator group and the Education Forum group will work together to develop these presentations to assist the Program Review Panel in addressing the above questions. These presentations should include, but not necessarily be limited to:

1. A statement of the goals and objectives of each group.
2. The value of those goals and objectives to the Science Mission Directorate (this should include both how those objectives fit in to overall NASA education goals and how they are specifically relevant to the SMD).
3. A synopsis of achievements for the last two years
4. A frank assessment of strengths and weaknesses in the Support Network concept, the SMD E/PO program, and possible corrective actions.

[The Panel may provide additional areas to be included in the presentations.]

One representative from each Forum and each Broker/Facilitator group is invited to attend the first day of the Panel meeting.

**Attachment 1**  
**Program Review: Education and Public Outreach Support Network**  
**November 8 2005**  
**TBD, Washington, DC**

**November 8:**

8:30 AM Meeting Introduction and Logistics  
9:00 Group Discussion  
    -- Panel Charter  
    -- Panel Work Planning and Organization  
9:30AM SMD Space Science Education Program—Cooper  
10:15 BREAK  
10:30 Forum Presentation  
12:00 PM LUNCH  
1:15 Broker Presentation  
2:45 BREAK  
3:00 Group Discussion  
5:00 ADJOURN  
7:00 Group Dinner: TBD

**November 9:**

8:30 Group Discussion  
    -- Panel Work Planning and Organization  
    -- Panel Assignments  
NOON LUNCH  
1:00 PM Continuation of Group Discussion  
4:00 ADJOURN

**November 10:**

8:30 Continuation of Group Discussion and Report Writing  
NOON LUNCH  
1:00 PM Continuation of Group Discussion and Report Writing  
4:00 ADJOURN

**Attachment 2**  
**Reference Materials**

1. NASA, Partners in Education: A Strategy for Integrating Education and Public Outreach into NASA's Space Science Programs, NASA, 1995.  
*The 1995 OSS E/PO Strategy that sets out most of the basic policies that are still governing the overall Space Science effort.*
2. NASA, Implementing the Office of Space Science Education/Public Outreach Strategy, NASA, 1996.  
*The 1996 OSS E/PO Implementation Plan—developed an SScAC E/PO Task Force that laid out the approach for realizing in practice the policies contained in the Strategy. Co-Chaired by Reta Beebe and Jeff Rosendhal.*
3. Implementing the Office of Space Science Education/Public Outreach Strategy: A Critical Evaluation at the Six-year mark  
*The 2003 OSS E/PO Evaluation Report—developed an SScAC E/PO Task Force that assessed the progress of the E/PO program in carrying out the 1996 Implementation Plan. Chaired by Paul Knappenberger.*
4. The NASA Office Of Space Science Education And Public Outreach Program  
*This paper provides an overview of the program origins, policies and philosophies, and describes the development and growth of the program. Program accomplishments and the challenges that remain are discussed.*
5. Program Evaluation Reports  
Interim Evaluation Report, *January 2000—May 2001*  
Interim Evaluation Report, *October 2001—June 2002*  
Phase III Final Evaluation Report, *October 2001—October 2003*  
*Reports on the independent evaluation of the Office of Space Science Education and Public Outreach Program. The Program Evaluation and Research Group at Lesley University in Cambridge, MA conducted the evaluations*
6. 2005 Annual Reports  
**Forums**  
Sun-Earth Connection Education Forum  
Structure & Evolution of the Universe Education Forum  
Solar System Exploration Education Forum  
Origins Education Forum  
**Brokers**  
NESSIE (Boston Museum of Science)  
SERCH (College of Charleston)  
MARSBB (Wheeling-Jesuit University)  
SCORE (Lunar and Planetary Institute)  
DePaul University  
Space Science Institute  
S2N2 (University of Washington)
7. Solicitation For Office Of Space Science (OSS) Education And Public Outreach (E/PO) Broker/Facilitator Program – 2001.

**APPENDIX B****E/PO Support Network Review Panel**

Paul Knappenberger (Panel Chair)	Adler Planetarium and Science Museum	paul@adlernet.org
Shelly Lee	Wisconsin Department of Public Instruction	<a href="mailto:shelley.lee@dpi.state.wi.us">shelley.lee@dpi.state.wi.us</a>
Katy Garmany	National Optical Astronomy Observatory	garmany@noao.edu
Shelly Canright	NASA Office of Education	shelley.canright@nasa.gov
Krisstina Wilmoth	NASA Astrobiology Institute	Krisstina.L.Wilmoth@nasa.gov
Peter Folger	American Geological Institute	pfolger@agu.org
Elizabeth (Lisa) Rom	National Science Foundation	erom@nsf.gov
Susana E. Deustua	American Astronomical Society	deustua@aaas.org

## APPENDIX C Measure Definitions (OMB)

**Output Measures:** Outputs describe the level of activity that will be provided over a period of time, including a description of the characteristics (e.g., timeliness) established as standards for the activity. Outputs refer to the internal activities of a program (i.e., the products and services delivered). For example, the number of students served.

**Outcome Measures:** Outcomes describe the intended result from carrying out a program or activity. They define an event or condition that is external to the program or activity and that is of direct importance to the intended beneficiaries and/or the public. While performance measures must distinguish between outcomes and outputs, there must be a reasonable connection between them, with outputs supporting (i.e., leading to) outcomes in a logical fashion.

**Efficiency Measures:** While outcome measures provide valuable insight into program achievement, more of an outcome can be achieved with the same resources if an effective program increases its efficiency. Sound efficiency measures capture skillfulness in executing programs, implementing activities, and achieving results, while avoiding wasted resources, effort, time, and/or money. Simply put, efficiency is the ratio of the outcome or output to the input of any program. The best efficiency measures capture improvements in program outcomes for a given level of resource use.

NOTE: Leveraging is not an acceptable efficiency measure, because the leveraging ratio of non-federal to federal dollars represents only inputs. Leveraging stretches federal program dollars further but doesn't measure improvements in the management of total program resources, systems, or outcomes.

**Output versus Outcome Measures:** Outcome measures are best, because these are the ultimate results that benefit the public. Programs must try to translate existing measures that focus on outputs into outcome measures by focusing on the ultimate goal of the program

**Target:** Targets refer to improved levels of performance needed to achieve the stated goals. Targets must be ambitious and achievable given program characteristics. Each target must have a timeframe (e.g., year(s) in which the target level is to be achieved). Targets should be quantifiable but OMB recognizes measures and targets may need to be qualitative and supported by peer review (e.g., expert Panels). When a target is not quantitative, it must still be verifiable

**APPENDIX D      Sample: Measures**

*Strategic Objective: Improve public understanding and appreciation of space science mission.*

	OUTPUT	OUTCOME	EFFICIENCY
<b><u>Informal Education</u></b>			
National Program:	<ul style="list-style-type: none"> <li>• MARS Museum Visualization Alliance: Create a network of museums utilizing NASA data and resources to engage the public in Mars exploration. The network will provide access to imagery, animation, schedules, expertise and resources related to NASA's Mars missions</li> </ul>	<ul style="list-style-type: none"> <li>• At least 100 museums will create new, continually updated programs, exhibits, resources and public engagement experiences by joining and participating in the Mars Museum Visualization Alliance</li> </ul>	<ul style="list-style-type: none"> <li>• NASA will use the MMVA infrastructure and network to provide new resources in support of the Cassini-Huygens mission and exploration of Saturn</li> </ul>
Instructional Materials:	<ul style="list-style-type: none"> <li>• Youth-Based Organizations: Develop formal relationships between NASA and the Boy Scouts of the United States and the Girl Scouts of the United States</li> <li>• Provide tools and materials to GSUSA and BSUSA trainers to engage and excite youth in STEM disciplines</li> </ul>	<ul style="list-style-type: none"> <li>• Engage and train 50 national Girl Scout trainers representing 15% of the GSUSA councils, or over 400,000 girls on earth and space science content.</li> <li>• Support the National BSUSA Jamboree, directly reaching 40,000 Scouts and leaders</li> </ul>	<ul style="list-style-type: none"> <li>• Develop lessons learned models from work with GSUSA and BSUSA to develop NASA strategy for engagement of the Boys &amp; Girls Clubs of America and National 4-H</li> </ul>
Professional Development:	<ul style="list-style-type: none"> <li>• NASA Explorer Institutes: Implement six NASA Explorer Institute Workshops and 10 NASA Explorer Institute focus groups to establish linkages that promote new relationships between providers of informal education.</li> </ul>	<ul style="list-style-type: none"> <li>• Over 100 informal education organizations will participate in workshops or focus groups, developing plans to engage their constituents in NASA content and STEM opportunities</li> </ul>	



**APPENDIX E      Sample: Project Brief Status**

	Green	Yellow	Red
<i>COST</i> - Evaluate how the Project budget is performing (EAC-Estimate At Complete) against the approved Program/Project Plan* budget (BAC-Budget At Complete), and FY Actual versus Planned performance.	<i>Progress according to plan</i>  · Meeting management plans or commitments	<i>Area of Concern.</i>  · Problem can be resolved within Reporting organization.	<i>Significant Problem</i>  · Help required beyond the Reporting organization to address the problem.
<i>SCHEDULE</i> - Evaluate how the Project schedule is performing to ensure major milestones and the Program/Project delivery date(s) approved in the Program/Project Plan are met.	<i>Progress according to plan</i>  · Meeting management plans or commitments	<i>Area of Concern.</i>  · Problem can be resolved within Reporting organization.	<i>Significant Problem</i>  · Help required beyond the Reporting organization to address the problem.
<i>Technical Performance</i> - Evaluate how the Project is meeting the requirements that are documented in the approved Program/Project Plan.	<i>Progress according to plan</i>  · Meeting management plans or commitments	<i>Area of Concern.</i>  · Problem can be resolved within Reporting organization.	<i>Significant Problem</i>  · Help required beyond the Reporting organization to address the problem.
<i>Management Issues</i> - Evaluate management products/processes and other management responsibilities to ensure ability of the Program/Project to meet commitments.	<i>Progress according to plan</i>  · Meeting management plans or commitments	<i>Area of Concern.</i>  · Problem can be resolved within Reporting organization.	<i>Significant Problem</i>  · <i>Help required beyond the Reporting organization to address the problem.</i>