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NASA-TM-111796

AIAA-95-1058

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Interface Between NASA Life Sciences
the Nation's Students**

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**Life Sciences and Space
Medicine Conference**
April 3-5, 1995 / Houston, TX

DEFINING A MECHANISM OF EDUCATIONAL INTERFACE BETWEEN NASA LIFE SCIENCES THE NATION'S STUDENTS

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Abstract

Harnessing our greatest national resource, as represented by the nation's students, will require a thoughtful, well developed and administered program that includes precise, executable strategies and valid evaluation tools. Responding to a national education outreach priority, the National Aeronautics and Space Administration's Life and Biomedical Sciences and Applications Division has initiated a process of organizing and implementing various strategies through a steering committee that includes representatives from Headquarters and three field centers with major Life Science Programs. The mandate of the Life Sciences Education Outreach Steering Committee is to develop ways of communicating space life science issues to America's students through the nation's teachers by curriculum enhancement and direct participation in the education process with an emphasis in the primary and secondary schools. Metrics are also being developed for each individually defined process so that the mechanism can be continuously refined and improved.

Education and Science Communication - The Government's Responsibility

Intrinsic to every scientific endeavor is the essential and most basic need to disseminate

the results for the good of the people. Government science is doubly bound - not only is there a social and ethical mandate to disseminate information, but the public is also the definitive customer and by law, federal agencies are required to make unclassified scientific results available.

This process of dissemination to academia and the general public is one of wide and varied approaches. Not only do results get disseminated but in so doing, young minds are stimulated to develop an interest in the widely variable fields represented by the research endeavors. The underlying philosophical driver of this approach has historically been "...to ensure global competitiveness... (by maintaining) a scientifically literate citizen(ry)... capable of understanding complex economic, political, ethical and social issues derived from an increasingly technological society." Ultimately this process of ongoing educational awareness will lead to "... encouragement of the science education efforts of the Federal government" which will result in the "encouragement and motivation of our youth to study mathematics and science...."¹ This is a somewhat parochial approach that feeds qualified individuals back into the employment pipeline even years removed from the effort.

But such parochial interests notwithstanding, such an approach is sufficiently diffuse so that other, broad ranging national interests are

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served as well. Industry benefits by this educational stimulation because they also obtain qualified professionals at the end of the educational pipeline. And students who never enter scientific or technical fields feel a kind of kinship with the nation's space program because through a given educational presentation or other process, they have personally touched or have been touched by the presentation. This block of individuals make up a substantially powerful political force in an age when budgets are more often than not determined by political realities of public support.

It is quite obvious that each of these concepts are driven by different facets of political concerns, either from an agency requirement for continuous supply of fresh scientific and technical expertise or the exigencies of a congressional voting block. Deeper than these justifications; however, are other reasons more philanthropic in origin. Returning to the most elemental justification for information dissemination, the ultimate basis for outreach of all kinds is ultimately a consideration of the ultimate good of the nation:

"...To maintain a leadership role in the 21st century, the National Aeronautics and Space Administration and other Federal agencies must take steps to contribute to the systemic reform of American education... by enhancing and expanding scientific and technological competence...to improve the competitiveness of our Nation in the world community."²

The range of issues from meeting the needs of NASA to the annual reality of defending the Space Agency's existence before congress are all a part of the reason for taking NASA's focus out of the laboratories and field centers directly to the people. The reasons are very diverse, the history is often convoluted

and difficult to follow, but the bottom line formed out of the philosophic whole is the mandate itself - to communicate the excitement and benefit of science to the American public and participate in the educational outreach process and thereby integrate itself into the daily affairs of the nation is as strong and well defined as it has ever been.

Process Implementation

On March 31, 1994, President Bill Clinton signed into law the Goals 2000: Educate America Act.³ In his speech to the children of the Zamorano Fine Arts Academy, the President remarked,

"This is a remarkable departure. First, there have never been any national standards. Second, there's never been any way to measure them. Third, there's never been any national skill standards for our workers. Fourth, we never thought we could do it with grassroots reforms."⁴

U.S. Secretary of Education, Richard W. Riley stated,

"Goals 2000 represents the culmination of years of hard work by many individuals committed to turning around and rebuilding this nation's education fortunes, and creating a comprehensive approach to education that will improve learning at every level - from early childhood to adulthood."⁵

The United States Department of Education has stated that Goals 2000 will rely on the "...Federal government providing assistance and seed money for local reform efforts."⁶

The National Aeronautics and Space Administration (NASA) has administered a large and very diverse suite of educational programs for many years, spanning the educational range from elementary school to postdoctoral studies. There were two main reasons for the development of these programs:

- (1) The programs were established in response to national needs to attract American students to careers in science, engineering, mathematics and technology.
- (2) Educational programs were established to meet the needs of the Agency and of individual NASA centers for skilled scientists, engineers, and technicians.

The prime thrust of their development was to ensure NASA always had a supply of highly trained personnel to carry out the agency's mission.⁷ Because of the nature of that mission, the prime educational thrust in these programs was science, mathematics and technology.

The Agency's role in education became even more important when in September 1989, President George Bush met with the Nation's Governors in Charlottesville in September of 1989 to discuss "... the education crisis".⁸ Attending this meeting were various Department Secretaries and NASA's Administrator. At this summit, the National Education Goals were established which ultimately led to the Goals 2000:

Educate America Act.* The summit also laid the groundwork in defining the role of NASA and other national Agencies participating in the education of the nation's school children.⁹

* The 1989 Education Summit itself resulted from the 1983 report to the President on the state of national education titled, "A Nation at Risk", which warned of the "...rising tide of mediocrity" in American education.

In order to better define and assess the effectiveness of its educational programs, NASA asked the National Research Council (NRC) to establish the NASA Education Program Outcomes (NEPO) Committee which was charged with evaluating all NASA educational programs and recommending comprehensive data collection procedures and indicators to assess program effectiveness.¹⁰

Prior to the NRC NEPO Committee's formation, the government had also established a like panel of experts called the Federal Coordinating Council for Science, Engineering and Technology (FCCSET). FCCSET (now named the National Science and Technology Council [NSTC]) outlined their own categories of programs that NEPO attempted to parallel, precluding redundancy and duplication of effort.¹¹

Concurrently, the NRC was establishing a set of National Science Education Standards for the nation's schools, a working draft of which first appeared in July of 1994.¹² This set of standards was to become a fundamental charter for national science education that would be implemented through GOALS 2000 with the assurance that its most basic meaning was "... a coherent vision of what it means to be scientifically literate." The NRC also promised that it was not to be a federal mandate to locally control schools, but an agreement and did not define a national standardization or actual curriculum.¹³

The fresh agency thrust with NASA, the new grade level priorities and approach was passed down through the various science offices and divisions at NASA Headquarters, many of whom responded in turn and formed Education Outreach Committees. Their task was to coordinate educational activities for their individual disciplines between NASA Headquarters, the field centers, schools and

general public.¹⁴ Such an outreach committee was established in November of 1994 by the Life and Biomedical Sciences and Applications Division (LBSAD) at NASA headquarters.¹⁵

The LBSAD Response

LBSAD formed an Education Outreach Committee on September 12, 1994 in Washington D. C. to develop guidelines for educational and public outreach activities within the division. This committee was appointed by the Director of LBSAD and consists of representatives from three NASA Centers that are involved in research in space life sciences. The Centers represented are: Kennedy Space Center (KSC), Florida; Johnson Space Center (JSC), Texas; and Ames Research Center (ARC), California. During that week, the members of the committee developed an inventory of life science related education outreach activities taking place at each of the Centers and a draft of the LBSAD Education Outreach plan.¹⁶ At the end of the week, the effort was presented to the LBSAD Director and representatives from the NASA Education Office for comments and approval. Two subsequent meetings were held at Ames Research in October of 1994 and at Johnson Space Center in November of 1994 to put the final touches on the plan.

The plan was specifically developed to describe and quantify how LBSAD will provide education outreach to the benefit of the American public. Education outreach was broadly defined to include NASA activities that interest, excite, inform, and teach science and math to students, educators, and the general public. It also included activities that advance scientific and technological literacy and keep the public informed of the benefits to be derived from space life sciences research.

LBSAD researchers, space-based and ground-based laboratory facilities represent the primary resources of the division targeted for integration into the program. Through the plan, LBSAD is instituting a comprehensive program of review, evaluation, collaboration and shared implementation strategies across all space life sciences organizations to enhance the division's overall educational efforts.¹⁷ Existing headquarters and field center sponsored programs will continue to be supported with their already impressive breadth and depth of educational interfaces in addition to initiation of new programs.

The purpose of the LBSAD outreach plan is to: 1) provide guidance to management with respect to NASA and life science goals in education and outreach efforts; 2) identify the education outreach areas requiring emphasis; 3) establish an organizational and programmatic infrastructure that supports education outreach and; 4) encourage employees to pursue efforts in education outreach.

Outreach activities are targeted to reach as much of the American public as possible, with an emphasis on students and educators. NASA financially supports many university students and provides funding for research in their laboratories. Yet, over the next decade, the elementary, intermediate, and high school students and teachers will also be included. By working with younger students, NASA can influence their formative years to generate interest and appreciation of life sciences. Women, minorities, and other historically unrepresented groups must be encouraged to participate in the science and engineering fields. It is hoped that more of these students will pursue life sciences careers through the LBSAD effort.¹⁸

For greater cost-effectiveness, efforts will be coordinated and leveraged between NASA field centers and with other federal agencies to achieve a greater level of efficiency and output in education outreach. Involving educators will be a high priority because they are the focal point of thousands of students during the course of their careers. By providing more support to teachers and faculty, NASA can reach more students with greater effectiveness.

Many education outreach activities arise out of employee initiatives and these are to be encouraged. LBSAD seeks to strongly encourage the innovative and creative spirit inherent in NASA employees and contractor personnel.

The LBSAD Education Outreach Plan describes nine objectives and implementation strategies for each of these objectives. Progress in these areas will be measured on a NASA-wide basis. The three field centers (ARC, JSC, and KSC) and NASA Headquarters will be perceived as one, unified organization in terms of organization, progress, and metrics.

The eight objectives of the plan are:

1. Increase general public awareness of Space Life Sciences
2. Enhance grade K-12 education
3. Enhance undergraduate, graduate, and post-graduate education
4. Improve communications among LBSAD organizations
5. Strengthen partnerships with professional educators
6. Encourage historically under represented groups
7. Improve collaborations with other federal agencies
8. Develop evaluation methods to measure the effectiveness of enhancement efforts to

measure effectiveness of enhancement effort¹⁹

Many programs currently being implemented by the NASA Education Office already target many of these objectives for the Agency. LBSAD will encourage increased participation in these programs by its personnel. Other strategies for implementation will require new programs or modification of existing programs or procedures and all will need to be evaluated as to their effectiveness and output. This will involve the development of metrics (methods of evaluation and benchmarks) in order to establish success or failure of the individual programs or the overall plan. Development of these metrics are targeted as a major ongoing task by the LBSAD Education Outreach Committee.

Conclusions

Education outreach and science communication have become one of NASA's primary missions. To enhance this mission, the unique capabilities and opportunities represented by life sciences missions and other research will be expanded by an educational program targeting teachers and students in K through 12th grade. The LBSAD has taken a significant step in organizing this effort to increase educational outreach in the area of space life sciences to the American public. It is the intent of the division to meet NASA's mission of stimulating public interest and knowledge in science and mathematics, particularly space science and engineering. The necessity for this effort can be summed up by a quote by P. Teilhard de Chardin: "The future lies in the hands of those who are able to give the coming generation good reasons to live and hope".

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