

August 15, 2001

Mr. Frank C. Owens
Director, Education Division
Office of Human Resources and Education
National Aeronautics and Space Administration
Washington, DC 20546

Dear Mr. Owens:

Enclosed is the NASA Education Program Evaluation Review Final Report, which outlines the panel's conclusions and recommendations for the NASA Education Program. The panel members have had considerable experience in both producing and utilizing reports. The panel decided before the review that the report would have to be both readable and to the point if it was to achieve maximum value for the community. We should emphasize, however, that the findings presented in this report are based on an extensive review of materials, meetings with NASA staff, and considerable deliberation among panel members. We have tried to keep our report short and concise; however, the brevity of this report in some ways belies the extent of the analysis that went into it, and if more detail is needed in any particular area it can be provided.

Prior to convening, the panel members examined background information and data found in briefing books supplied to us by the support staff from Westat. We reviewed nearly 200 pages of program description and voluminous data produced through NASA's Education Computer Aided Tracking System. After witnessing presentations made by NASA staff during the initial day of the three-day meeting, the panel spent the remaining two days reaching the conclusions that are presented in this report.

Over the course of these two days, the panel reexamined data, testimony, and various documents concerning virtually all aspects of the NASA Education Program. The panel also engaged in extensive discussion in which each of the seven members contributed his or her thoughts on the Program. We subsequently reached consensus on the five questions from OMB, which formed the basis for our review, and all other observations and recommendations found in this report.

We are pleased to submit our report on the NASA Education Program, along with recommendations for enhancements. We hope that staff at NASA as well as those responsible for program oversight at Office of Management and Budget will find its contents useful and informative.

Sincerely,

A handwritten signature in black ink, appearing to read "W. A. Sibley", with a long horizontal line extending to the right.

William Sibley, Ph.D.
Expert Panel Chair

Enclosure

**NASA EDUCATION PROGRAM EVALUATION REVIEW
(NEPER)**

FINAL REPORT

Submitted by:

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August 2001

NASA External Panel Education Program Review

FINAL REPORT

1. Mission and Overview

The National Aeronautics and Space Administration (NASA) has been directed by the Office of Management and Budget (OMB) to conduct an external evaluation of its Education Program. The purpose of our review was to determine the extent to which the NASA Program provides an important contribution to the federal education portfolio, as well as to provide an assessment of the Program's strengths and opportunities for improvement. To fulfill this mandate, an expert panel was chosen to review the NASA Program and to assess the contribution that the Program is making to the field of education.

The panel based its study on a review of the professional literature, existing data, strategic plans, and testimony by selected program administrators and participants. The five key questions discussed in Section 2 served as a basis for the evaluation. (Selection criteria and background information on the panel members are provided in Appendices A and B, respectively.) Specific duties of the panel included a review of various evaluation data and other relevant materials, participation in a 3-day session in which NASA plans and programs were examined, and the development, with the help of Westat staff, of this final report that summarizes the panel's findings and provides specific recommendations to the Program for future direction. (The meeting agenda is included in Appendix C.)

After reviewing the available information, the panel concluded that NASA possesses a unique opportunity to use its facilities and personnel to enrich the education pipeline, from K-12 through the Ph.D. degree, in order to contribute to ameliorating the nation's projected workforce shortage in science and engineering. The panel believes it takes a community to build a strong and effective national science, mathematics, engineering, and technology (SMET) program. NASA is an important member of this community, and part of its role is to transfer and infuse the results of NASA R&D and Technology into the nation's SMET education efforts. The cutting edge experiments inherent in the NASA Program provide unique resources in every state and help position NASA as an education pacesetter. Although we have some suggestions for improving the system, the NASA program is serving to bring the next generation of technology into the nation's classrooms and universities.

2. Responses to Five Key Questions

This section focuses on the panel's responses to the five specific questions from OMB that formed the basis for our review. Included are our responses and specific recommendations for follow-up activities.

Is there an appropriate role in education for NASA that is unique from other federal agencies, such as the Department of Education and the National Science Foundation?

NASA today is a name and not just an acronym in American culture. NASA is synonymous with space exploration, risks, challenges, and problem solving. The Program operated by NASA captivates the imagination, generates dreams, and inspires future scientists, mathematicians, engineers, and technologists.

Surrounding the mission of NASA are sets of resources unique to this endeavor such as established networks and facilities in 50 states, Washington, DC and the U.S. territories, energized people from all walks of life who work for and with NASA, and technologies, documents and studies that open new questions and new frontiers. NASA captures the spirit of adventure in almost every activity by creating plans and revolutionary technologies to unlock the mysteries of the universe, reaching beyond the seemingly impossible, and generating an exclusive brand of excitement.

All of these factors make NASA a remarkable presence in the educational arena, promoting and supporting excellence in the fields of science, mathematics, engineering, and other related disciplines. These special scientific and technological resources provide NASA with a unique niche in the national science and education community. Therefore, this committee strongly supports NASA's Education Program.

What is the appropriate role in education for NASA?

NASA, with its FY \$13 billion budget, has fiduciary and moral responsibilities to transfer and translate the knowledge gained from sophisticated science and engineering ventures into compelling educational experiences for students, teachers, and faculty throughout the nation. Three characteristics of educational transfer appear important: 1) the contributions should support national, state, and local agendas, not create new agendas; 2) the content delivery should cover the vision and scope of mathematics, science (especially aeronautics and aerospace), technology, and engineering; and 3) the endeavors should capture the excitement and spirit of NASA exploration and new discovery.

NASA's Education Program comprises a suite of programs that address two broad groups: children in grades K-12 and students in postsecondary through graduate institutions. The K-12 offerings are measured by the three characteristics noted above. Most of NASA's university activities are congressionally mandated (Space Grant and EPSCoR, both of which are congressionally mandated, comprise two-thirds of spending at the university level) and follow the intent of the specific mandate. These efforts are particularly aligned to critical workforce development needs for NASA and other technologically/scientifically driven organizations.

Has NASA established appropriate goals and objectives for its Education Program?

The panel concluded that the appropriate set of goals and objectives guides NASA's national SMET educational enterprise. NASA accomplishes its K-12 sector goals by identifying leading SMET organizations and deploying their national network and resources to incorporate NASA-derived educational materials and products into curriculum, teacher/faculty preparation and enhancement, and student enrichment programs. At the postsecondary level, NASA meets its goals by providing support for students and faculty through scholarships, stipends, and fellowships to pursue careers and to research problems in NASA-related areas in the academic, federal, and industrial sector.

The NASA Education Program makes a broad impact with a relatively small amount of dollars. The agency has accomplished this objective through the following actions:

- Using sound planning and careful development of programs that exploit the unique scientific and technical facilities, products, and knowledge resulting from the NASA enterprises;
- Integrating active scientists in field centers and universities nationwide into education programs; and
- Building alliances, partnerships, and coalitions with key national SMET organizations to convert NASA high technology and products in space and earth sciences into educational materials and products that are infused into national educational initiatives.

Is the NASA Implementation Plan an effective document to guide the Education Program to the achievement of the identified goals and objectives?

The components of the Education Program have been designed and implemented to meet clearly defined objectives outlined in the NASA Implementation Plan for Education 1999-2003. Based on our review, the panel concluded that NASA's Implementation Plan includes appropriate goals and objectives that guide its Education Program and keep it aligned with NASA's mission. The panel's review of the Implementation Plan indicates that the work addresses three goals: (1) Information dissemination that contributes to public understanding and support for a strong and vibrant science and technology enterprise; (2) conversion of high technology knowledge and products into educational materials and products that stimulate learning; and (3) workforce development efforts to produce the next generation of scientists and engineers.

Is NASA's Education Program effective at achieving its established goals and objectives with the appropriate balance of recipients?

This question is one essentially of evaluation. The panel recognized the mandate to conduct "an external evaluation of NASA's Education Program." The members reviewed two large briefing books containing extensive printed material and listened to 1.5 days of oral reports by administrators and program officers. Extensive evaluation data were provided, although only a limited amount were longitudinal and recorded outputs over a significant period of time. Some of the panel had personal experience with the effectiveness of the Program from contact with the recipients.

The panel was impressed with the number of projects undertaken, the number and diversity of persons affected, and the effectiveness based on dollars spent per person reached. We concluded that the NASA Education Program is effective at reaching its goals within NASA's appropriate role. However, we recommended further longitudinal studies to document actual outcomes.

The panel identified four potentially promising actions the Education Division has taken to determine the extent to which goals and objectives have been achieved. The first is the implementation of the 1993 congressionally mandated Government Performance and Results Act (GPRA). The second is the division's new Education Computer Aided Tracking System, known as EDCATS. The third is the commissioning of selective programming evaluation conducted by independent third parties. The fourth is the establishment of a senior-level position within the division that includes responsibility for evaluation.

As to the first action identified, GPRA implementation requires that federal agencies annually assess the degree to which their programs produce intended results, and report their findings to Congress. The Education Division has incorporated this concept by developing a detailed NASA Implementation Plan for Education 1999-2003 and creating an evaluation framework to address each of its six program categories. It is too soon to judge the effectiveness of the Implementation Plan, but its comprehensiveness will be useful in evaluation and for making recommendations for change.

Regarding the second action, the division commissioned the National Research Council to review the NASA Education Program and to recommend indicators of program effectiveness. As a result, the division redefined its goals and objectives and created EDCATS. This Internet-based data collection system provides numerical information on the target population served, program characteristics, and participant rating of program quality. The system is designed to help determine the extent to which the Program addresses each of the major goals and objectives of the strategic plan, provides summaries of data showing trends over time in participation and ratings of programs, and produces data for use in a detailed review of individual programs. Still in the implementation phase, EDCATS is being revised to better assess the Education Program's long-term impact on students, teachers, faculty, curriculum enhancements, and other improvement such as leveraging of resources.

The third action the panel identified was the commissioning of selective education program evaluations by independent third parties. For example, the Chicago Academy of Sciences has evaluated the Spacelink Visitors Program, the NASA Education Resource Center Network, and the Graduate Student Research Program. Other examinations include a progress report on the Classroom of the Future (COTF) program and an American Customer Satisfaction Index report. In reviewing these evaluations, it was evident to the panel that the studies identified program strengths and weaknesses as well as made recommendations for improvements.

The panel believes that the Education Division must do the following:

- Remain vibrant while making certain that program operations do not preclude the evaluation obligations. A complete longitudinal database should be required for all programs.
- Take action on evaluation findings and recommendations.
- Develop additional metric indicators of education program performance, particularly in light of a continuing stream of external inquiries about the program. Ensure that minority and gender information is available for all programs.
- Make the important distinction between program implementation evaluation and program outcome evaluation. Include data on the *output* per NASA dollar investment.
- Stay abreast of national workforce development trends in order to ensure that its Education Program is responsive to actual and predicted needs. Make certain stipends are sufficient to attract and retain students in the areas of science, mathematics, engineering, and technology.

3. Panel Program Evaluations and Recommendations

This section highlights the panel's evaluation of specific programs in the five budget categories of the Education Division. The strengths of the individual programs are noted and panel recommendations for improved performance are indicated in the table below.

Section 3: Panel Program Evaluations and Recommendations

Program Areas	Strengths	Suggested Improvements/ Recommendations	Illustrative Indicators
<p>Teacher-Faculty Enhancement & Preparation FY 2001 \$9.6 million</p> <p>NEW NOVA SFFP TFSP</p>	<ul style="list-style-type: none"> Teachers and university faculty work directly with NASA scientists and engineers Many work in NASA Centers or University partners working towards NASA mission Nationwide dissemination of materials 	<ul style="list-style-type: none"> Increase stipends for university and K-12 teachers Ensure collaboration with NSF, state and U.S. Departments of Education and other efforts at the state and local levels 	<ul style="list-style-type: none"> NOVA: 76 university member institutions; 450-470 participants; 25% African-American; 125 new and revised courses TFSP: 83 faculty; 230 students; 75% of participants are female Research & Evaluation Study being done for FY 2002
<p>Student Support Programs FY 2001 \$20.9 million</p> <p>GSRP NSIP SHARP USRP</p>	<ul style="list-style-type: none"> Exposes students to the uniqueness and excitement and resources of NASA Bridges from K-12 to Higher Education programs Links education and research experiences to existing and future workforce needs of NASA 	<ul style="list-style-type: none"> Stipends need to be competitive with other agency programs Increase minority involvement in graduate programs Closer coordination with NASA's Minority Research and Education arm Increase leveraging of funding and resources (e.g. co-funding) with NASA Enterprises Increase coordination among K-12 programs 	<ul style="list-style-type: none"> Broad representation in application pool University programs parallel NASA Center programs (SHARP), thereby multiplying impact NSIP: 3211 students; 176 teachers; 75% of participants are female USRP: 1192 applicants; 839 qualified; 16% of participants are Hispanic; 12% African-American
<p>Education Technology FY 2001 \$9.1 million</p> <p>COTF LTP</p>	<ul style="list-style-type: none"> Responsive to community environment, trends, and needs (Bush Plan, etc.) 	<ul style="list-style-type: none"> Ensure education technology infusion into all NASA activities at all levels 	<ul style="list-style-type: none"> LTP: 85 percent of 62 projects have continued beyond NASA money; 22 participating universities
<p>Support of Systemic Improvement FY 2001 \$30.4 million</p> <p>AESP EPSCoR Linking Leaders Space Grant</p>	<ul style="list-style-type: none"> Strong linkages between awardees and Centers Strong leveraging exists with state, private sector and other universities and educational organizations in the state State-based coordinated initiatives 	<ul style="list-style-type: none"> Ensure coordination of Linking Leaders & AESP Enhance Congressionally mandated programs in accordance with Congressional intent 	<ul style="list-style-type: none"> AESP: 50 states; 180,000 Students; 45,000 Teachers Space Grant: 1600 undergraduate scholarships; 760 Affiliates; 25970 undergraduates; 4128 graduate students EPSCoR: 35 focused research groups in 19 states
<p>Evaluation FY 2001 \$1.6 million (EDCATS)</p>	<ul style="list-style-type: none"> Intention to establish and maintain an external program review panel Review of EDCATS for utility and oversight 	<ul style="list-style-type: none"> A complete longitudinal database is required for all programs Minority and gender information must be included Evidence of output resulting from the investment of NASA dollars should be measured 	
<p>AESP: Aerospace Education Services Program EPSCoR: Experimental Program to Stimulate Competitive Research NEW: NASA Education Workshops NSIP: NASA Student Involvement Program SHARP: Summer High School Apprenticeship Program UCEP: Urban Community Enrichment Program</p>		<p>COTF: Classroom of the Future GSRP: Graduate Student Research Program NOVA: NASA Opportunities for Visionary Academics SFFP: Summer Faculty Fellowship Program TFSP: Teaching from Space Program USRP: Undergraduate Student Research Program</p>	

4. Summary and Recommendations

The findings of the panel indicate that the role of the NASA Education Program is unique from other federal agencies. The mission, facilities, and specialized workforce of NASA offer appropriate opportunities to significantly impact education nationally. Experiences at NASA Centers such as the Johnson, Langley, and Goddard Space Flight Centers can significantly impact education and the workforce.

The panel commended NASA for developing its Implementation Plan for Education 1999-2003 and recommended close monitoring and evaluations of goals and objectives. Other panel recommendations included improving the coordination of some programs, and designing and implementing a robust evaluation component to show the impact of the NASA Education Program pipeline for SMET.

The NASA Education Program's continued role in K-12 through the doctoral level must be maintained, but stipends for students, educators, and faculty should be increased. The Space Grant Program should expand its national network through effective use of the uniqueness of individual states.

The panel further recommends that closer cooperation between NASA's Education Division and the Minority University and Education Division be used to diversify programs such as the Graduate Student Research Program. Interagency coordination and collaboration in this education and workforce arena is imperative. We recommend that a NASA representative be appointed by the President to participate in his 21st Century Workforce Initiative (Executive Order 13218 of June 20, 2001) and/or be a major player in an interagency team designed to make major progress in this area.

Appendix A

Method of Selecting Panel Members

To choose the expert panel, NASA's Task Order Officer (TOO) was asked to recommend individuals with knowledge and experience in relevant subject areas such as K-12 education, math/science education, educational technology, and postsecondary research. In the recruiting process, every effort was made to ensure diversity in terms of gender, ethnicity, and area of expertise. Potential candidates were also queried as to their current level of involvement with NASA to ensure that there were no issues that might be perceived as possible conflicts of interest.

The resulting panel contains diversity in terms of racial/ethnic background and subject matter expertise. While the inclusion of additional females and an evaluator who had participated in the Federal Coordinating Council for Science, Engineering, and Technology (FCCSET) review was preferred, it was not possible to achieve given the task's time and scheduling constraints. The demographics of the seven panel members are as follows: six males, one female, three whites, three African-Americans, and one Hispanic. The range of expertise spans six of the 10 desired subject matter areas: K-12 education, university research, science education, educational technology, private enterprise, and informal education.

Prior knowledge of and/or experience with NASA's educational programs were considered highly valuable. It was important that panel members had some understanding of NASA's role in education, as the timeline for this review did not permit much time to be devoted to providing that background. In selecting individuals, a balance between this requirement for previous experience with NASA with the goal of creating a panel that could take an unbiased look at the accomplishments of the educational program and offer constructive suggestions for improvement was sought. Interviews with potential panel members revealed that while all of the selected panelists have been involved with NASA's educational programs to one extent or another, there are no apparent conflict of interest issues that would cause concern for any of the parties associated with this endeavor. The panel members also stated that they felt they could provide an objective review of what has been accomplished to date.

Appendix B

List of Panel Members

William Sibley (Chair)

Dr. Sibley has dedicated his career to the field of postsecondary science research. Currently, as President of the Oklahoma Center for the Advancement of Science and Technology (OCAST), Dr. Sibley directs the development, implementation, evaluation, and modification of the center's programs and financial systems and represents OCAST before local, state, and national groups. His prior experience at the University of Alabama included serving as Vice President for Academic Affairs as well as professor of physics. In addition, he has served at the National Science Foundation as director of the Materials Research Division and of the Research, Evaluation, and Communication Division, and as program director for the Experimental Program to Stimulate Competitive Research (EPSCoR) for the National Science Foundation.

Thomas Acker

Currently, Dr. Acker is serving as Executive Director of Forward Southern West Virginia, Inc., an organization focused on issues relating to health, education, and economic development in the third congressional district in West Virginia. In this role, Dr. Acker has recently developed and implemented a training program for middle school teachers of science and math. He has also served as President of Wheeling Jesuit University in West Virginia and was founder of the Robert C. Byrd National Technology Transfer Center. He has also been a professor of biology at several postsecondary institutions.

Joseph Danek

As Senior Vice President of The Implementation Group, Inc., Dr. Danek provides consulting services to universities, schools, and other not-for-profit organizations in science, mathematics, engineering, and research improvement. He also serves as the Executive Director for the EPSCoR Foundation. As such, he acts as a national spokesperson for participating EPSCoR states working with the director of the SpaceGrant program to help develop programs at the state and federal level and as a consultant for improving institutional R&D infrastructures.

Robert Brown

Prior to retiring from his 36-year federal career, Dr. Brown served as NASA's Director of the Aerospace Education Division. He managed the Teacher in Space Program for 10 years and subsequently became Deputy Associate Administrator for Human Resources and Education until his retirement in 1994. Prior to his second retirement in March 2000, Dr. Brown was appointed Senior Associate to the Director of the Graduate School, USDA, where he designed, developed, and coordinated the school's strategic plan, and as Director of the International Institute for Training and Education.

Winnie Wooley

From 1962 to 1999, Ms. Wooley dedicated her career to teaching in the field of science at instructional levels K-16, including serving as principal of the Howard B. Owens Science Center in Prince George's County, MD. She has been a consultant in the field for over 20 years, and since 1999 has been a university supervisor at Bowie State University.

James Mitchell

Dr. Mitchell is the National Education Projects Manager at CASIO, Inc., where his responsibilities include providing strategic planning for the company's education-related initiatives. He provides guidance and feedback related to marketing efforts for CASIO's products. In doing such, he also is involved with curriculum and professional development initiatives as well as interfacing with other private and public enterprises, foundations, and federal agencies to facilitate the use of technology in learning.

Vicente LLamas

Dr. LLamas, currently Co-president of the New Mexico Partnership for Mathematics and Science Education, has devoted his career to the teaching of science and increasing the access to SMET careers of underrepresented populations. He has taught physics at the middle school, high school, and postsecondary levels and has served as a reviewer for many National Science Foundation programs and initiatives. In addition, he has been an NSF grant recipient for numerous programs such as instruction in physics and mathematics and course development in physics, and has been the principal investigator and consultant for organizations concerned with systemic initiatives.

Appendix C

Review Process and Meeting Agenda

On July 18th, 19th, and 20th, 2001, the panel officially convened to review NASA's Education Program. Prior to the meeting, all panel members received a briefing book, which provided existing data, strategic plans, testimony from selected program administrators and participants, and other relevant information. Additional materials were distributed over the three-day period, which provided more detail on significant programs and the present and future evaluation approach. The meeting agenda is below.

Day 1

9:00-9:30	Introduction of Participants, Review of Charge Bill Sibley
9:30-10:00	History of the Education Program Frank Owens
10:00-11:00	NASA's Implementation Plan Frank Owens/Malcom Phelps
11:00-11:15	Break
11:15-11:45	Budget Sherri McGee
11:45-12:30	Program Description, Goals, Accomplishments
	Student Support Lynn Marra
	NASA Student Involvement Program (NSIP) Lynn Marra
	Summer High School Apprenticeship Program
	(SHARP) Debbie Glasco
	Graduate Student Research Program (GSRP) Katie Blanding
	Undergraduate Student Research Program (USRP) Jim Gorman
12:30-1:30	Lunch
1:30-5:00	Program Descriptions, Goals, Accomplishments (cont.)
	Teacher/Faculty Enhancement and Preparation Shelley Canright
	NASA Education Workshops (NEW) Shelley Canright
	NASA Opportunity for Visionary Academics
	(NOVA) Malcom Phelps
	Summer Faculty Fellowship Program (SFFP) Katie Blanding
	Break (approximately 2:30)
	Curriculum Support and Dissemination Pam Mountjoy
	Teaching from Space Program (TFSP) Pam Mountjoy

Educational Technology	Shelley Canright
Classroom of the Future (COTF)	
Learning Technologies Project (LTP)	Shelley Canright
Break (approximately 3:30)	
Support of Systemic Improvement	Larry Bilbrough
Linking Leaders	Larry Bilbrough
Aerospace Education Services Program (AESP)	Larry Bilbrough
National Space Grant College/Fellowship Program (Space Grant)	Julius Dasch/DianeDeTroye
Research and Development	Julius Dasch
Experimental Program to Stimulate Competitive Research (EPSCoR)	Julius Dasch

Day 2

9:00-9:15	Overview of Day	Bill Sibley
9:15-9:30	Introduction to Evaluation	Malcom Phelps
9:30-10:15	EDCATS	BJ Bluth
10:15-10:30	Break	
10:30-11:00	Review of Interviews	Westat Staff
11:00-12:00	Discussion of Program, Clarification of Issues.....	Bill Sibley/ Panel/NASA Staff
12:00-1:00	Lunch	
1:00-5:00	Panel Discussion without NASA Staff	Bill Sibley/ Panel/NASA Staff
	Preliminary Discussion of Findings With Regard to Five Questions	
	Development of Initial Recommendations	
	Development of Report	

Day 3

9:00-2:00	Development of Report.....	Bill Sibley/ Panel/Westat Staff (NASA Staff on call)
2:00-3:00	Debriefing on NASA Staff	Bill Sibley/Panel
