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First National Space Grant Conference Report

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January 16-19, 1990

Johns Hopkins Space Grant Consortium

Johns Hopkins Applied Physics Laboratory

Columbia, Maryland

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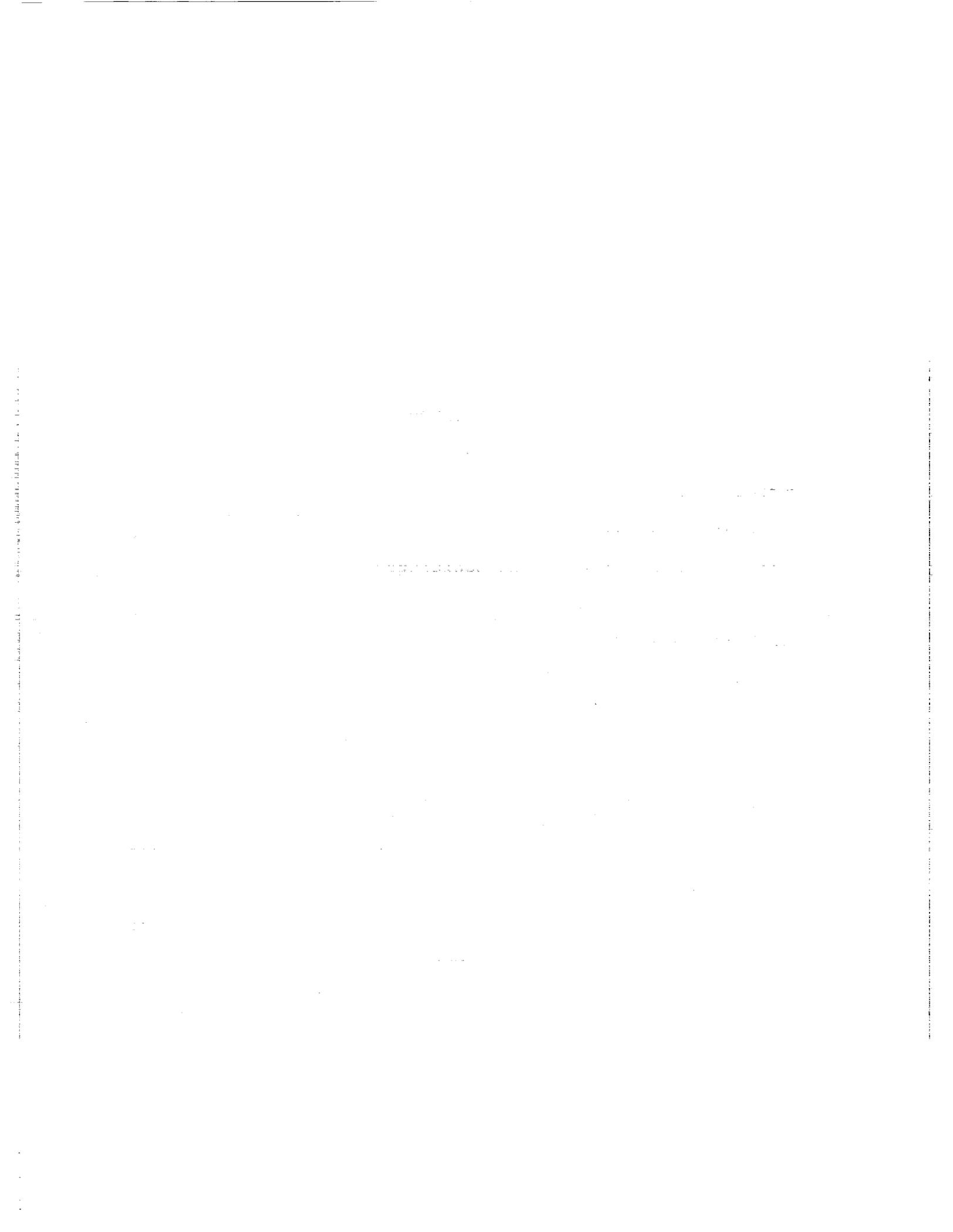
FIRST NATIONAL SPACE GRANT CONFERENCE REPORT

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THE NASA NATIONAL SPACE GRANT COLLEGE AND FELLOWSHIP PROGRAM

Background

The National Space Grant College and Fellowship Program was initiated by Congress with the passage, on October 30, 1987, of the National Space Grant College and Fellowship Act. The Space Grant Program was brought about as a result of efforts by Senator Lloyd Bentsen (D-TX) to respond to what he termed the need for a coordinated effort to help maintain America's preeminence in aerospace science and technology.

The Act -- Public Law 100-147 -- cites broad objectives of the Space Grant Program such as assuring the vitality of the Nation and the quality of life through the understanding, assessment, development and utilization of space resources. In addition, the law held that research and development of space science, space technology and space commercialization would contribute to the quality of life, to national security and to the enhancement of commerce. In recognizing these objectives, the Congress urged a "broad commitment and intense involvement on the part of the Federal government in partnership with state and local governments, private industry, universities, organizations, and individuals concerned with the exploration and utilization of space;..."

Of particular concern to lawmakers was the steadily shrinking pool of trained scientists and engineers. The Senate Committee on Commerce, Science and Transportation, in its report accompanying NASA's 1988 Authorization bill, suggested that neither NASA nor Congress had heretofore placed proper emphasis on developing the next generation of qualified technical personnel, while noting additionally that "more than 56 percent of NASA's current technical base are civil servants over age 45."

Moreover, in addition to promoting a strong educational base to assure future science and engineering resources, Congress urged NASA to consider distributing its research and development (R&D) funds on a geographical basis, where feasible.

To translate the objectives of the legislation into realistic and achievable goals, NASA Educational Affairs Division Personnel brought a number of individuals representing professional education and other associations into discussions on how best to structure the Space Grant Program. Representatives from the Association of American Universities, the Council of Graduate Schools, the National Association for Equal Opportunity in Higher Education, the National Association of State Universities and Land Grant Colleges, and the National Science Foundation, organized as the Space Grant Interim Review Panel, met with NASA personnel to outline program objectives and the means by which they could be fulfilled.

Program Objectives

As a result of these discussions, program objectives took shape as follows: (1) the establishment of a national network of universities with interests and capabilities in aeronautics, space and related fields; (2) the formation of cooperative programs among universities, aerospace industry, and federal, state and local governments; (3) the broadening of interdisciplinary training, research and public-service programs related to aerospace; (4) the recruiting and training of professionals, especially women and underrepresented minorities, for careers in aerospace science, technology and allied fields; and (5) the development of a strong science, mathematics and technology base from elementary school through university levels.

A major goal of the Space Grant program is to broaden the base of universities with interests and capabilities in space and aerospace fields. To accomplish this goal despite limited funding for Phase I of the program -- the designation of Space Grant Colleges/Consortia -- NASA encouraged the formation of consortia by providing financial incentives and through a "one Space Grant designation per state" restriction. Ideally, universities with existing resources would then be favorably disposed to share those resources with others. The University Programs Branch of NASA's Educational Affairs Division issued a Program Announcement the latter part of April 1989.

The designated institutions were selected based on a competitive evaluation of the university or consortium's existing aerospace activities and the quality of their plans to meet program objectives.

The 21 Space Grant Colleges/Consortia selected are: Alabama Space Grant Consortium; Arizona Space Grant College Consortium, California Space Grant Consortium; Colorado Space Grant Consortium; Cornell Space Grant Consortium; Florida Space Grant Consortium; Georgia Institute of Technology Space Grant Consortium; University of Hawaii at Manoa Space Grant College; Aerospace Illinois Space Grant Consortium; Iowa Space Grant Consortium; The Johns Hopkins Space Grant Consortium; Massachusetts Institute of Technology Space Grant College; Michigan Space Grant College Program; New Mexico Space Grant Consortium; Ohio Aerospace Institute; Pennsylvania State University Space Grant College; Rocky Mountain Space Grant Consortium; Tennessee Valley Space Grant Consortium; Texas Space Grant Consortium; Virginia Space Grant Consortium; and the University of Washington Space Grant College.

The total number of institutions in the Space Grant Program at the end of the Phase I selection is 86.

Provided that yearly evaluations show progress toward program objectives, Space Grant Colleges/Consortia will receive funding for five years, at which time the Space Grant designation may be renewed. In fiscal year 1989 each designee received \$75,000. In fiscal year 1990 and each year thereafter, provided that yearly performances are adequate, the institutions will receive \$150,000 for the Space Grant program, and \$100,000 for fellowships. Consortia receive additional funding, up to \$75,000, based on the number and particular strengths of member institutions. Total awards thus range from \$250,000 to \$325,000 a year. All Space Grant institutions must additionally obtain and provide matching non-Federal funds for all program (non fellowship) awards. Additional support for fellowships was encouraged.

The designation of Space Grant Colleges/Consortia is the first phase in an ambitious program to improve America's aerospace capabilities. Phase II and subsequent program development will provide program grants, project awards and fellowships to support space grant programs at other institutions so that university participation in aerospace fields may be expanded.

FIRST NATIONAL SPACE GRANT CONFERENCE

Marking the beginning of Space Grant programs for NASA and the 21 Colleges/Consortia, the First National Space Grant Conference was held January 17-19 at the Kossiakoff Center on the grounds of the Johns Hopkins University Applied Physics Laboratory in Columbia, Maryland.

The conference was organized by the NASA Educational Affairs Division/University Programs Branch in conjunction with the Johns Hopkins Space Grant Consortium -- the Johns Hopkins University, Morgan State University and the Space Telescope Science Institute -- and the NASA Goddard Space Flight Center, which co-hosted the meeting.

One hundred forty-eight representatives from the 21 designated Space Grant Colleges and Space Grant Consortia met with Headquarters personnel from Educational Affairs and became acquainted with University Affairs Officers from NASA field centers including Ames Research Center, Goddard Space Flight Center, Lyndon B. Johnson Space Center, Jet Propulsion Laboratory, Kennedy Space Center, Langley Research Center, Lewis Research Center, George C. Marshall Space Flight Center and Stennis Space Center. Space Grant designees were encouraged to establish associations with NASA field centers, and to share resources where feasible.

Conference goals were: (1) to provide a setting for Space Grant College/Consortia leaders to meet, learn about other participant groups, and discuss program plans; (2) to provide participants with updates on major NASA science and engineering programs and Educational Affairs activities; (3) to hold workshops on themes of critical importance to the program; and (4) to provide tours of NASA Goddard Space Flight Center and the Johns Hopkins University Applied Physics Laboratory and the Space Telescope Science Institute.

The conference schedule was an extremely full one. Conference Chair was Dr. E. Julius Dasch, Program Manager for the Space Grant Program. The opening session saw NASA Administrator Adm. Richard H. Truly, Code X Associate Administrator Kenneth S. Pedersen and Code EL Director of Solar System Exploration Division Dr. Geoffrey A. Briggs address the assembled participants. The first day's afternoon agenda included discussion by a panel of University Affairs Officers from NASA field centers, chaired by Elaine T. Schwartz, Chief of the University Programs Branch (XEU) of the Educational Affairs Division. The University Programs Branch is responsible for administering the Space Grant Program.

The main business of the conference centered around a series of 15 workshops in which 15 program directors or their designates discussed various components of the Space Grant program. These components -- outreach, pre-college education, publicity and organization, for example -- were earlier incorporated in very specific ways within individual program plans. The conference thus afforded those attending an opportunity to exchange information and concerns regarding program elements while exploring ways to structure, enhance and perhaps broaden their program plans. Space Grant representatives also discussed with Headquarters officials ways in which the Space Grant program itself should be evaluated.

Workshop facilitators presented to workshop participants a previously written "strawman" position paper on an assigned topic. For instance, in the workshop on Underrepresented Groups -- which include women, underrepresented minorities and persons with disabilities -- participants discussed, among other things, current methods of university minority recruitment and ways in which Space Grant Colleges and Consortia can effect better minority participation in aerospace programs.

After workshop discussions, revised papers were presented to the entire assembly. Because workshop topics covered most of the major themes of the Space Grant initiative, program directors and other conference participants were able to deepen their understanding of the broader objectives and implications of the entire program. On the basis of the workshops and conference discussion, the workshop facilitators redrafted and edited the reports which are contained herein. These reports, however, are not final statements on these critically important program topics; rather, they should be viewed as working documents.

Evening activities during the conference included a reception at the Maryland Science Center at Baltimore's Inner Harbor and a banquet hosted by Morgan State University; the banquet speaker was Dr. Franklin D. Martin, Assistant Administrator, NASA Office of Exploration. After workshops and before evening activities, conferees were also treated to tours of the APL facilities, the Space Telescope Science Center (located on the Johns Hopkins University Homewood Campus) and the NASA Goddard Space Flight Center.

Immediately after the conference, NASA Educational Affairs personnel and NASA University Affairs Officers met with members of the Johns Hopkins University local planning committee to discuss the conference and how it might be modified. Several formal and informal invitations for holding future Space Grant conferences were received from Space Grant College/Consortia representatives.

A committee consisting of three Space Grant Program Directors was established to study questions for future conferences such as their timing and content. It was determined that the Second Space Grant Conference will be co-hosted by the Alabama Space Grant Consortium and the NASA Marshall Space Flight Center in Huntsville, Alabama in 1991. The Third Space Grant Conference, whose timing has yet to be determined, will be co-hosted by the Texas Space Grant Consortium and the NASA Johnson Space Center.

FIRST NATIONAL SPACE GRANT CONFERENCE

WORKSHOP TOPICS AND FACILITATORS

- WORKSHOP 1 - Evaluation of NASA Space Grant Consortia Programs. Dr. Martin A. Eisenberg, Florida Space Grant Consortium.
- WORKSHOP 2 - Pre-College Education. Dr. Sylvia Stein, Pennsylvania State University Space Grant College.
- WORKSHOP 3 - College Education. Dr. David R. Criswell, California Space Grant Consortium.
- WORKSHOP 4 - The Use of Continuing Adult Education. Dr. Frank J. Redd, Rocky Mountain Space Grant Consortium.
- WORKSHOP 5 - Publicity and Public Relations. Dr. Charles E. Fosha, Colorado Space Grant Consortium.
- WORKSHOP 6 - Underrepresented Groups. Dr. David A. Peters, Georgia Institute of Technology Space Grant Consortium.
- WORKSHOP 7 - Outreach and Public Service. Dr. Harold J. Wilson, Alabama Space Grant Consortium.
- WORKSHOP 8 - Pipeline Issues. Dr. Joe T. Eisley, Michigan Space Grant Consortium.
- WORKSHOP 9 - State and Local Governments. Dr. Dennis Barnes, Virginia Space Grant Consortium.
- WORKSHOP 10 - Focusing Educational Initiatives. Dr. George K. Parks and Ms. Lisa Peterson, University of Washington Space Grant College.
- WORKSHOP 11 - University - Industry Interaction. Dr. Daniel E. Hastings, Massachusetts Institute of Technology Space Grant College.
- WORKSHOP 12 - Organization and Management of Space Grant Programs. Dr. Sallie Sheppard and Dr. Steven Nichols, Texas Space Grant Consortium.

WORKSHOP 13 - Communications. Dr. Donald D. Stouffer, Ohio
Aerospace Institute Space Grant Consortium.

WORKSHOP 14 - Use of Fellowships. Dr. Peter J. Gierasch,
Cornell Space Grant Consortium.

WORKSHOP 15 - Pitfalls. Dr. Terry Triffet, Arizona Space
Grant Consortium.

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Workshop 1

Evaluation of NASA Space Grant Consortia Programs

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**First National Space Grant Conference
Columbia, Maryland
January 16-19, 1990**

Evaluation of NASA Space Grant Consortia Programs

Abstract

The meaningful evaluation of the NASA Space Grant Consortium and Fellowship Programs must overcome unusual difficulties: a) the program, in its infancy, is undergoing dynamic change; b) the several state consortia and universities have widely divergent parochial goals that defy a uniform evaluative process; and c) the pilot-sized consortium programs require that the evaluative process be economical in human costs lest the process of evaluation compromise the effectiveness of the programs they are meant to assess. This paper represents an attempt to assess the context in which evaluation is to be conducted, the goals and limitations inherent to the evaluation, and to recommend appropriate guidelines for evaluation.

Introduction

The NASA Space Grant Program inaugurated in September 1989 was designed to catalyze the development of ideas, programs, and a broad-based institutional commitment and infrastructure that will, in the long run, satisfy the following explicitly or implicitly stated objectives:

1. To arouse the interest of a generation of K-12 students in mathematics and science, to improve their levels of competency in such subjects, and to stimulate their collective interests in, preparation for, and dedication to careers in diverse technologically-based disciplines.
2. To arouse the interest of the general public in aerospace-related activities of NASA and other governmental and private agencies, to get John and Mary Q. Public to stop yawning at the day-to-day successes of NASA et al., to develop a public appreciation for the scientific and technological challenges of aerospace science and technology, to develop and understanding of the scientific and technological benefits to accrue from a vigorous program of aerospace-related research and development, to develop a public understanding of the economic benefit of such programs to the nation, indeed, to convince the public that such programs are imperative to our economic health and national security.
3. To engender broad-based public support and the associated political constituency necessary for budgetary commitments essential to realize these objectives.

4. To co-opt increasing devotion of resources from State, Federal, and private agencies toward aerospace-related research and development and human resource development.
5. To assure a stream of well qualified and motivated technologically educated students being graduated at the BS, MS, and PhD levels, adequate to meet the needs of NASA, DOD, and our aerospace industries, and thereby preserve and enhance our technological competitiveness, balance of payments, national economy, and national security.
6. Affirmative action goals to enhance the opportunities for affected minorities and women are an independent objective and inherent to and a necessary condition to the meeting of the above stated five goals. Given the demographics of the work force projected for the coming decades, even the most mean-spirited, socially retrograde, morally perverse, but intelligent individual, would adopt as a Machiavellian strategy, a strong pro-affirmative action bias.

The above stated long-term objectives of the Space Grant Program define the context in which one can attempt evaluation of the National program and several State Consortia. The resources currently allocated to the task are woefully inadequate to fulfill the above goals but they can encourage the development of a cadre of committed people and institutions, and the establishment of effective means of communications among them.

Goals of the Evaluation Process

All that can be asked of the current programs at the current levels of funding commitment is the demonstration of promising approaches, and the identification of pitfalls, and promising looking but blind alleys, so that, when (not if) Congress, NASA, the States and private industry develop the resolve to provide the levels of investment necessary to attack problems that must be attacked we will do it with greater wisdom and efficiency.

Thus, the primary purpose of the evaluation process must be to set the stage for a cost-effective scaleup of the operations of the Space Grant Program. Since significant institutional and individual stakes will be riding on these evaluative assessments they will be necessarily biased.

Limitations to the Evaluation Process

Don Griffin, formerly of Westinghouse's Bettis Atomic Power Labs articulated what I will call, Griffin's Law:

"Under the best of circumstances, the product of objectivity and expertise in any one observer is a constant."

This "law", somewhat reminiscent of Heisenberg's Uncertainty Principle, articulated in the context of evaluation of high technology programs in a different discipline is applicable to NASA's goal of evaluation of the Space Grant Program. We will have to rely to a considerable extent on people with an "ax to grind" to prepare the evaluations. The best that we can do is to require that the bases for the evaluations be clearly articulated, that the underlying data be public, that the authors of the evaluations be identified, and that those responsible for reviewing the evaluations do so with clear understanding of the inherent biases of the authors. I am sufficiently sanguine with regard to human nature to trust to the basic intellectual integrity of the evaluators (ensemble average) not to fabricate the data. On the other hand, there will be wishful thinking that manana we will see the light at the end of the tunnel and our programs will be productive.

NASA has already missed (I believe) the opportunity to perform the evaluations with scientific rigor. To do so they should have rank ordered all of the Space Grant Proposals and funded all of the odd-ranked proposals, denying funding to the even-ranked proposals. One could then compare the performances of paired States with universities of inherently comparable qualities and would-be PI's of comparable imagination and enthusiasm. Such a controlled experiment would then allow one to isolate the effect of NASA funding on the outcomes. NASA was probably wise not to conduct such an experiment. The basic message is that we shall be hard pressed to measure the extent to which the NASA funding was the cause of the measurable advances. Those institutions and individuals represented at this meeting are aggressive, capable, and dedicated to the Space Grant goals. They would have found alternative ways to achieve some of the successes that we shall report.

It should also be noted that the Space Grant Program is only one of many factors that will affect the realization of the above stated goals. The overall state of the national and world economies, the national perception of the relative severity and importance of social problems, the worldwide geopolitical trends and Congress' and State legislative reactions to them, particularly as they may affect funding for DOD, NASA, and education, can be expected to have major impacts on the very variables that one would like to evaluate to assess the NASA Space Grant Program.

Conclusions and Recommendations

The Space Grant Program is in it's infancy. We are just beginning on the learning curve. The resources allocated to the problems are at the proof-of-concept level. The several Consortia are starting from diverse positions, have established diverse initial strategies, have articulated diverse short-term and long-term goals, dictated by conditions parochial to their specific situations. Accordingly, the following criteria for evaluation are recommended:

1. Quantitative Space Grant-wide objective functions should not be defined to evaluate individual programs.
2. It will probably be useful to gather data on standard quantitative measure of productivity (enrollments, degrees granted, papers published, patents awarded...) to report for the NASA Space Grant Program at large. The data will be of most interest in terms of year-to-year changes.
3. First year results should not be given heavy weight. The evaluations of the programs should be made over a longer haul.
4. Significant experimentation with and modification of programs is anticipated in the early years of the programs. Evidence of internal evaluation and responsive adaptation of program strategies is to be encouraged. Wherever possible such evaluation processes should be designed into the programs to assure timely feedback. Such internal use of evaluation should be the primary purpose of Consortium evaluations.
5. The consortia should be encouraged to develop parochially appropriate (that doesn't mean self-serving) evaluative criteria.
6. The evaluative criteria and means of assessment should be anticipated to be dynamic in the early years of the program.
7. From annual review of the individual criteria and evaluative processes will evolve a more systematic and common basis for evaluation as the programs mature.
8. NASA should provide early general guidance for the manner in which evaluation issues are to be treated in the September annual report.

9. It is our understanding that the first step in the Consortium internal evaluation process is to review the NASA RFP goals and to restate them in Consortium-specific terms.
10. During the formative years the primary thrust of the evaluation process is to assess overall national program effectiveness.
11. Longer-term evaluation of the national program and the consortia should ask the basic questions: Did we achieve the development of an effective network? Did we provide meaningful space-related experiences for students? Did we achieve leverage from the seed funding? Did we achieve a genuine commitment from our universities, industry, NASA and other public agencies?
12. We must avoid the development of an overly formalized and burdensome evaluation process, disproportionate to the programmatic size and level of effort.

For all the reasons stated herein, ultimate assessment of evaluations will remain to some extent subjective, requiring sagacity and judgment, and an ability to look beyond statistics to form a valid gestalt assessment of program(s) effectiveness.

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Workshop 2

Pre-College Education

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**First National Space Grant Conference
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Pre-College Education

Abstract

Pre-college education efforts are many and varied, involving the teachers, students, parents, museums, and youth groups. However, it is necessary to reach out to school administration at all levels if teachers are to be innovative in their approaches. This introductory meeting clearly indicated that more interaction between the participants would be profitable.

It is clear that the science pipeline leading from kindergarten to college entry needs to be filled with students. What is not clear is how we can do it. The plethora of projects being pursued by the NASA Space Grant College Fellowship (NSGC) programs to accomplish that goal are heartening and exciting. However this large gamut of programs may also indicate how new we are in this game and how little anyone knows about creating a pre-college interest in science and engineering. In a way it resembles the situation of the common cold--there is no known cure yet, so there are many so-called remedies. Unfortunately, the time we had together was entirely too short to address the evaluation situation, so that we can in the future zero in on the most effective approaches.

This report is: (1) a summary of the many ways the different NSGC's are approaching pre-college education; and (2) a list of suggestions.

The methods for introducing, interesting teaching and/or upgrading teachers in K-12 include:

Workshops, courses, conferences, institutes for

- Training
- Retraining
- Curriculum development
- Counseling methods
- Laboratory experience

Summer employment in aerospace industries

Similar endeavors for college education majors

Preparation of resources for teacher use includes:

- * Curricula
- * Libraries
- * Resource center
- * Audiovisual aids
- * Computer Programs
- * Props

Programs for students are being put in place:

- * Introduction of space-related topics into ongoing science programs
- * Seminars and symposia
- * After school space club
- * Adopt a school (by an NSGC college)
- * Space test competition between schools
- * Field trips
- * Hands on projects
 - Space and tools
 - 800# for assistance
- * College laboratory research experience
- * After school industry/teacher taught program for advanced students
- * Speakers at assembly
- * Summer day school program
- * Essay contest
- * Summer space-related employment
- * Space Camps
- * Tours of aerospace and NASA facilities
- * Science fairs
- * Traveling "museums" and "classrooms"
- * 800# - "Talk to an Astronaut"
- * Special TV programs for use in 4, 5, 6 grades with related teacher's guide and student materials
- * College student presentations
- * College campus visits
- * Computer conferences

Programs to enlist assistance from other sources include evening workshops for parents, establishment of a Scout Space Badge, and museum programs.

The following recommendations/comments were made by the participants:

- * Recruitment to participatory programs is no problem if there are good, on-going presentations in place.
- * Involve as many kinds of students as possible, not just science/engineer/math oriented--i.e., industrial arts.
- * Students like lots of give-aways.
- * Emphasize communication skills.
- * Bring parents into equation.
- * NASA has massive teaching resources.
- * Let's not con ourselves--creating enthusiasm doesn't substitute for good, basic learning and thinking in the sciences and math.

- * Why is there a drop in interest in science after 3rd or 4th grade?
- * We need to take advantage of the latest communication technology.
- * We need to continue networking as programs develop.
- * We should be doing more hands on science, since science educators place heavy emphasis on the value of experiments and laboratory work.

Two speakers strongly emphasized that if teachers are to use innovative means for reaching NASA's objective, the administrators must be reached--principals, supervisors, curriculum coordinates, as well as state-level administrators. Teachers are very often stymied in their efforts by lack of interest or understanding at executive levels. The felt that if this roadblock were not addressed, our efforts would fail. We as a group should be planning activity in that direction.

The general consensus is that this was just introductory and that more time is needed at our next meeting for input from experts and discussion of the value of each category of approach.

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Workshop 3

College Education

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**First National Space Grant Conference
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College Education

Abstract

Space Grant Colleges and Universities must build the space curriculum of the future on the firm basis of deep knowledge of an involvement with the present operating programs of the nation and an on-going and extensive program of leading edge research in the aerospace sciences and engineering, management, law, finance, and the other arts that are integral to our planetary society. The Space Grant College and Fellowship Program must create new academic fields of enquiry, a long and difficult process which will require deeper and broader interaction between NASA and academia than has previously existed.

Introduction

Our society has learned that increasing human knowledge extends the health, freedom, resources, and prosperity of our nation and the world. American society intends that college graduates acquire the skills to participate in increasing human understanding. In the later half of the 19th century the United States Congress realized that centers of higher education had to be created and nurtured in both the established and frontier states of America in order that Americans could develop the understanding of their land and its uses and to increase their abilities to envision and invent the future. To these ends a series of laws were passed that encouraged the system of national land grant colleges for the advancement of the agricultural and industrial arts (Morrill Act--1862; Hatch Act--1887; Merrill Act--1890). Congress provided 17.4 million acres of land and 8 million dollars of long term base funding in 1861. In 1887 each state was granted \$15,000/year. In 1890 an additional \$15,000/year was provided and an annual increase of \$1,000/year for 10 years was used to accelerate the growth and vitality of these land grant institutions. This vigorous support was rewarded. In 1860 the nation had 4 schools of engineering. By 1885 there were 85. The Smith-Lever Act and over 30 other educational measures passed in the first two decades of the Twentieth Century greatly extended the federal support of higher education. Now land grant colleges and universities award over 468,000 degrees annually, including over 33.5% of all bachelor's, 33% of all masters, and 60% of all doctoral degrees (NASULGC 1989). These federally aided institutions now play a major role in the advancement of the aerospace activities of the nation.

America, along with most of the advanced nations of the world, makes significant and growing expenditures in aerospace activities. In 1990 the United States will expend over 150 billion dollars in aerospace (AW7ST 1990). The expenditures are approximately evenly divided between the three categories of space and missiles, military aircraft, and commercial transport and business flying. Total world expenditures in these fields are approximately three times greater. In the era of declining world tensions expenditures on military aircraft and missiles are declining. However, expenditures on commercial air transport and business flying and space programs are growing. Aircraft link the people of the world to such an extent that at any one time approximately 1 person in 10,000, of the entire population of the world, is in an aircraft above 10 kilometers altitude and traveling within 80% of Mach 1. An educated person of the 1880s would view this vast number of people as almost being space travelers. In 1887 the academician Ernst Mach published the first photograph of a supersonic shock wave (Anderson, 1985). In less than 100 years the world has moved from the academic demonstration of supersonic flow about a rifle bullet to more than 400,000 people flying near Mach 1 day in and day out over all the lands and seas of Earth. Aviation has fundamentally changed the world. People, parcels, threats, and mail now travel far easier internationally than they did locally one hundred years ago.

An immense range of skills are necessary to support the present day hero activities of the nation. They clearly include technical subjects such as materials science, aeronautics, propulsion, electronics, computer science, physics, mathematics, flight medicine, and meteorology to name only a few. The required skills extend to the creation and maintenance of the large government and private organizations (Federal Aviation Administration, airline companies, manufactures, international and support organizations), civil engineering firms, and fuel companies. business administration, international relations, finance, accounting, economics, government relations, advertising, marketing, insurance, and food preparation are but a few of the professional skills that have enabled the large and dynamic aero-industry. People with these human and organizationally directed skills envelop and direct the technical accomplishments of aircraft and airports and create the overall organizations that tie diverse parts of American and the world together via the living systems of aircraft and airlines.

Many of the core technological and organizational skills grow directly from the educational activities of Land Grant Universities. The Land Grant Universities teach their students how to build and grow using the tangible resources of Earth. Stepping beyond Earth provides new challenges to America, its people, and its system of higher education. In the Nineteenth Century the challenge was to build a new civilization across the face of America using the resources under foot. The next step is far more difficult. Many of the major resources are remote and the basic machines remain to be derived from our terrestrial experience or invented. Our expectations have to be extended in scope. Our motivations must be extended beyond the rewards of exploration and the familiar but limited examples provided by local (Earth centered) communications, remote sensing, and defense. Large teams will be necessary to cultivate the seeds of economic growth beyond Earth. Many individuals must struggle and search for years at the frontiers of knowledge to discover and direct our national teams to higher accomplishments.

America has been committed since the 1950s to the exploration and exploitation of space. World investments have grown far beyond the tiny research expenditures by the Smithsonian Institute, \$5,000 in 1917 to an obscure Robert H. Goddard (Anderson 1985). Now world expenditures exceed 60 billion dollars annually. Much of the original investment was for the development of nuclear ballistic missiles and the Apollo program. The world space program has widened in scope. Space satellites monitor the world for natural and human threats, look outward into the universe, and link people worldwide through radio and television. Immense stores of data have been collected concerning the moon, the planets, objects in deep space, the sun, and the Earth. Future programs such as Hubble Space Telescope, the other great observatories, and the Earth Observing System (EOS) will require large numbers of new scientists and engineers to study the observations and change them into knowledge and practical applications. Already over 300 people have ventured to orbit about earth and 12 people have been to the moon and returned with samples, geophysical data, operational knowledge, and the understanding that humans can work and live beyond Earth if they are supported by extensive ground operations. In the 1990s people will permanently reside in orbit about Earth.

On July 20, 1989, President Bush committed the nation to the emplacement of a permanent base on the moon and the planning of an expedition to Mars.

"The time has come to look beyond brief encounters. We must commit ourselves anew to a sustained program of named exploration of the solar system--and yes--the permanent settlement of space. We must commit ourselves to a future where Americans and citizens of all nations will live and work in space...And our goal is nothing less that to establish the United States as the preeminent space faring nation".

NASA (1989) responded to that Human Exploration Initiative (HEI) challenge with a Presidentially requested report that synthesizes the many studies of moon and Mars exploration missions that have been provided since the pre-Apollo era and were under intense study during the last three years. A special committee of the National Research Council (1990) reviewed the NASA (1989) report. They noted that a decades long commitment would be required for the success of HEI. The committee's final comment was--

"Last, the committee believes that, whatever the selected architecture for *HEI, there is a need for a new emphasis on advanced technology development and that it is highly desirable to continue to cast a wide net for innovative concepts".

If America is to continue to reap benefits from its investments in space activities we must invent the means by which Americans will travel to and live in space and use the resources of space to propagate beyond Earth. There is no fundamental reason that travel from Earth to orbit cannot be as common and inexpensive as trans-oceanic flight. The challenges are greater than those that faced the our great grandparents as they migrated westward across America in the 1800s; however, our modern society possesses far greater resources, knowledge, wealth, and tools. To this end the 100th Congress received and the 101st Congress of the United States passed the National Space Grant College and Fellowship Act and instructed NASA to establish and manage the program (Congressional Record 1987, 1989). The primary challenge of the National Space Grant College and Fellowship Program is to establish the college and university systems that will produce graduates trained to invent the useful, independent future of Americans beyond Earth and manage the development of space activities for the benefit of Earth.

National Purposes

Congress intends that the Space Grant activities take a broad view of the fields to be considered. In the Congressional Record (1987, p. S 3207, Sec 4. (4)) the following definition is given:

* "HEI", later was modified to SEI, the Space Exploration Institutite.

"(4) the term "field related to space" means any academic discipline or field of study (including the physical, natural, and biological sciences, and engineering, space technology, education, economics, sociology, communications, planning, law, international affairs, and public administration) which is concerned with or likely to improve the understanding, assessment, development, and utilization of space";

The purposes of the Act (per Section 3) are to:

"(1) increase the understanding, assessment, development, and utilization of space resources by promoting a strong educational base, responsive research and training activities, and broad and prompt dissemination of knowledge and techniques;

(2) utilize the capabilities and talents of the universities of the Nation to support and contribute to the exploration and development of the resources and opportunities afforded by the space environment;

(3) encourage and support the existence of interdisciplinary and multidisciplinary programs of space research within the university community of the Nation, to engage in integrated activities of training, research and public service, to program of the National Aeronautics and Space Administration;

(4) encourage and support the existence of consortia, made up of university and industry members, to advance the exploration and development of space resources in cases in which national objective can be better fulfilled than through the programs of single universities;

(5) encourage and support Federal funding for graduate fellowships in fields related to space; and

(6) support activities in colleges and universities generally for the purpose of creating and operating a network of Institutional programs that will enhance achievements resulting from efforts under this Act".

Educational Goals

The Educational Panel focused on higher education. Other panels considered K-12 education, outreach, and other relevant functions. Thus the focus of this panel report is college level undergraduate and graduate education and research and post-doctoral research. The primary goals for higher education were determined to be:

- * Provide graduates with advanced skills in aerospace disciplines that support United States space activities through formal courses and research programs
- * Participate in recognizing and defining the needed programs of higher education for support of the national activities in aerospace
- * Support programs of post-college professional education
- * Provide educational and research experiences off Earth
 - Via telemetry
 - Eventually in situ
- * Help in defining the long-range planning guidelines and priorities for future space activities
- * Establish requirements of K-12 and external programs
- * Make space education a permanent part of state education

The Land Grant Colleges helped to elevate the agricultural and industrial skills of the nation to economic world prominence in less than fifty years. The system of the National Space Grant Colleges should strive to surpass that performance. The intellectual challenges are immense but the rewards are greater. Eventually the graduates of National Space Grant Colleges will provide homes in space that will support humans and a wide range of other life independent of Earth, will dependably tap the immense engeries of the sun, convert resources of the solar system to human use, and greatly extend our knowledge of the universe. A vast range of new options will be created for our children's children. However, deep understanding of our present capabilities and clear, precise projections of our knowledge will be required to profitably expand beyond Earth.

Issues

Space Grant Colleges and Universities must build the space curriculum of the future on the firm basis of deep knowledge of and involvement with the present operating space programs of the nation and an on-going and extensive program of leading edge research in the aerospace sciences and engineering, management, law, finance, and the other arts that are integral to our planetary society. All aspects of NASA (operations, space sciences, management and financial, legal), portions of the DoD space programs, and other government space programs must be accessible to study, participation, and evolution by this new academic community the U.S. Congress has offered to the nation.

The government space programs of the 20th century are the "barrier islands" that must be used to access and create the "new lands" in space in the 21st century. In the 21st century this movement must be both physical and intellectual.

There must be significant government, state, and private funding for the development and conduct of programs of higher education. Now, and for the foreseeable future, most graduates will find employment in government laboratories and in companies that are supported through government contacts. Every effort should be made to recognize these employment needs and plan educational programs that will provide the needed professionals. It must be realized that establishment of new courses, degree programs, departments, and even "space" campuses will be decades long activities that absolutely require steady support at the national level both by Congress and the agency assigned to age the National Space Grant and Fellowship Program.

Graduate research usually requires projects that are of one to three years duration. Space projects often involve decade or longer programs. The full range of national aerospace activities must be examined to find and create research opportunities that support undergraduate and graduate research.

New space markets must be invented and developed over a period of decades that will broaden the economic base of space industries. Many, if not most, of the new ideas that will grow to economic importance will well up from the fertile minds of students in Space Grant Colleges and Universities. Steady support and encouragement must be given to cultivate new advanced concepts for scientific and economic activities. Space program activities are traditionally computer intensive and the use of computers use continues to grow. The Polaris and Apollo programs introduced the nation to the extensive use of computers to plan and execute major high technology projects. Special efforts will be needed to expedite the use of computers as personal tools for education, research, and future employment.

Graduates of Space Grant programs should be recognized and encouraged to make use of their special training and research. Courses, interdisciplinary and distinct degrees, and professional designations should be defined. NASA, other government agencies, and private organizations should strive to make use of their particular talents and training. Professional societies should be formed that cultivate and encourage the interdisciplinary activities of space grant graduates.

Existing state programs of education and economic development should be used and extended to encourage the growth of space related activities nationwide. Professors in and graduates of Space Grant programs can provide the guidance for the definition and development of K-12 and extension services within each state.

Actions

There are specific actions that should be taken to build on the major strengths of our existing systems of higher education. A comprehensive assessment should be made of existing educational programs in aerospace science and engineering and related fields. The results should be made readily available and annually updated. The assessment should include listings of academic professionals, their interests, academic institutions involved in aerospace related work, curricula, lists of source materials and aids in accessing them, definitive listings of government resources expended on aerospace related education, and a listing of government organizations active in planning, assessing, and directing educational expenditures. Interdisciplinary activities should be emphasized. This review and assessment should be done by a joint university/government panel and participation by industry should be encouraged.

A series of curricula workshops should be conducted at which the needs for and content of future programs of higher education in the aerospace sciences and engineering and related fields are debated and recommendations are made as to content and emphasis. The participants of these workshops should have access to the above information and studies in a timely manner.

A major NASA and DoD effort should be started to understand the possibilities and payoffs that could be afforded by the economic expansion of mankind beyond Earth, by access to resources of the solar system, and the capabilities that might be possible for a society that operates freely far beyond our planet. There will be a few easy insights and extrapolations. However, most of the work will be as long range and difficult as that required in the development of new agricultural crops and demonstrating the utility of extension services in the early 20th century. A permanent and significant commitment to long range planning must be established at the academic level that has not been afforded to any nation, even during Apollo. Extensive use should be made of the data and experience obtained during the Apollo program as a focus for advanced groups to consider how humans can begin to live off the Earth using non-terrestrial resources.

A new academic community must be formed, somewhat in the manner that was done for lunar sample and lunar science investigations during the Apollo era. The community will be different. It will encompass a wider range of disciplines, interests, styles of research, and types of reward. There will be more connections to industrial concerns and more international interactions. This new academic aerospace community must be provided with a richer set of opportunities for aerospace related research by both professors and students. The students must have options for 1 to 3 year projects.

The Land Grant Colleges bring new technologies and new techniques to the practices of agriculture and industry. The same must be true for the National Space Grant Colleges and the aerospace industry. These new contributions can be expedited by changes to government policies for procurement and competition of aerospace programs. Industry should be encouraged and enabled to participate far more deeply in the development of higher education and long range research programs in aerospace sciences and engineering.

NASA should fund research and development of computer hardware and software supportive of aerospace education. NASA will benefit by developing better techniques for people to understand and control complex systems.

Long Term Development

We note that the United States has made a permanent and significant commitment to the development of American interests beyond the Earth. These commitments started with the National Space Act in 1957 and have expanded through national and international law, growing civilian and domestic space programs, and an increasing web of international agreements and programs. These commitments have been enabled primarily by the engineering knowledge in rocketry, aeronautics, materials, and systems formulated before that 1970s. The newly formed Space Engineering Research Centers constitute one aspect of the needed NASA support of the National Space Grant Colleges and Fellowship Consortia.

However, what has not happened is an increasing commitment to understanding how to systematically use the burgeoning technologies and sciences, of an opening world society to meet its environmental and economic needs during the later part of the twentieth century. The drive to develop space resources to meet the needs of humans on Earth can greatly accelerate our development of resources off Earth and expedite the permanent presence of rapidly growing numbers of Americans beyond Earth. The organizations established under the National Space Grant College and Fellowship Act can provide the environment and rewards conducive to long range research and the context within which the young can be trained to invent and lead our society into the national future in space.

The National Space Grant College and Fellowship Program must create new academic fields of enquiry. This is a long and difficult process. It cannot be mandated or contracted into existence. Much deeper and broader interactions will be required between NASA and the fledgling communities than have occurred in the past. There are many lessons to be learned from the success of NASA in establishing vigorous communities in the space sciences. It will be necessary to balance the needs for immediate evidence of progress against support of longer term research teams. Above all the program must be open and allow vigorous debate and examination of all issues--just as happens in the healthy academic community. Such debate will create pain, that, like most birth pains, will push these new academic creatures into a wider world.

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College Education Panel
(National Space Grant College and Fellowship Program)

Goals

- * Provide the Nation with college and university graduates who are trained to understand, invent, and help direct the beneficial future presence of the United States off Earth.
- * Do this by establishing the major new National Space Grant College (NSGC) programs that provide the educational and research opportunities.
- * Provide educational experiences off Earth
 - Via telemetry
 - Eventually in space
- * Make space education a permanent part of state education
 - Establish requirements of K-12
 - Establish teacher training and External education program
- * Link NSGC programs to industry, government, and NPO space activities.

Issues

- * Defining, establishing, and evolving new curricula and research unique to NSCGs
 - Present unfulfilled needs of government, industry, and NPOs
 - Processes to identify and meet future needs
 - Coping with long time scales to identify and establish courses, course materials, tests, degree programs, departments, schools, professional societies
 - Providing space related research programs of 1 to 3 years span (MS and PhD)
- * Learning how to invent and establish new beneficial activities beyond Earth
- * Funding long term educational programs that support
 - Government dominated markets now
 - Commercially dominated markets later
- * Using existing state programs efficiently
- * Recognizing the graduate
 - Courses, interdisciplinary or distinct degrees
 - Professional designations (ex. Space Lawyer, Prof. of Space Engineering)

- * Using computers and networks in education
- * Meeting AA & outreach goals (topic of other working groups)

Actions

Form Working Groups

- To define the curricula needed by governments, academics, industries and NPOs
- To define the unique research needs of undergraduate, MS, and PhD students and post doctoral fellows.

Conduct Resources Analyses

- Identify present aerospace courses, texts, degree programs, teachers
- Identify existing demonstration and research facilities at universities, national laboratories, and industry

Others

- Annual conference and publication on higher education and university research
- Link NSGC to general education (Astronomy-20% of science education courses)
- Project new markets (10-15 years; ex. New Earth-space links, lunar manufacturing)
- Link NSGC curricula and research programs to operational NASA and DoD programs and encourage industrial funding of academic research

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Workshop 4

The Use of Continuing Adult Education

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Columbia, Maryland
January 16-19, 1990

The Use of Continuing Adult Education

Abstract

The objectives of the National Space Grant and Fellowship Program include the expansion of space-oriented educational programs beyond the traditional boundaries of university campuses to reach "non-traditional" students whose personal and professional lives would be enhanced by access to such programs. These objectives coincide with those of the continuing education programs that exist on most university campuses. By utilizing continuing education resources and facilities, members of the National Space Grant Program can greatly enhance the achievement of program objectives.

Introduction

The objectives of the National Space Grant and Fellowship Program include the expansion of space-oriented educational programs beyond the boundaries of the university campus to reach at least four groups of people: (1) middle and secondary school teachers, (2) aerospace professionals in need of skills upgrade training, (3) non-aerospace professionals who desire to transition to aerospace employment, and (4) the general young-adult and adult public.

The concept of continuing adult education is dedicated to providing on-campus and off-campus educational opportunities to "non-traditional" students who do not attend the university full time, but who are in need of the educational opportunities provided by university staff and facilities. Thus, it seems evident that the use of existing continuing education resources to provide access to space-oriented educational programs will strongly enhance the achievement of National Space Grant Program objectives. This paper reviews the conclusions of a workshop on the subject of the use of continuing adult education to meet National Space Grant Program goals. The workshop was conducted during the First National Space Grant Conference at the Johns Hopkins Applied Physics Laboratory during January 16-19, 1990.

Objectives

The participants in the referenced workshop agreed upon the following objectives for the use of continuing education in support of National Space Grant Program goals:

- (1) To provide teaching methods, materials and instruction to secondary and middle school science and mathematics teachers with the goal of providing real linkages between the subjects they are teaching and space applications.
- (2) To provide appropriate courses of instruction to aerospace professionals to enable them to upgrade their skill in consonance with rapidly advancing technology and the introduction of new engineering/scientific design and analysis tools. Courses should also be provided for non-aerospace professionals who desire to transition to aerospace employment.
- (3) To help the general young adult and adult public become "space literate"; that is, to help members of the general public understand current space related issues and the relationships of those issues to their everyday lives.

An examination of these objectives reveals, then, that the focus of the space-oriented continuing education should be upon secondary and middle school science and mathematics teachers, aerospace professionals in need of upgrading their skills, professionals in non-aerospace fields who desire to transition into aerospace employment, and the adult general public.

Methods

The methods suggested by workshop participants for meeting the above objectives are generally well within the scope of traditional university-based continuing education programs. However, the suggested methods are different for each objective; thus, the programs must be tailored for the objective they are supporting.

Secondary and Middle School Teachers. Workshop participants concluded that the most effective method for assisting middle and secondary school teachers in the development of teaching methods and the acquisition of materials for classroom demonstrations was to bring them to the university campus for a workshop experience which includes instruction and "hands-on" experience. Workshops should be at least a week in length and participants should stay on-campus in order to be absorbed in the educational experience. Social functions (e.g. banquets, cookouts) should be provided to enhance the formation of acquaintances which will lead to long-term sharing of educational experiences.

At least two universities, University of Washington and Utah State University, were in the process of planning such workshops for the summer of 1990. At the writing of this paper (April 1990) the response to invitations to the "First Annual Utah State University Summer Workshop for Physics Teachers" has been overwhelming. This workshop provides instruction in the relationship of space science to high school physics instruction and gives the participants the opportunity to build classroom demonstration projects which can be taken to their individual classrooms. Physics teachers throughout the states of Utah, Idaho, Nevada and Wyoming have unanimously voiced their feeling of need for such experience. Many are coming at substantial sacrifice in summer employment opportunities. This tremendous response more than corroborates the views of the National Space Grant workshop participants regarding the need to reach out to this group.

Universities with space research programs can also reach out to secondary and middle school teachers by providing opportunities for them to fly space experiments in space (through NASA's Get Away Special Program) for example, on balloons and on NASA's zero-g k-Bird. Although such opportunities are not usually included in traditional continuing education programs, they certainly are consistent with the "reaching out" tradition of such programs.

Courses of Instruction for Professional Skill Upgrading.

This objective focuses upon both the aerospace professional seeking to upgrade his technical skills and the non-aerospace professional who seeks to attain the skills necessary to transition into aerospace employment. The methods of addressing this objective are mostly oriented toward providing classroom instructional opportunities through on-campus short courses; TV based courses which are carried to off-campus classrooms, either in university extension service classrooms or into industrial plants; and correspondence courses. Some universities have also used videotaped courses for use among groups of professionals. The advantage of such courses is that they can be taken at times which are compatible with individual employee needs. Although correspondence courses may be useful for broad aerospace policy and program oriented courses, they are not suitable for courses with strong technical orientations.

General Adult Public. Methods discussed for reaching out to the general public were focused upon the young adult and adult public who are most able to understand the objectives of the National Space Program and its impact upon their lives. Much of the National Space Program is perceived by its planners to be in the public benefit; thus, it is important that the public understand its various facets, challenges and applications.

The means for reaching the adult public are very much oriented toward public relations types of events, presentations and displays. The use of a speakers bureau which serves as a focal point for arranging speakers on space topics for local service clubs; the creation of educational displays for local schools, malls, and public gathering places; volunteers for local radio and television talk shows, particularly when a much-publicized space event is taking place; on-campus tours associated with such events as homecoming and graduation; and the creation of serious monographs on key elements of the National Space Program are all examples of the kinds of outreach efforts that can help to bring "space literacy" to the American public. It is recognized that some of these types of activities fall outside the traditional bounds of most university continuing education organizations; but, again, they don't fall outside the philosophy of continuing education and, thus, they are included in the responsibility to provide opportunities for the continuous education of a public in need.

Implementation

Time limitations did not permit the workshop participants to spend much time on implementation. Obviously, those programs, such as workshops and short courses, which fit well within current continuing education approaches and capabilities will be easier to implement than those which require new approaches. Some programs already have a great demand, such as the Physics Teachers Workshop described above. Others will need to be nurtured from a small but growing need. Financial support will also differ, depending upon the specific program. Well constructed and advertised workshops and short courses which are tailored to meet a well researched need will usually be self supporting. Others will require some outside financial backing, in many cases from National Space Grant funding. Hopefully, the knotty details of implementing continuing education concepts into viable programs will be addressed at a future workshop.

Conclusions

The role of continuing adult educational programs in supporting the achievement of National Space Grant and Fellowship objectives is quite clear. Indeed, the outreach objective is common to both continuing education and the National Space Grant Program. The objectives of stimulating and supporting teachers, enhancing skill-upgrade opportunities for professionals and creating "space literacy" within the general public must each be addressed with different methods; however, all these methods fall within the overall philosophy of continuing education. Some methods will be easier to implement than others, depending upon their relationship to existing continuing education approaches and financial support. The examination of specific implementation strategies is a ripe subject for future workshops.

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Workshop 5

Publicity and Public Relations

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**First National Space Grant Conference
Columbia, Maryland
January 16-19, 1990**

Publicity and Public Relations

Abstract

This paper addresses approaches to using publicity and public relations to meet the goals of the NASA Space Grant College. Methods universities and colleges can use to publicize space activities are presented.

Introduction

The NASA Space Grant College program has specific goals to be accomplished. Publicity and public relations can make attainment of those goals possible. The goals are identified below.

Promote partnerships and cooperation among universities, government, and aerospace industries.

Promote strong science-math-technical educational base from kindergarten to university.

Encourage interdisciplinary training, research and public service programs to recruit and train professionals in the field of aerospace.

The workshop participants decided that to further the goals of the NASA Space Grant College, it would be best to define tools, approaches and relationships. Some pitfalls are also presented.

Tools

Tools are mechanisms that can be used to inform the specific audience of the purpose of the Space Grant College or what special events may be of interest to them.

Examples are:

Brochures

For industry

What research is on-going

What classes are available

What opportunities might be available for employees

For education

Fellowships available

Scholarships available

Press releases of specific events

Knickknacks
Paperweights, T-Shirts, Games, Pens, Decals, Nerf Balls

Presentation Materials
Video Tapes, Printed material

Newsletter

NASA Publications
Public Affairs
Public Education

Approaches

Approaches to be used to strengthen the public relations effort could include:

Electronic Mail such as Compu-Serve or others

A national board consisting of the program directors

College students participate in and/or judge high school science fairs

Presentation of the program to senior industry representatives

Presentation of the program to secondary education by undergraduate and graduate students

Meet with state legislatures

Develop a national Space Grant College library

Award scholarships to secondary students to Space Camps

Develop a LOGO that will identify the program

Use local educational television programs to inform the public of what is happening at the NASA Space Grant College

Utilize existing news bureaus

Link with other organizations, including underrepresented groups.

Encourage computer companies to develop software and games for the Space Grant Colleges to distribute to kindergarten through grade 12 students.

Relationships

Forming relationships with industry and the educational community is necessary. The following ideas were discussed.

With industry

- Named Fellowships

- National Space Grant College Board Membership

With other educational institutions

- Work with secondary education students and help the transition into college

- Give award letters to most promising students who participate in NASA Space Grant College events

Pitfalls

There are errors that can be made using publicity. Some of these are:

- Over publicize and generate too high expectations

- Incur high costs

- Over commitment

Summary

This summary of the workshop presents some ideas for using publicity and public relations to further the goals of the NASA Space Grant College. What is presented here is not exhaustive and some of these ideas may not work for your particular situation. When the next symposium is held, we will be able to report on how some of these ideas worked.



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Workshop 6

Underrepresented Groups

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Underrepresented Groups

Abstract

The problem with the shortage of underrepresented groups in science and engineering is absolutely crucial, especially considering that U.S. will experience a shortage of 560,000 science and engineering personnel by the year 2010. Most studies by the National Science Foundation also concluded that projected shortages cannot be alleviated without significant increases in the involvement of Blacks, Hispanics, Native Americans, handicapped persons, and women.

Introduction

NASA's policies and procedures for administering training grants for the National Space Grant College and Fellowship Program has as objectives: "recruiting and training professionals, especially women and underrepresented minorities for careers in aerospace science, technology, and allied fields; and to promote a strong science, math, and technology education base from elementary through university levels.

Effective recruiting and training of any diverse groups of persons presents serious challenges. Obvious answers to the shortage of underrepresented groups are traditional programs such as summer workshops, tutoring, recruitment, retention, and fellowships. Traditional suggestions of increasing involvement have not had the high level of effectiveness needed to alleviate the problem of underrepresentation. In using more traditional tactics, issues such as race, ethnic origin, sex, and mental and physical disabilities have not been dealt with sensitively enough; therefore, success rates have not had a particularly phenomenal impact. Non-traditional options; however, are increasingly appealing as their success rates become more substantial.

Current Programs

Less traditional suggestions includes the AAAS 2061 Project which was developed in 1985 by the American Association for the Advancement of Science (AAAS); the National Science Foundation; the Carnegie Corporation of New York; and International Business Machines (IBM). The plan is called Project 2061 because that is when Halley's Comet returns, and it was created the year of the comet's last appearance.

The educational reforms of this program are expected to be in wide use by the year 2061. Plans for the program include developing new approaches to teaching with a possible end to teaching traditional subjects and administering standardized tests. Teaching would focus on leading all students through all subjects. Students would begin studying substantial subjects from kindergarten through high school and study them in depth from different perspectives, instead of the standard method which is to teach "piece by piece" a little of each subject. Currently, there are 11 school districts in 5 states involved with project 2061. Twenty teachers, 2 university scholars, and 3 school administrators will develop the curricula.

Other non-traditional approaches include one developed by Philip Uri Treisman, Director of the Charles A. Dana Center at UCLA-Berkley. Treisman questions the premise of most academic support programs for minority students - "Why focus on students' weaknesses rather than on their strengths?" He prefers to "focus on helping minority students excel at the university rather than merely avoid failure," as many minority programs do. Treisman formed a Mathematics Workshop after examining the study habits of Black and Asian students. He found that Black students were self-reliant and carried these habits over to their studying. Asian students studied in groups; consequently, excelling in their classes. Black students were organized into study groups and spent 6 hours per week working on tough problems. Failure rates among Black students in this program dropped from 60% to 4%.

Another program, the Valued Youth Partnership Peer Tutoring Project in San Antonio, enlists Hispanic High School students at risk of dropping out, as tutors for Hispanic elementary students. During the four years since the inception of the program, absenteeism and disciplinary action referrals declined and students' self concept improved. Dropout rates of over 40% declined to an average of 2.5%. In 1989, the dropout rate fell to 0.

The Education for Minorities Project has made 58 recommendations to benefit minorities and the entire education system including:

- Eliminate "tracking" or ability grouping
- Extend the school day and years to minimize summer loss and maximize exposure to mathematics and science.
- Provide more financial aid grants and fewer loans.

A number of non-traditional programs are being utilized or introduced, and each of these programs' successes or failures appear to be based on positive expectations, identifying needs, and recognizing the diversity of underrepresented groups. The report Changing America: The New Face of Science and Technology lists additional exemplary programs designed to increase the participation of underrepresented groups.

Networking

The Space Grant Colleges/Consortia may choose to utilize non-traditional suggestions, or a combination of both. Another suggestion would be to locate organizations on college campuses that have been specifically developed for increasing the participation of underrepresented groups in science and engineering. These already established organizations include the American Indian Science and Engineering Society (AISES); National Consortium for Graduate Minorities Consortium for Minorities in Engineering (SECME); Society of Hispanic Professional Engineers (SHPE); Mathematics, Engineering and Science Achievement (MESA); National Action Council for Minorities in Engineering, Inc. (NACME); Society of Women Engineers and numerous others.

Handicapped individuals are often ignored as an underrepresented group. The final report compiled by the Task Force on Women, Minorities, and the Handicapped in Science and Technology Changing America: The New Face of Science and Engineering states: "Unfortunately no one collects Nationwide statistics on degrees earned by people with disabilities so we cannot present the same analysis as for the other groups. We do note that, at 10.5 percent of the postsecondary education students, people with disabilities represent a large untapped pool of talent for science and engineering." Another report The Education of Students With Disabilities: Where Do We Stand? Was compiled by the National Council on Disability (September 1989) for the President and Congress of the United States. The latter report has comprehensive recommendations for educating disabled individuals.

Obviously the problem of underrepresentation can just be highlighted in a paper such as this. The problem is being addressed in detail by: the National Science Foundation; National Education Association; U.S. Labor Department; and various other government agencies. Several bills in congress (including the Hatfield-Glenn bills S-1950 and S-1951) deal with the problem.

Working Group Discussion

During the workshop session at the First Annual National Space Grant Consortia Conference held at Johns Hopkins University this past January, our group discussed some key issues, but were limited by time constraints and the magnitude of the issue.

Several key issues discussed, relating to Space Grant goals include:

- * Space is an interesting and unknown field, and the appeal to underrepresented groups should be that space is universal.
- * Avoid culturally biased educational materials.
- * Utilize role models for underrepresented groups.
- * Acknowledge cultural diversity and emphasize cultural awareness.
- * Work with other institutions including Historically Black Colleges and Universities.
- * Expose younger children to math and science activities.

Conclusion

Exposure to mathematics and science and high expectations from underrepresented groups are what the Space Grant Colleges/Consortia must aim for. Success will depend upon these expectations and the environment created. The Space Grant Colleges/Consortia must be creative, innovative, and use whatever resources are available for the greatest impact on underrepresented groups.

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Workshop 7

Outreach and Public Service

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Outreach and Public Service

Abstract

The Alabama Space Grant Consortium plan for outreach and public service is presented as a model for study and discussion. It is consistent with the objectives of the Space Grant Program and expresses a strong commitment to cooperation between academia, industry, and government.

Introduction

In carrying out the objectives of the NASA sponsored National Space Grant College and Fellowship Program, the Alabama Space Grant Consortium (ASGC) is presently involved in substantial outreach (public service) activities. Additionally, a number of new outreach efforts as well as extension of present efforts are proposed.

The Alabama Space Grant Consortium (ASGC) defines outreach/public service as any effort designed to increase the level of knowledge and awareness of NASA type activities in and among the various sectors of the non-NASA community and to encourage present and future generations to pursue NASA oriented careers.

The members of the Alabama Space Grant Consortium are:

- The University of Alabama in Huntsville - (UAH)
- Alabama A & M University - (A&MU)
- The University of Alabama - (UA)
- The University of Alabama at Birmingham - (UAB)
- Auburn University - (AU)

Outreach/Public Service Activities

Alabama Space and Rocket Center: The Alabama Space and Rocket Center (ASRC), an agency of the State of Alabama located in Huntsville adjacent to the Marshall Space Flight Center (MSFC), will be an affiliate of the Consortium. The ASRC, home of Space Camp and Space Academy, is a showcase of America's space technology and is widely known for its "learn by doing" exhibits related to astronaut training and rocket technology. It also serves as the Visitor Information Center for MSFC. As an affiliate of the Consortium, ASRC will provide a valuable interface with the public and will expand its current collaboration with the universities in special teacher training programs and motivation of youth toward studies in mathematics, science, and other aerospace-related fields. Additionally, ASRC will host several major consortium activities.

Current Public Service Activities: The consortium members have extensive aerospace public services that involve many academic departments and specialize research centers. These services demonstrate not only the universities' commitments to disseminate their expertise to the public sector, but also the maturity of programs of aerospace research and instruction within the universities. Current programs assist NASA and aerospace industries in maintaining well-qualified work forces, disseminating aerospace information, encouraging minority participation in the nation's space program, and assisting the development of aerospace industries. A sampling of public service activities follows.

Summer Faculty Fellowship Program: UA and UAH jointly administer the NASA/ASEE Summer Faculty Fellowship Program for the Marshall Space Flight Center. Participants spend 10 weeks at MSFC doing research with a NASA colleague. Since December 1988, UA has administered a Research Continuation Program for faculty members who have completed the fellowship program. These programs broaden the base of university support for NASA and, in some cases, introduce faculty to new opportunities for participation.

Nursing in Space: In April 1988, UAH and its College of Nursing sponsored the first National Conference on Nursing in Space. This conference introduced new research and service opportunities for the participants and demonstrated the strong interest of the nursing discipline in becoming more involved in space activities. A second conference is scheduled for the spring of 1990.

Space Orientation for Professional Educators: UAH has developed a model in-service program called "Space Orientation for Professional Educators (SOPE)." This program, began in the summer 1987, provides concentrated instruction to prepare teachers to broaden and enrich their own teaching of science and technology. Teachers from elementary and secondary schools and junior colleges from across the nation learn about space during a credit-earning graduate course of one week that uses the facilities and personnel of UAH, ASRC, and MSFC. Teachers take back to their schools ideas for class presentations and simulation activities, sets of easily-reproduced experiments, and an enthusiasm for space that should spread to their students and encourage them to study mathematics, science, and other disciplines critical to this nation's future in space exploration and development. More than 900 teachers participated in this program in its first year two years and approximately 700 are enrolled for the current year. In 1987, the SOPE Program was recognized as an exemplary demonstration project by the United States Department of Education.

Space Academy II: The UAH College of Science collaborates with ASRC in a program called Space Academy II where advanced high school students spend a concentrated two-week period being trained in simulators and in demonstrations at ASRC and in lectures by UAH faculty. More than 1500 students have taken this course called "Introduction to Space Science".

Teaching Physics in Public Schools: Over the past four years through an informal arrangement between the College of Science and the Huntsville City Schools, UAH graduate teaching assistants have taught physics classes in selected city high schools with large minority enrollments. This has stimulated a 300 percent increase in physics enrollments at these schools and increased interest in mathematics.

Public Services to Promote Minority Participation in Space-Related Activities: The Consortium members recognize the rich resources to be afforded by this nation by enhancing participation of women and minorities in science and technology and, as a consequence, have developed programs and strategies to enlarge the number of minorities, female faculty and students.

Alabama A & M University hosted, in January 1989, a forum to facilitate discussion between NASA and historically black colleges and universities (HBCU) with interests and capabilities in space-related research. A similar conference was held with the Department of Defense and focused on research at the HBCUs in optics and materials, remote sensing, artificial intelligence, intelligent systems, computational fluid dynamics, and biological systems.

Kiddie College: Other activities include a Kiddie College to encourage the study of science, and mathematics at the elementary level; assistance to the two local magnet programs (space science and international studies in the city's secondary school with the largest minority/black enrollment; and development of computer-based instructional techniques.

Space Education in High Schools: UA has been actively involved in promoting science and engineering in Tuscaloosa high schools. The Aerospace Engineering Department helped students in an area high school build a low-speed wind tunnel that is used in classes to demonstrate various aerodynamic principles. The Department of Physics and Astronomy assists public schools and serves as a community resource for astronomical events. The UA College of Education conducts summer programs in aerospace education for elementary students. Also, in conjunction with Livingston University, UA has a state-funded Teacher In-Service Center providing programs for teachers in twelve west Alabama counties. Some of the most popular programs offered by the In-Service Center are in aerospace education.

Public Services to Assist Aerospace Industries: The most significant public service of the Consortium members has been the development of graduates to staff government and industry, and this will continue as a primary function. In addition, the universities encourage their faculty to assist industry and government, especially in the development of new enterprises. For example, at UAB the Office for the Advancement of Developing Industries (OADI), a partnership of university, government, and private resources, fosters the growth of advanced technology start-up companies located in Alabama. The OADI offers a variety of clerical, professional, and management services to entrepreneurs and manages the Center for the Advancement of Developing Industries (CADI), Alabama's high-technology incubator facility. This new 36,000 square foot facility became operational in October 1986, and contains lease space for 10 wet laboratories and approximately 25 office suites. One of the tenants of this facility, BioCryst, was a direct outgrowth of the Center for Macromolecular Crystallography.

Engineer Day Activities: The engineering colleges of the Consortium universities conduct annual Engineer Day activities and include special emphasis on space-related activity. This feature always attracts large numbers of prospective students. Recently, AU sponsored a one-day public symposium entitled; "The University Role in Space Research, Development, and Missions" that attracted national officials and astronauts as well as current and prospective students. Such events add to the continuing interest of students in space-related careers. In addition, the engineering Extension service of AU conducts about 150 programs yearly to a broad cross section of its engineering constituency. Discussions of aerospace-related opportunities and responsibilities are prominent in these programs.

Proposed Outreach/Public Service Activities

Information Network: The Consortium will implement a comprehensive aerospace information network to enhance state and regional understanding of space resources and the nation's goals and objectives in space. The Alabama Consortium is fortunate to have at its disposal the full information-distribution systems of two major land grant universities (AAMU and AU). These systems will be used to support consortium activities to create broad-based public knowledge of space exploration and development. By September 1989, the new state-of-the-art satellite uplink facility (K-band and C-band transmitters) at AU will be completed and will be used in the Consortium's programs of education and information dissemination. Through these and other mechanisms, the consortium will make available vital space-related information to individuals, elementary and secondary schools, junior and senior colleges, industries, and government organizations.

The Consortium also will use the TI-IN United Star Network to enhance and enrich science and mathematics education in state and regional high schools that otherwise would be unable to provide such instruction.

The Consortium will maintain a library of the academic, research and service activities in progress in the member universities that may be of common interest to the members, NASA, and others. This library will include all relevant technical publications, curriculum development activities, outreach activities, research updates, and announcements of colloquia and seminars. The Consortium also will maintain a composite directory of faculty and staff members, including their aerospace research interests, at the member institutions.

Summer Faculty Program: The Consortium will plan a summer visiting-faculty research fellowship program for implementation on a small scale during summer, 1990. This program will assist faculty in non-research oriented colleges and universities to do space-related research. These fellowships will bring such faculty to the campuses of Consortium member universities to participate in research on issues of importance to NASA and for other professional activities designed to enrich the instruction provided in non-research colleges and universities.

Personnel Exchange with Marshall Space Flight Center: The Consortium also proposes to implement in 1990 a pilot program with NASA through which the Consortium and NASA exchange personnel agreed upon periods of time. This exchange will encourage communication between universities and the space agency based upon improved understanding of the activities and capabilities of each institution. Research and teaching will benefit from the exchange. The pilot will involve initially the Alabama Consortium, UAH and AAMU because of their proximity to MSFC. The program will operate at no additional costs to the universities or to NASA. As funds became available, this program will be expanded to include participation of faculty at universities outside Huntsville.

Space Science and Engineering Center: Auburn University plans to inaugurate in the fall 1989, a Space Science and Engineering Center as an umbrella organization to initiate, advocate, and foster campus-wide programs of instruction, research, and extension focused on aerospace. The proposed Center will draw together the wide variety of current and planned projects and coordinate the rapid growth in space-related activities anticipated for the 1990s.

Summary

In summary, the Alabama Space Grant Consortium's program plan is consistent with NASA's objectives for the Space Grant College and Fellowship Program. The new and enhanced activities of the Consortium, which are outlined above, express a strong commitment to cooperation with government, industries, and educational institutions. Some initiatives will be identified closely with one Consortium member and some will be joint efforts involving several of the members. Flexibility to accommodate new ideas and new projects will be maintained at all times. In all its activities, the Consortium will share information, make use of the substantial talents of individuals at all the universities, and will be responsible to NASA's needs.

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Workshop 8

Pipeline Issues

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Pipeline Issues

Abstract

The declining pool of graduates, the lack of rigorous preparation in science and mathematics, and the declining interest in science and engineering careers at the precollege level promises a shortage of technically educated personnel at the college level for industry, government, and the universities in the next several decades. The educational process, which starts out with a large number of students at the elementary level, but with an ever smaller number preparing for science and engineering at each more advanced educational level, is in a state of crisis. These pipeline issues, so called because the educational process is likened to a series of ever smaller constrictions in a pipe, were examined in a workshop at the Space Grant Conference and a summary of the presentations and the results of the discussion and the conclusions of the workshop participants is reported.

Introduction

A major concern in the fields of aerospace science and engineering is the lack of sufficient numbers of students choosing study and work in these professions. In the next two decades this problem will be compounded by a decline in the number of high school graduates, the poor preparation of many of these graduates, especially in science and mathematics, and the declining interest among them in science and engineering careers. These problems are a part of the so called pipeline effect wherein the educational process, which starts out with a large number of students at the elementary level, but with an ever smaller number preparing for science and engineering at each more advanced educational level, is likened to a series of ever small constrictions in a pipe. Efforts to date to offset the effects of the declining numbers from traditional sources, that is from among white males, by tapping less traditional sources, namely women and minorities, have been less than successful.

The Pool of College Age Students

Data presented in the Interim Report of the Task Force on Women, Minorities, and the Handicapped in Science and Technology, September, 1988, entitled "Changing America: The New Face of Science and Engineering", outline the problem and its causes. To quote from the report:

The percentage of young Americans preparing for careers in science and engineering has been declining steadily. Our most experienced scientists and engineers, recruited after Sputnik, will be retiring in the 1990s. Meanwhile, by the year 2000 the number of jobs requiring college degrees will increase dramatically. The educational pipeline from prekindergarten through the Ph.D. is failing to produce the scientifically literate and mathematically capable workers needed to meet future demand.

In a series of charts and figures the evidence is set forth.

1. Between 1980 and 2000 the number of 18-24 years old in the U.S. population will decline by 19 percent while the overall population increases by 18 percent.
2. Of the new workers entering the labor force by the year 2000, only 15 percent will be white men (the traditional source of scientific and engineering manpower), and of the rest will be white women, members of minority groups, and immigrants (the groups traditionally most likely not to enter science and engineering fields).
3. The scores of American twelfth grade students in mathematics and science achievement tests is among the lowest among industrialized countries.
4. Interest among freshmen in science and engineering is down dramatically (one quarter to one third or more depending on the field) in the last decade.
5. Decline in interest in engineering and science of Americans carries through to graduate school where participation of foreign nations has increased dramatically.
6. A shortfall of science and engineering graduates needed to serve industry may reach several hundred thousand by 2010.

In another report, prepared by the Western Interstate Commission for Higher Education, The College Board, and Teachers Insurance and Annuity Association, entitled "High School Graduates: Projections by States, 1986 to 2004", the problem of the projected student supply is reported by region and by state. This report shows that

1. Between 1988 and 1994 there will be a 12 percent drop in the number of high school graduates nationwide; by 2004 there will be 6 percent increase over 1988.

2. There will be dramatic differences between regions with the West and South/South Central showing increases and the Northeast and North Central showing declines between 1988 and 2004.
3. There will be dramatic differences between states within regions. A few states will show large gains but many will show declines.

Preparation for College

Much more worrisome than the size of the total pool of high school graduates is the lack of preparation in basic subjects. Many very bright potential students for science and engineering are woefully unprepared to go on to college in these fields. Many have not taken appropriate science and mathematics courses in high school, others have taken them but not learned them well, while others have taken them and not found them interesting.

Many social, cultural and economic factors have led to a decline in the quality and quantity of K-12 education, especially in science, mathematics, and written and oral expression. This decline is most evident in inner cities with large minority enrollments, but is increasingly evident throughout primary and secondary education. Some of those factors are:

1. Poor teaching. Low teacher expectations.
2. Poor facilities and learning environment.
3. Short school days, short school year, no homework.
4. Lack of discipline. Drugs.
5. Poor work ethic; low self esteem; absenteeism; negative peer pressure.
6. Lack of parental and community support.

Until there is substantial reform in secondary education, the pool of prepared students will remain very low.

Declining Interest in Science and Engineering

Of equal concern is the lack of interest by potential students for careers in science and engineering. There are many reasons.

1. Social, cultural, and economic factors that keep many students away from science and engineering careers.
 - a. Perception of science, mathematics, and engineering are too difficult for most students.
 - b. Perception of science, mathematics, and engineering are dull subjects.
 - c. Higher work loads and longer degree programs compared to liberal arts.
 - d. Perception of science, mathematics, and engineering as not people oriented - in contrast to careers in law, medicine, social work, etc.
 - e. Perception of negative impact of science and technology on environment.
 - f. Close association of science, mathematics, and engineering with war related activities.
 - g. Perception of low pay compared to law, medicine, entertainment, etc. Growing opportunities in the service sector of the economy.
 - h. High cost of higher education.
2. Additional social, cultural, economic factors that keep women away from science and engineering careers.
 - a. Widespread belief that science and engineering are not for girls. Competing careers that are traditionally female - nursing, teaching, library science, etc.-and, therefore, safe for a girl to pursue.
 - b. Tracking of girls out of physics, higher mathematics, etc.; belief that girls can not do as well as boys in these subjects.
 - c. No role models; belief that women are not accepted in industrial employment (except as secretaries).
 - d. Marriage and child raising alternative.
3. Additional social, cultural, and economic factors that keep minorities away from science and engineering careers.
 - a. No role models; perception of past discrimination in industry.

- b. Tracking of minority students out of physics, higher mathematics, etc., because they are thought less likely to go to college - a self fulfilling prophecy.
- c. Likely first generation to go to college; therefore less academic and career guidance and counseling from home.
- d. Misleading concepts of alternatives: sports, entertainment, etc.
- e. Low family financial support expectations.
- f. More likely to be in one of the weaker high schools with poorer preparation.

The Lack of Attraction of Graduate Education

Among those who do complete undergraduate education in science and engineering, many do not find graduate education to be sufficiently attractive. Among the reasons are:

- 1. Attractive job offers. Most firms deliberately try to hire at the BS level those students who have the most potential for graduate study.
- 2. Low pay differential for higher degrees.
- 3. Perception that turning to management, which does not require higher technical degrees, is the only way to ensure promotion. Many turn to advanced degrees in business, law, etc.
- 4. High cost of graduate education. Limited financial aid (when compared to job offers and earning potential). Debt from undergraduate years.
- 5. Academic burn out from high undergraduate work loads.

What Can Be Done

To stimulate some discussion, here are some suggestions in broad general categories of what might be done.

- 1. Push for reform in primary and secondary education.
- 2. Inform potential college students of the opportunities and rewards that abound in science and engineering careers.

3. Breakdown stereotypical views of science and engineering.
4. Breakdown stereotypical views of the opportunities for women and minorities.
5. Make science and engineering undergraduate more attractive.
6. More clearly articulate the need for graduate education.
7. Make science and engineering careers more attractive.

Discussion

The initial discussion was concerned with the end of the pipeline, the graduate program, and the issue of foreign versus US graduate students. It was agreed that foreign students are valuable and welcome addition to our graduate schools but there was belief that a more generous supply of US students would be desirable. We should not depend so heavily on importing students and, for that matter, importing employees at the post graduate degree level. The discussion then shifted down to the undergraduate level. The need to counsel, encourage, support, etc., more of the better undergraduate students to continue in graduate school was emphasized.

Will there be enough educated scientists and engineers in the next two decades? No one challenged the need for more scientists and engineers but the need for those educated in aerospace disciplines will depend on world events and national policy. The large number of retirements coming in the next decade in the aerospace industries was mentioned as a factor.

At this point in the discussion the issue of quality versus quantity was introduced. Within the room there seemed to be more concern about quality than quantity. It was noted that at the last downturn in quantity - late 60's and early 70's - the downturn in quantity was accompanied by a sharp drop in quality. The belief was widely shared that efforts to prevent a quality loss this time around should be given priority, and, perhaps, the quantity problem was not as serious as some believe.

At the secondary school level, the lack of counseling or other means to let students know what engineering and science careers are all about, was expressed as a major concern. The discussion shifted quickly, however, to the middle school level where this is most painfully apparent. The need for good guidance at that level was considered essential because this is where the students are making the decisions that will keep them available or rule them out of science and engineering careers. It was noted that girls and minority students have still tracked out courses of study essential for college preparation whether by choice or poor advice.

At the primary school level the teacher interested or enthusiastic about science was considered desirable. The quest for quality starts here. And without the quality throughout primary and secondary education we are limited in what we can do about the quantity of future scientists and engineers.

Conclusions

In the last few minutes of discussion there was substantial agreement on the following conclusions:

1. There is a need for more scientists and engineers, but since we cannot do much about the birth rate of the 1970's and 80's, we shall have to act so that those high school graduates who are potential candidates are well prepared and interested in pursuing such careers.
2. Our best opportunity at the primary school level is to work with teachers. These teachers must have a better understanding and appreciation of science and mathematics as it relates to future the development of the students. They must make the student both more proficient and more interested in these subjects.
3. The middle school students are most critical. We must develop programs which help improve instruction, which help students make proper choices of courses, and which ensure that they learn these subjects. We must not only work with teachers but we must intervene directly with the students to provide role models, counseling, and encouragement.
4. We must develop programs at the high school level to reinforce and continue the efforts made at the middle school level.

5. Undergraduate college students must be encouraged to continue in graduate school in greater numbers. We can continue to pursue, but not depend so strongly on, imported graduate students.
6. We are concerned with the quantity of students in science and engineering but are even more concerned about quality. Those efforts made to increase the number of students in science and engineering should also have the purpose of improving the quality of the students, the quality of their preparation, and the quality of programs they enter.

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Workshop 9

State and Local Governments

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State and Local Governments

Abstract

The Virginia Space Grant Consortium approach to a close working relation to state and local governments is presented as a model for consideration. State government relations are especially important in that this is a primary resource in securing matching funds. Avenues for establishing these relationships are listed and discussed.

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This workshop is intended to provide models for how the several Space Grant programs may interact effectively and on a continuing basis with local and state governmental agencies.

Since the circumstances of each state are distinctive, generalizations are difficult; the Virginia experience is offered as an example with which comparisons may be made or generalizations drawn.

The initial influence in the Commonwealth was Governor Gerald Baliles, who identified aerospace in early 1987 as an economic and educational factor potentially of great importance. His intuition was reinforced by a blue ribbon study commission, and as a result, the Governor appointed his Space Business Advocate, "to work with representatives of businesses, state agencies, and universities to achieve this goal."

At the same time a major focus was given on aerospace commercialization by the Center for Innovative Technology (CIT), a private agency, created and funded in 1984 by the Commonwealth to foster the interaction of universities and industry through research, technology transfer, and commercialization. CIT has provided strong leadership in building joint funding of university research with industry, drawing attention to Virginia as a center of aerospace activity, and directly cultivating and encouraging the growth of commercial space activity, e.g. small satellites.

CIT has taken the leadership in helping state agencies identify potential applications of remote sensing and to understand how the utility of these applications can be realized. The Space Business Advocate works closely with CIT, so that they periodically briefed the Governor and his Cabinet (Economic Development, Education, Transportation, Natural Resources) on progress. The written progress reports have been widely distributed.

At the Governor's request CIT prepared a brochure, "Virginia Focuses on Space; The Commonwealth's Heritage, Resources, and Activities in the Enterprise of Space," which has been widely distributed within and outside the Commonwealth to businesses, public agencies, and individuals. The brochure conveys a strong impression of the Commonwealth's substantial aerospace activity and aspirations.

When the Space Business Advocate undertook the proposal effort for Space Grant designation, it was with the specific support of the Governor and the appropriate agency heads. Participants in the Virginia Space Grant Consortium were also chosen with an eye to maintaining contact with state and local governments. Thus the current membership includes:

- * Virginia Tech
 - * Old Dominion University
- * University of Virginia
- * Hampton University
- * College of William and Mary
- * State Council of Higher Education for Virginia
- * Department of Education
- * Center for Innovative Technology (CIT)
 - * Science Museum of Virginia
 - * Virginia Air and Space Museum (VASM)
- * State Chamber of Commerce
- * NASA Langley Reserach Center (LaRC), Hampton

The Space Business Advocate serves as the initial Director of the Virginia Space Grant Consortium, thus maintaining the direct contact with the Governor.

The Consortium is also working to apprise individuals in the General Assembly about how Space Grant affects their jurisdictions. This is easiest in areas where commercial aerospace activity is already significant, such as Northern Virginia and Hampton Roads, where NASA LaRC is located. Interest in aerospace within the General Assembly is evident in the specific appropriations for the Science Museum aerospace exhibit and toward the construction of a \$22 million educational and research facility in Hampton, which will include the VASM. The Governor's attention has already given a high profile to the CIT and Space Business Advocate efforts to promote aerospace activity which has also heightened familiarity on the part of legislators. Even those from areas which do not have obvious aerospace activity, e.g. the rural Southwest, are aware of and interested in the impact which the Consortium and CIT might have on science and mathematics education, in particular, and also on commercial development.

Effecting relations with local government is easiest where activity is most apparent. This is certainly the case with the VASM, near NASA/LaRC, where local commitment to the financial success has focused attention. The Consortium has focused on school science and mathematics as an initial priority, and it is hoped that this will provide a link to local government. Important criteria for effecting meaningful interaction with state and local governments seem to be:

- * patron(s) or other clear connection with governmental leadership, e.g. Governor, agency head, committee chairperson;
- * a process or vehicle for continued association with the patron(s), e.g. economic development, education; "Space" usually should not be presented as an end interest in itself;
- * acceptance that Space Grant provides something of importance that is otherwise unattainable, e.g. support of state or local science and mathematics education by university aerospace faculty.

State and Local Government

This workshop addressed the intention of the Space Grant program to "encourage cooperative programs among universities, aerospace industry, and Federal, state and local governments." The discussion focused primarily on relations with state government, in part because this is the primary source of governmental cost sharing with the NASA program.

Commonly there is a desire to pursue association of a program with the State Chief Executive, and this can be a very important advantage in pursuing state budgetary commitments or attention from agencies and departments; however, Governors are usually very selective about direct association with programs. There are also dangers in identifying too closely with a specific Chief Executive; a successor may be reluctant to assume the priorities of his or her predecessor, and may instead pursue initiatives with no such identification.

However, there are other avenues for establishing substantial relationships within the Executive Branch, for example:

* Assistants to the Governor - many of these people have regular access to the Governor and are often important contributors to policy and budgetary choices. Some states have a "science adviser to the Governor," or an equivalent, who is likely to be outside of the immediate Office of the Governor, but who may be an effective conduit, nevertheless. In addition, many are reasonably accessible and likely to find aerospace education, research, and commercialization appealing.

* Agency heads and program directors - heads of education or economic development programs are especially likely to identify with the purposes of Space Grant; other possibilities might be natural resources or transportation. This can mean the secretaries, heads of higher education or public school agencies, or advisory bodies to the agencies, as examples.

* Industry leaders - many of these people have regular access to the Office of the Governor, the secretaries, or agency heads. In some cases and industry organization, such as the Chamber of Commerce, may be appropriate.

* College and University Alumni - governors, agency heads, etc.. almost certainly went to college somewhere, and most are responsive to approaches from their alumna maters. Many other alumni are closely involved with these same people and can act as intermediaries.

One should also consider cultivating relationships with the Legislature, either in addition to those with the Executive Branch, or instead of, if necessary. Every college or university is in the district of at least one and usually two legislators, i.e. one each from the lower and upper houses, who are very interested in cultivating and supporting these assets for their constituents. In addition, legislators share with their executive colleagues a likely alma mater. Other alumni are friends or supporters of legislators and can help in the cultivation of support for Space Grant.

In most schools, relationships with the Executive and Legislative Branches of government are handled by offices of governmental (state and/or federal) relations, special assistants to the President, and the like. These can be very useful avenues to the most appropriate officials and legislators. It is advisable, in any event, to alert the university offices of an interest in or intention to contact governmental officials and offices.

Most of the workshop participants seem not to have formal relations with the Executive or Legislative Branches in their states, but feel that doing so is important and desirable.

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Workshop 10

Focusing Educational Initiatives

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Focusing Educational Initiatives

Abstract

The United States will soon be facing a critical shortage of aerospace scientists and engineers. To address this problem, Space Grant Colleges can assist in focusing interest in existing educational initiatives and in creating new educational opportunities, particularly for women and underrepresented minorities.

Introduction

The availability of qualified scientists and engineers needed to maintain US leadership in aerospace science and engineering is approaching crisis proportions. By the year 2000, America will face a shortage of scientists and engineers. As the proportion of minorities to whites increases, and as more white males turn to non-engineering/science fields, there will be a critical shortage of trained professionals. Women and minorities must be given the educational opportunities necessary for them to qualify for positions as scientists and engineers. To address this crisis, NASA has created the Space Grant Colleges and Consortia to establish a national network of universities with interests and capabilities in aeronautics, space, and related fields. The purpose of the Space Grant Colleges and Consortia is to encourage cooperative programs among universities, the aerospace industry, and federal, state, and local governments. In addition, they are to encourage interdisciplinary training, research, and public-service programs related to aerospace; recruit and train professionals, especially women and underrepresented minorities, for careers in aerospace science, technology, and allied fields; and promote a strong science, mathematics, and technology education base from elementary through university levels.

The task of this workshop is to provide a format by which Space Grant programs can identify, disseminate information about, leverage, and help to focus existing and developing educational initiatives of aerospace interest.

Collection and Dissemination of Information

Space Grant Colleges can increase the general public awareness of aerospace science and engineering issues. This can be done through posters and brochures, newspapers, and television advertising centrally designed and targeted at these specific populations. It can also be done through more specific channels. Individual programs can send information to prospective undergraduate and graduate students, secondary level science teachers, and to local professional and amateur science and engineering associations.

Space Grant Colleges and Consortia should gather information on educational opportunities in aerospace science and engineering in their state or region. Information can be collected from federal educational organizations, from other Space Grant institutions, from NASA research centers (Ames Research Center, Johnson Space Center, Jet Propulsion Lab, etc.), from local educational groups, and from groups providing financial support for education. A library of the collected information should be established so that Space Grant institutions can serve as clearinghouses for aerospace science and engineering opportunities. Students and educators should have access to all of this information, both for checking out, and for photocopying. The Space Grant programs should be responsible for keeping this information current. The Space Grant programs can increase their own visibility through this library, and can provide a central location of aerospace education information that will serve a wide region.

To increase awareness of and interest in aerospace science and engineering topics, the information collected must be disseminated to educators, students, and the public. This can be done through a variety of means. A newsletter, either centrally edited or produced at one of the Consortia members, can be sent to all interested parties. This newsletter should contain up-to-date information on aerospace science and engineering research and educational opportunities for researchers, teachers, and students. Educational advancement opportunities can be advertised through local and state teachers' organizations, and can be sent directly to established mailing lists of teachers interested in aerospace science and engineering.

A "speaker's bureau" can be established, consisting of persons in education and in industry who are willing to speak to the general public and to K-12 schools on aerospace science and engineering topics. The Space Grant Graduate Fellows can also provide public service by speaking to local K-12 schools about their particular research topic, and how they were able to succeed in science and engineering education. Mentor arrangements can be made between university students and at-risk children in the K-12 schools.

Information on educational and job opportunities can be distributed to precollege students by sending flyers to an established mailing list on local science teachers, and by going through educational networks similar to Washington State's MESA (Mathematics, Engineering, and Science Achievement) program.

Once the above procedures are in place, Space Grant programs can work to focus on educational initiatives by directly assisting or augmenting existing educational programs, and where necessary, creating new programs. In Washington State, the Space Grant Program will be writing aerospace science and engineering curriculum kits for use in elementary and secondary level classrooms in state schools. These kits will be distributed through organizations such as MESA, and through the Pacific Science Center. The Pacific Science Center can provide technical and backup support for curriculum development and can assist in educating teachers on the most effective uses of these new curriculum kits.

Developing Educational Initiatives

Space Grant Colleges and Consortia should provide preservice and inservice teachers with science education. One of the major reasons that science education is in a state of crisis is that pre-college teachers are not prepared to teach science effectively. Teachers who are inadequately prepared transmit their feelings of dislike and/or lack of confidence in science to their students. This results in students discontinuing further education in science. To focus students' attention on aerospace science and engineering education, the teachers themselves must be well prepared, articulate, and have a thorough understanding of the science and engineering topics they are teaching. Existing programs for preservice and inservice teachers can be augmented by providing financial, technical, or administrative support to science and engineering departments for expanding teacher education programs and by providing financial incentives to preservice teachers to continue with a science/engineering education. Teacher education can also be improved through aerospace enrichment programs for preservice and inservice teachers and by providing curricula for teachers to use in their classrooms. Another mechanism for reaching the teachers is through summer workshops for continuing education credit. These workshops can focus on current aerospace science and engineering research and bring the teachers up-to-date in this field. Teachers that are motivated and excited about science will motivate their students to continue with science and engineering studies.

Space Grant programs should provide financial support for education. The Fellowship portion of the Space Grant Colleges can provide a great deal of support for graduate students. In addition, Space Grant programs can provide undergraduate support, and financial support for inservice teachers to continue with their continuing education. Small financial incentives can also be offered to outstanding high school students. These forms of financial support will enable individuals to pursue their aerospace science and engineering interests, where it would otherwise be impossible. This is particularly true for economically disadvantaged and minority individuals.

One of the critical elements of the Space Grant program is the recruitment of minorities and women to aerospace science and engineering fields. By the year 2000, 85% of the new workers will be women, minorities or immigrants. The recruitment of women and minorities to science and engineering must begin at a very young age. Currently, students are identified as being particularly adapt at science or engineering in their early grade school years, and girls, minorities, average and less-able students are filtered out of the science and math tracks. Space Grant Colleges can effect a change by promoting and developing programs such as Washington State's MESA program.

The MESA program targets underrepresented minorities and women at the junior and high school levels. This program is designed to increase the number of underrepresented minorities and women in the mathematics, engineering, and science-related professions. MESA accomplishes this through a partnership of higher education, school districts, business and industry, and community organizations. Students are required to take a college preparatory curriculum consisting of four years each of mathematics, science, and English, as well as participating in special MESA activities. Specific academic enrichment classes are established in participating schools. In the classroom, special curriculum kits are introduced that include hands-on experiments that provide students with an immediate understanding of how their learning is useful in the real world. In addition, MESA presents achievement awards for high scholarship, provides tutors, sponsors summer enrichment programs that expose participants to current research being conducted at local colleges and universities, provides academic/career counseling, holds academic competitions and conferences, and offers field trips to local industrial plants, research centers, universities, engineering firms, and computer centers. The success rate of this type of program is very high; 80% of the students enrolled in MESA programs in secondary schools go on to college.

To interest and motivate students to study aerospace science and engineering, Space Grant programs can design new hands-on experiments to teach students about aerospace science and engineering. These experiments can be distributed through educational organizations such as MESA, and directly to teachers. Educational programs can also be initiated through local science centers, such as Washington's Pacific Science Center. The Pacific Science Center (PSC) currently provides science camps for adults and children, a "science champions" program, family workshops, science celebrations for children, and on-site instructional programs at the Science Center. They also provide van programs that travel through the state to K-8 schools. The vans come into schools, hold an all-school assembly, set up hands-on experiments in the hallways, and give 45 minute interactive lectures to the individual classrooms. The vans are set up with various themes, such as Stars and Snakes, Water on Wheels, and Blood and Guts. These vans provide current information on science, as well as motivating and exciting young students to pursue science as "fun." Children remember what they have learned from these "Pacific Science Center Van Days" much longer than something they learned from books, and they also learn to like science. Space Grant programs can fund the development of additional vans, based on aerospace themes. PSC also develops curriculum kits ready-made for classroom use. Washington's Space Grant Program is planning to collaborate with PSC on writing aerospace curriculum kits. The Pacific Science Center is also involved in teacher education, In 1989, PSC held workshops for 3500 teachers on various science and engineering topics, stressing interactive methods of teaching science and mathematics. Space Grant programs can tie in with strong programs such as these, and can augment the existing curriculum for teachers by adding aerospace topics.

In summary, the Space Grant program can help to focus existing and developing educational initiatives by improving science and engineering education at all levels--K-12 science and engineering education of pre-college teachers, and by keeping the public aware of aerospace research and education. At the same time, Space Grant programs can act as clearinghouses for aerospace science and engineering educational and job opportunities.

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Workshop 11

University - Industry Interaction

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University Industry Interaction

Abstract

It is posited that university industry interaction is highly desirable from the viewpoint of the long term economic development of the country as well as being desirable for the Space Grant Programs. The present and future possible interactions are reviewed for the three university levels namely, undergraduate, graduate and faculty research.

Introduction

It is a truism that the long term health of high technology industry depends on access to and employment of creative, knowledgeable people. It is critical, therefore, that the industry be able to attract and retain such people. One of the prime examples of high technology industry is the aerospace industry which historically has progressed by fits and starts. Many of the leaps forward have come through the inspired leadership of creative individuals as well as through the determined efforts of legions of dedicated scientists and engineers. Some examples that arise are Robert Goddard, Werhner Von Braun and Kelly Johnson.

While there have been many recent critiques of the secondary school education in the US, education in the US at the university level is clearly first rate. This is a fact recognized by students from all over the world who clamor to get into American universities. This includes in particular, students from countries which are our main economic competitors. Students from these countries, particularly Japan, mainly come to the US in order to participate in the research experience at the universities as well as to gain an appreciation of American culture.

After the Second World War, the US had the dominant economy in the world with essentially no competitors and for that period of time US universities did a good job of filling the needs of US industry. In recent years it has been recognized that the paradigm that worked right after the war is no longer valid in light of the changed and changing world order. From the university point of view, the enormous amount of federal money which built and sustained the growth of research in universities is now shrinking. This demands attention to be paid as to other possible sources of support.

In addition the desire of many states to use the universities as seed beds for industrial development also means that the universities have to be more proactively involved in the business world. From the industrial point of view, the increasingly competitive world market and the growth of the economic powerhouses in Asia and Europe means that industry must scramble to stay ahead or to catch up. The universities provide a possible means for doing this. Additionally, as the number of young people entering technical fields in the country continues to drop, industry will face a shortfall of about half a million scientists and engineers by the end of the century. Unhappily, this shortfall comes at time when the overall educational standards in the US are low as compared to our major competitors. All these arguments point to the fact that the time is ripe for a new, close and cooperative relationship between US industry and US universities.

In this new climate exist the NASA Space Grant Programs which have as their avowed aims the encouragement of cooperative programs among universities, aerospace industry and government as well as the recruitment and training of professionals, especially women and underrepresented minorities, for careers in aerospace science and engineering. This paper will address the mechanisms by which universities and industry can interact with particular reference as to how the Space Grant Programs can interact with aerospace industry. The discussion is framed in terms of the three levels in universities, namely undergraduate, graduates and faculty/staff research.

Interaction at Undergraduate Levels

The undergraduate levels are traditionally the levels which supply most of the people in industry. For example, 60% of the undergraduate class at MIT in aeronautics and astronautics goes on to work in the aerospace industry after graduation with the Bachelors degree. This is clearly a level at which industry has a great incentive to participate with universities to ensure that it gets the engineers it needs.

Many recent studies have called attention to the fact that while the US has a large and creative basic research establishment, our competitors often end up beating us in terms of bringing cost effective goods to market.

One of the explanations for this is the lack of any systematic study of design and manufacturing engineering at either the university or the industry level. It is often suggested that researchers, design engineers and manufacturing engineers do not communicate with each other, with the attendant loss of synergetic interactions. This situation did not always exist in US industry. After the war in many aerospace industries, engineers were required to undertake apprenticeships in several areas of a company before starting on their main job. This was so they appreciate and communicate with other engineers. This is a practice still adopted in Japanese aerospace companies. In US companies it has fallen out of favor as the increased mobility of American society has meant that the average time an engineer stays with a company has decreased relative to what it was. This makes it uneconomic for US companies to employ an engineer and not get a return from his work. In parallel with this trend is the rise of engineering science at universities. Since it is much easier to judge faculty in this area rather than in basic engineering the universities are now filled with faculty who are mainly engineering scientists rather than engineers. These two trends and their consequences are now recognized and both universities and industry are moving to correct them. One major way to do this at the undergraduate level is to teach courses in the design and manufacturing of products by practicing engineers from industry. For the aerospace industry, the Space Grant Programs could make a major contribution to this process by sponsoring such courses in their universities. In order for this to be successful, industry would have to be willing to release an engineer for a semester to teach such a course as well as allow that engineer to speak on the details of the manufacturing process. This may raise some questions of a proprietary nature. The universities would have to recognize the importance of such a course by making it a requirement for graduation with a degree in aerospace engineering. An excellent example of this was noted in the Soviet Union, where at the Moscow Aviation Institute they have an aircraft design course taught by the lead designer for the Sukhoi design bureau. He works part time at the Institute and part time at Sukhoi.

Many students who decide to go in for aerospace science and technology do so because they find the whole enterprise of space research and exploration very exciting. For these students, one of the best ways to attract, motivate and retain them in the aerospace field is to show them how exciting the field can be. One way to do this is for industry to support research projects at the universities specifically designed so that undergraduates can make vital contributions to the project. By this means the students can see and feel the excitement of a research project which previously was something that only graduate researchers could know. Specific recent examples at MIT are the Deadalus project which built a man powered aircraft and set a world record. This project involved many undergraduates in the design and manufacturing of the aircraft.

Interestingly, this project was underwritten by Annhauser-Busch which is a well known beer company. Another example is the EASE project which involved a shuttle experiment on the ease of constructing structures in space. While the shuttle astronauts ultimately performed the experiment, many student participated in the design and testing at the MIT swimming pool and the NASA Marshall neutral buoyancy facility.

This project was underwritten by NASA. For this to be a successful industry we would have too be willing to commit money and suggest creative ideas for undergraduates. The universities must be willing to allow faculty to spend their time on these projects and judge it as an important part of the educational process. That is, faculty must be rewarded for participating in these projects.

Finally, there are the traditional ways in which universities and industry have interacted. These include industry offering summer positions to students as well as co-op arrangements whereby students go to school part time and work part-time. The Space Grant Programs could create such arrangements and administer with aerospace industry. This is one of the approaches taken at the MIT Space Grant Program which has put together a consortium of nine companies involved in the aerospace business. These companies have all committed to provide summer employment for students recruited by the Space Grant Program. The program and companies are particularly geared to recruiting students early in their careers as well as minority and women students. The response so far at MIT indicates that this approach has been well received by the students.

Interaction at the Graduate Level

In the aerospace industry, in many ways the optimal degree to possess presently is a Masters degree. This is because the management track is much easier to get into with this degree. Additionally, the amount of knowledge required for modern aerospace engineering is such that many in the educational field question whether it can be encapsulated only in a Bachelors program. For work in any field of space science, a Doctor's degree is essential in order to get a meaningful job. In light of these trends a major level of interaction between industry and universities can be by industry supporting it's employees to get graduate degrees. While many of the aerospace companies have such programs, the employees are often only allowed to go part-time or at night to local universities. This is driven by economic considerations since the company does not wish to lose services of a valuable employee either temporarily or permanently if he leaves for a better job right after getting the graduate degree.

In contrast, Japanese companies are sending many employees to US universities to get graduate degrees. The students come full time, take courses, engage in state-of-the-art research and then return to their companies after a period of two to four years. The Japanese companies can afford to do this because of the tradition of lifetime employment both in terms of the company and of the employee. Interestingly, many career Air Force officers come full time for graduate degrees and they are encouraged to do so by the Air Force since it is recognized that the officer will be staying in the military. The Space Grant Programs can sponsor and arrange faculty support for industry employees taking graduate degrees through them.

The other traditional ways for universities and industry to interact at the graduate level are for industry to support graduate fellowships, graduate research projects and offer summer employment for graduate students. The role of graduate fellowships is becoming increasingly important as the character of the undergraduate population changes. The number of underrepresented minorities going into graduate school has been dropping at precisely the time that it needs to rise to supply the needs of the country. This in part can be traced to the decline of federal support for undergraduate loans and grants through the eighties. Minority students are much more likely than majority students to end undergraduate years with crippling loans and the lack of graduate fellowships acts as a disincentive to go on for graduate school. Graduate research projects leading to a S.M. or Ph.D. can be very useful to a company if the project coincides with the research interests of the company. The Space Grant Programs have graduate fellowships from NASA and can and should obtain additional fellowships from industry.

Interaction at the Faculty/Staff Levels

The US is widely recognized as having the premier research and educational establishment in the world. This is largely due to the fact that for several decades the universities have benefited from federal largesse and that in the research based universities the teaching loads on the faculty are deliberately kept low. This has enabled many faculty in universities to establish research groups at which first rate research is undertaken. Many universities have established formal industrial liaison programs whereby companies pay a fee to participate and are given facilitated access to university faculty as well as invited to university symposia. These programs have been moderately successful in bringing together industry and universities. Space Grant Programs can support or create such programs where they do not exist.

A major way that industry can learn of university work is by sending research staff to spend some time in university labs.

At MIT Japanese companies have sent many researchers to laboratories in electrical engineering and in material science. Typically such researchers come for two years and periodically report to the companies on the work that is going on in the labs. Space Grant Programs can organize and sponsor exchanges like this with the aerospace companies. The Space Grant Programs can use their contacts in industry to help arrange sabbaticals for faculty in companies. These sabbaticals would help the university by bringing in industrial experience and help industry by giving access to highly qualified faculty.

Finally, companies can support research projects with faculty directly or perhaps better, support endowed chairs for faculty. These enable faculty to be free to pursue their research as they see fit. If their company also sent along research staff then the faculty member and the staff could interact and mutually benefit from each other. Space Grant Programs can be active in encouraging the donation of such chairs.

Conclusions

Industry and universities need each other especially in the future and for the well being of the country. The Space Grant Programs can play a significant role in bringing together universities and companies in the aerospace field.

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Workshop 12

Organization and Management of Space Grant Programs

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Organization and Management of Space Grant Programs

Abstract

The 21 Space Grant Programs represent a broad range of organizational structures which operate programs ranging in size from single university organizations to organizations including up to 41 members involving a composite of industrial organizations such as state agencies, and universities. Some of the space grant awards were made to organizations already in existence with on-going programs while other awards were made to consortia newly formed for the purpose of applying to the Space Grant Program. The workshop on organization and management of Space Grant Programs provided an opportunity for directors and program representatives to discuss and compare the relative advantages and disadvantages of the various models being used. This paper offers examples of the diversity of organizations, summarizes the common concerns to be met by each organizational model, and provides a case study of the Texas Space Grant Consortium organization.

Diversity of Organizations

NASA's Space Grant College and Fellowship Program encouraged proposals from consortia composed of academic, industrial, and governmental agencies. This approach has allowed each program to take advantage of existing organizations and space-related activities within the various states and has resulted in a diversity of organizational structures. NASA's foresight in anticipating and allowing such diversity has opened possibilities that would not be available under a more restrictive structure.

The makeup of five space grant programs discussed at the workshop illustrates the diversity.

Texas: The Texas Space Grant Consortium consists of 21 university members, 18 industrial members, and two state agency members. Matching funds to support the Consortia objectives are provided by universities.

Illinois: The Illinois Consortium consists of five universities working in cooperation with Argonne National Laboratory. Matching funds are provided by the state of Illinois.

Florida: The Florida Consortium consists of four university members and eight university affiliate members.

New Mexico: The New Mexico Consortium consists of one university and one state agency with matching funds from New Mexico State University.

Hawaii: The Hawaii Space Grant Program has one member, the University of Hawaii.

Because of the diversity in the makeup of the consortia, no single model can be devised that adequately represents the organization and management of Space Grant Programs. Moreover, the diversity itself provides an element of richness to the program which will support alternative approaches to programming.

It is important to note that while most organizations are confined to the boundary of a single state, one consortium crosses state boundaries.

Space Grant Program Infrastructure

Despite the diversity of the consortium makeup, the organizational structure chosen by each must provide management for a Space Grant Program meeting the basic criteria and program goals outlined by NASA. Thus, the infrastructure adopted by each must address similar issues.

In terms of organizational structure, each program includes a director charged with the responsibility of managing the Space Grant Program. This person serves the role of principle investigator for the NASA award. Thus, the director is responsible for technical contributions of the program, for fiscal accountability of the program, and for meeting basic NASA reporting requirements. In addition, the director provides leadership for the state organization in terms of program identification, development, and networking among the consortium members.

A single member Consortia may have no need for additional officers. The larger programs, however, have defined additional program officers. Typically these include associate directors, frequently located on different campuses of Consortium members. In addition, some consortia include a board of directors or advisors who are assigned the role of providing additional guidance and assisting in developing policy for the Space Grant Program.

The organizational structures possible under the Space Grant College and Fellowship Program are impacted by the categories of members defined by NASA.

Two categories of educational institutional members are defined by NASA: "space grant colleges"; and "members of space grant consortia". In order to use the designation "space grant college", an institution must have received an average \$2,000,000 per year in funding from NASA for the previous three years and must have at least three Ph.D. programs in appropriate space-related academic fields. Other educational institutions in space grant consortia which do not meet this criteria may use the designation of "members of the space grant consortia".

NASA did not preclude space grant categories of membership. As a result, Space Grant Consortia have members and representatives both from industry and other governmental agencies. Where these types of members are to be included, appropriate criteria for their selection and guidelines for their participation must be developed within the organization of the consortia.

Most of the Space Grant Programs have a very simple organization designed to meet NASA guidelines stated in the Announcement of Opportunity. For many, no formal documentation of the structure exists beyond the provided in the space grant proposal. Other programs have developed or are developing charters and bylaws for their organization which outline the organizational structure and the roles and responsibilities of each of the participants.

In the long run, mechanisms will need to be defined for changes within the structure. For example, routine changes in personnel such as election or selection procedures for the director and board of directors need to be accommodated. Some consortia are including within their structure the capability for adding new members as well as deleting inactive members. If the term "membership" is to carry a significant meaning, responsibilities of membership and minimum level of participation must be defined.

Although no two of the Space Grant Programs have selected the same infrastructure, concerns common to the whole Space Grant Program can be identified. Each consortium must have a mechanism for collecting the required matching funds and for distributing total space grant funding to members. In some consortia, the original proposal outlines a static distribution scheme of the money to the affiliates while in others the funds are held centrally with a mechanism defined for selection of specific projects for funding. A related concern is the disbursement of the fellowship and scholarship portion of the program. Various strategies for handling this aspect of the Space Grant Programs were addressed in a separate workshop.

All of the Space Grant Programs cite communication as a concern-communication to NASA, to other consortia, and among the members of the program. Communication via computer networks offers numerous advantages in all three of these areas. Good communication will maximize the accomplishments of the various programs by allowing the sharing of information and experiences. Poor communication, on the other hand, can stress even the best structured organizations.

Each space grant program has unique problems, needs, and as a result has its own organizational structure. It is not possible to discuss each in this presentation. In order to provide framework for discussion of some of the management and organizational issues, however, this paper describes the largest of the Space Grant programs: the Texas Space Grant Consortia (TSGC). Differences from and similarities to other Space Grant Programs will be included in the discussion.

An Example: Texas Space Grant Consortium

TSGC consists of twenty-one universities, eighteen industrial members, and two agencies of the State of Texas. The membership consists of the following:

Space Grant Colleges

The University of Texas at Austin (UT Austin)
Texas A&M University (TAMU)

Space Grant Consortium Members (Academic)

Baylor University
Lamar University
Prairie View A&M University
Rice University
Southern Methodist University
Texas A&I University
Texas A&M at Galveston
Texas Christian University
Texas Southern University
Texas Tech University
University of Houston-Clear Lake
University of Houston-Downtown
University of Houston-University Park
University of Texas at Arlington
University of Texas at Austin
University of Texas at Dallas
University of Texas at El Paso
University of Texas at San Antonio
University of Texas Health Science Center, Houston
University of Texas Health Science Center, San Antonio
University of Texas Southwestern Medical Center,
Dallas

Space Grant Consortium Members (Industrial/Research)

Barrios Technology, Inc.
David Aerospace
E-Systems
Eagle Aerospace Inc.
Entech, Inc.
Ford Aerospace Corporation
General Dynamics
Grumman Space Systems
IBM Corporation
ILC Space Systems
Krug International
LTV Missiles & Electronics
McDonnell Douglas
Microelectronics and Computer Technology
Rockwell International
Southwest Research Institute
Space Industries, Inc.
Space Services, Inc.

Space Grant Consortium Members (State Agencies)

Texas Higher Education Coordinating Board
Texas Space Commission

The list of membership of the Consortium is significantly larger than other consortia, but the mix is not typical for Space Grant Programs. The Consortium includes private universities, public universities, small universities, large universities, minority universities, large public-held corporations, a not-for-profit research organization, small business corporations, minority owned businesses, a State of Texas Commission, and a state higher education coordinating board.

Organization and Management

The host institution and financial agent for the Consortium is UT Austin. Dr. Byron D. Tapley (UT Austin) serves as the Director of the Consortium and is the Principal Investigator for the Grant. The Consortium has been established with multi-university "Program Offices." Each NASA designated "Space Grant College" is responsible for providing an Associate Director for the Consortium (and a program staff to support Consortium activities. As indicated in the list, UT Austin and TAMU currently are designated as Space Grant Colleges. Dr. Steven P. Nichols (UT Austin) and Dr. Sallie Sheppard (TAMU) serve as Associate Directors, and their staff serve as the Program Office for the Consortium. The time and expenses of the Director, the Associate Directors and their staff are contributed by UT Austin and TAMU.

The Director cooperates closely with a "Board of Directors" (unfortunate mixture of the term "Directors") in development of policy for the Consortium. The Board is selected from member groups of the Consortium (universities, industrial/research organizations, state agencies) and has been designed to provide a balanced and representative mix of the various interests of Consortium members. As an example, according to the Charter of the Consortium, the Chair of the Board must be a representative of a Space Grant College other than the host institution (since the host institution provides the Director). Mr. Oran Nicks (TAMU) serves as the Chair. Other Board members are selected as follows:

- Each Associate Director serves on the Board of Directors
- University Members of the Consortium elect three Board members. These members cannot be from designated Space Grant Colleges. At least one of the Board members must represent a university whose student body consists of a "majority of minority" students.
- Industrial/Research members select three members of the Board of Directors.
- State agencies select two board members.

This mix allows representation of numerous interests and provides to the Director a senior body to assist in the development of policy and direction of the Consortium. The expenses of the Chairman of the Board and his staff are contributed by TAMU. The expenses of travel and time of the Directors are contributed by their home institutions.

Most of the Space Grant Programs also have named a Director from a university member of their consortia. That situation is not uniform, however, as an example, the Illinois Consortium has a director from Argon National Laboratories.

Each institutional member of the Consortium has designated an "Institutional Representative" who serves as the official contact at the institution and is charged with organizing Consortium activities at the institution.

Consortium activities are supervised by four Program Committees: the Education Committee, the Research Committee, the Outreach Committee and Minorities Committee. These committees coordinate and supervise activities between and among the universities, industrial and research companies, and State Agencies. Since funding provided by NASA in support of Space Grant activities are so limited, the Consortium activities generally are highly leveraged with other funds from various sources. Committee Chairs cooperate with one another and with the Consortium Program Offices in seeking additional sources of funding for Consortium activities.

Consortium Meetings

The Texas Space Grant Consortium currently holds meetings of the entire Consortium twice a year. The meetings bring approximately sixty institutional representatives and their colleagues to the conference. During the meetings, Consortium members are brought up to date on Consortium activities, planning and budgets. The meetings also provide an opportunity for all of the committees to meet and for committees to share ideas and programs.

Communication

One of the key responsibilities of the Consortium management is to assist in the communication between and among Consortium members. The Consortium has created a newsletter to aid in communication both to Consortium members and to the general public. Included in the newsletter distribution are the state and federal congressional delegations from the State of Texas.

Conclusion

The organization and management of the various Space Grant Programs across the United States present a formidable task to the directors and managers of each program. NASA has delivered a serious challenge to these programs to make significant contributions in the areas of education, outreach, and research. The challenge includes a task to increase the involvement of women and underrepresented minorities in the space program. This challenge has been made to the Space Grant Programs with a maximum of \$225,000 per grant in NASA program support and \$100,000 per grant in NASA support for scholarships and fellowships. While this amount of funding represents a significant commitment from NASA headquarters, it requires the programs to rely heavily on leveraging, existing and potential sources of funding and requires a significant amount of matching support from participating institutions. The success of the Space Grant related activities will depend heavily on the management and organizational structures and capabilities of each Space Grant recipient. The participants at the workshop shared the approach taken by their institutions to meet the challenges made by NASA. This paper has summarized the discussions from the workshops. The management and organizational efforts presented in this paper, however, represent only the beginning of the organization of the various programs. The difficulty of the challenge requires each program to keep the flexibility necessary to adapt to the changes dictated by a dynamic program such as the NASA Space Grant and Fellowship Program.

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Workshop 13

Communications

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Communication

Abstract

Communication in its many forms is a critical component for an effective Space Grant Program. Good communication is needed within individual Space Grant College/Consortia, for example between consortium affiliates and the consortium program office. Effective communication between the several programs, NASA Headquarters and NASA field centers also is required. Further, communication among the above program elements, industry, local and state government, and the public also are necessary for meeting program objectives.

Objectives:

To establish effective communication at all levels in the Space Grant Program. This includes the communication between a consortium and the other members of the consortia; and NASA, industry and other organizations in the region of the consortium. The consortium must also have effective communication between the university members of the consortium. Finally, it is necessary to establish two way communication between the personnel in the participating organizations to achieve meaningful and lasting relationships.

The workshop was also asked to address two specific questions.

- (e) How can the NASA Center/Consortium establish a permanent presence in the region?
- (i.e.) Should there be a standing Space Grant committee devoted to this issue?

Approach

The proposed approach is to address the immediate communication needs of the program; and to also discuss the underlying communications required to change attitudes that will lead to permanent presence in the program. For example, developing effective communication with undergraduates to increase the U.S. citizen population in graduate programs or increase in industry funding of academic research programs.

The general steps required to achieve the long range goals include:

- (a) Identify specific communication requirements for the Space Grant Program.
- (b) Review communication programs in similar organizations and identify their attributes.
- (c) Identify mechanisms of effective communication that are applicable to the Space Grant Program.
- (d) Design a five year communication plan and implement.
- (e) Review plan annually and revise as appropriate.

Identification of some Specific Communications Requirements

To establish some of the short term needs, the general communication requirements were established.

First - The major parties that the Space Grant Program must communicate with include:

- Industry
- Government Research Laboratories
- Students and faculty
- The public
- Local, state, and federal governments
- Members of the program

Second - The major media for communication available to satisfy the requirements are:

- Telephone/fax
- Electronic/computer networks
- Published materials
- Meetings

Third - The communications program must also provide easy access to NASA and other data, be organized so as to avoid information overload, and must be convenient so it will be used.

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Workshop 14

Use of Fellowships

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Use of Fellowships

Abstract

The effective use of Space Grant Program fellowships are critical in meeting program objectives. In the first year of operation the 21 Colleges/Consortia will expend from 30-40 percent of their grants for fellowships; program policy will allow up to 50 percent to be spent for fellowships. Thus, fellowship policy must be carefully implemented and monitored.

Fellowship Objectives

In aerospace and space science fields the United States has historically been the world's leader. Even in recent years when launching difficulties brought our technical and management strengths into question, it still remained true that the pool of skilled scientific and engineering talent in the United States was unrivaled.

Recent trends raise fears that we might lose our leadership position in human resources. The Association of Aerospace Industries reports increasing difficulty in hiring new technical and engineering workers (Aerospace Education 2000, 1989). University representatives say that the quality of graduate student applications in space science has declined. A probable cause of declining interest is the publicity surrounding the Challenger disaster and its effect in retarding the nation's space program.

Another trend with alarming implications is the avoidance of space science and engineering fields by racial or cultural minorities and by women. These groups make up an increasing share of the American work force, and their absence from space-related fields in the future would mean a serious loss of important talent.

The objectives of a fellowship program should be to:

1. Attract talented students into space and aerospace fields.
2. Increase representation of minorities and women in these fields.
3. Promote effective and high quality training in these fields.

The first two follow directly from obvious needs. The third reflects the effect that declining student interest can have on educational programs. It is a legitimate objective of Space Grant Fellowships to contribute to strengthening educational programs which are fundamentally healthy and important, but which are endangered by recent lack of strong student participation, by funding additional students for these programs.

Types of Fellowships and Institutional Strategies

Institutional strategies can be expected to vary widely among the Space Grant Consortia, depending on the particular strengths of the institutions, on tuition costs, and on the ability of the institution to recruit from under-represented groups. Here we offer brief comment on a few of these issues, but in practice each institution will best know its own strengths and can best devise its own strategy.

Different types of fellowships can be offered. For example,

- * Conventional graduate student academic-year fellowship
- * Graduate student full-year fellowship
- * Graduate student partial support
- * Full support undergraduate fellowship
- * Undergraduate partial support

Balances must be struck between several conflicting benefits of different types of fellowships.

1. On the one hand it is desirable to award as many fellowships as possible, but on the other hand it is important to make the fellowships as large as possible, so that their attractiveness is maximized. How large should fellowships be?
2. It is desirable to open opportunities for students at the undergraduate level, but the typical effectiveness of an undergraduate fellowship is probably smaller than that of a graduate one because student ability, interest and commitment is not as easy to evaluate. What is the best balance between undergraduate and graduate fellowships?
3. It is extremely important to attract under-represented groups into space-related fields, yet it is often particularly difficult to predict success or retention rates for these students because their records are unconventional. How much risk should be accepted in offering fellowships to students who may be very promising, yet come from backgrounds that are difficult to evaluate.

Different Space Grant institutions can be expected to find different ways of meshing their strengths with the fellowship objectives. For example, private institutions with (a) high tuition charges, and (b) strong graduate programs, might choose to focus on graduate student fellowships, because their relatively small number of fellowships would have very limited impact at the undergraduate level. On the other hand, public institutions with lower tuition charges might effectively utilize fellowship funds at the undergraduate level, and might choose to make this their focus.

Summary of fellowship strategy questions which each Space Grant Consortium and College must answer:

- * What is the best balance between undergraduate and graduate fellowships?
- * What should be the size of awards?
- * What pool of students should be the focus?
- * How should fellowships be advertised?

Program Evaluation

Among the points that will enter an evaluation are:

1. Institutional strategy for Space Grant fellowships
2. Recruitment effort
3. Quality and diversity of awardees
4. Success of awardees
5. Impact on educational programs

It is extremely important that evaluation procedures not become rigid or intimidating. In general, it is difficult to evaluate the success of educational ventures because it takes a long time to determine the influence of an experience on a student. The consequences are often indirect. Evaluation procedures can easily become destructive. For example, a fellowship award committee might begin to operate under a quota system, or might confine awards to safe cases of assuredly successful students, if the committee felt that it might lose its fellowships with any other course of action.

Thus for program evaluation, institutions should be encouraged to describe their own unique circumstances, their strategy for meeting the Space Grant objectives, and their frustrations as well as their successes. A set of guidelines, such as the headings at the beginning of this section, might be provided, but the diversity of Space Grant institutions should be acknowledged in the NASA requests for reports.

Also, to benefit all concerned, reports should be kept brief, so that they will be read and so that their preparation is not so time-consuming that it interferes with the programs themselves.

Several additional points were raised during the Fellowship Workshop at the January 1990 Space Grant Conference.

1. It is clearly beneficial to use matching funds to stretch the number of fellowships as far as possible.
2. It will not be possible to name the fellowships identically across all colleges, even though there might be prestige benefits in doing so. Unfortunately, the use of matching funds, which is essential, will often require acknowledgment of other sources, as well as the Space Grant, in the name. In any case, a nice name which indicates the honor to the awardee would always be a good idea.
3. No matter at what academic level the fellowships are awarded, a strong effort should be made to encourage the awardee to make a lasting commitment to a space related field. Regular meetings with an advisor or mentor, for example, would be a good idea.
4. Another idea to encourage students to make a lasting commitment is to offer continuation of fellowships for more than one year if academic progress is satisfactory. One way to do this without costing the Space Grant program any money would be an arrangement with the University or the State for a matching year's support.
5. Different Space Grant institutions might cooperate to assist students. For example, an undergraduate Space Grant Fellowship awardee might be given preference for a graduate fellowship at another institution.

N 9 3 - 2 3 1 5 5

Workshop 15

Pitfalls

Terry Triffet
Arizona Space Grant Consortium
University of Arizona
Tucson, Arizona 85721

First National Space Grant Conference
Columbia, Maryland
January 16-19, 1990

pitfalls

Abstract

Though potentially of great benefit to the nation, the experience of the workshop participants and their discussions with Sea Grant and Land Grant officials make it clear that the Space Grant program must avoid certain pitfalls of the past and present if it is to be successful. The most important of these are listed and briefly discussed herein.

Funding Levels

Unless continuing NASA funding can be assured, and increased to at least \$1 million annually by some means for each consortium, it may not be possible for them to mount effective programs. In most cases the grant money must be divided between no less than three institutions or other organizations, so that even at this level Space Grant will have difficulty in competing locally with better funded programs for faculty time, space, and administrative support.

Number of Grants

Since funding levels, and the relative significance of belonging to the group, will be strongly influenced by the total number of consortium grants awarded, too many may have been selected already. This may lead to excessive leveraging and overloading industry. Despite the importance of achieving broad national coverage to build a constituency, any increase in the present number may jeopardize the entire Space Grant program.

Matching Fund Requirements

Continued insistence on equal matching by member organizations will also make it difficult to compete for local resources with programs that require little if any matching. Additionally, in order to plan meaningful activities many of the consortium members have been forced to absorb administrative costs considerably in excess of this requirement, a practice which could severely weaken the Space Grant program.

Federal Political Relations

Because of the nature of grant funding, Space Grant may become a target for budget cuts in some future administration. If this occurs, broad support within the Congress will be essential, but carries with it the added hazard of restored funds being earmarked for special political purposes.

Federal Agency Relations

Because of its overall management by NASA, technical managers may view Space Grant as an indirect threat to their own budgets, resulting in internal reprogramming of allocated funds in times of stress. Combatting this by emphasizing relevance to science and engineering objectives, and by establishing formal peer-review processes, may not be possible because of the educational/outreach character of the program. Top NASA administrators may also oppose independent lobbying at the federal level for similar reasons.

State Political Relations

If Space Grant support cannot be entered as an independent line item in the budget, program objectives may be compromised by internal reallocation decisions of the member organizations. Attempting to obtain legislative backing for such action would probably be opposed by the administrative officials of the universities involved for both management and fiscal reasons.

Consortium Interrelationships

The geographic spread, uneven strength, and diverse programmatic character of the individual consortium will make it difficult to operate a unified program. Failure to establish a central governing board charged with the responsibility of promoting communications and establishing operating rules, regulations and standards may lead to a dilution of overall quality and dominance or withdrawal of the strongest consortium. Definition of performance measures is critical, but must avoid encouraging micromanagement.

Local Procedures

The intended character of Sea Grant and experiences of other federal grant programs suggest the following to be of special importance:

- * Reporting directly to the chief administrative officer of the organization, e.g., the president of the university.
- * Buffering against federal funding delays, e.g., reserve for program development; use of local funds.
- * Arranging for program presentations to joint legislative budget committees, i.e., synchronized with the budget cycle.
- * Minimizing administrative and equipment costs, i.e., emphasizing educational and infrastructure development expenditures.
- * Avoiding the pursuit of research objectives, e.g., science and engineering projects supported in other ways.
- * Stressing the interdisciplinary nature of the program, e.g., developing cross-college and departmental ties.
- * Limiting objectives initially, i.e., agreeing on the goals to be achieved within the time and funds available.
- * Emphasizing public relations and appropriate publicity, without overselling the program, e.g., high school and community college contracts; brochures and media coverage.

Failure to observe any of these could have an adverse effect on local program development.

National Space Grant College and Fellowship Program

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National Space Grant College and Fellowship Program

Designated Space Grant Colleges/Consortia

Institutions which qualify for designated Space Grant College status are indicated with asterisks.

ALABAMA SPACE GRANT CONSORTIUM

* University of Alabama/Huntsville
University of Alabama/Birmingham
Alabama A&M University
Auburn University
University of Alabama

ARIZONA SPACE GRANT COLLEGE CONSORTIUM

* University of Arizona
Arizona State University
Northern Arizona University

CALIFORNIA SPACE GRANT CONSORTIUM AND FELLOWSHIP PROGRAM

* University of California/Berkeley
* University of California/Los Angeles
* University of California/San Diego

COLORADO SPACE GRANT CONSORTIUM

* University of Colorado/Boulder
Colorado State University
University of Colorado/Colorado Springs
Fort Lewis College
Mesa State College
University of Southern Colorado
United States Space Foundation

CORNELL SPACE GRANT CONSORTIUM

* Cornell University
Clarkson University

FLORIDA SPACE GRANT CONSORTIUM

University of Florida
Florida A&M University
Florida State University
University of Miami

GEORGIA INSTITUTE OF TECHNOLOGY SPACE GRANT CONSORTIUM

* Georgia Institute of Technology
Clark Atlanta University
Georgia State University
Tuskegee University

UNIVERSITY OF HAWAII AT MANOA

AEROSPACE ILLINOIS SPACE GRANT CONSORTIUM

- * University of Chicago
- * University of Illinois/Urbana
- University of Illinois/Chicago
- Illinois Institute of Technology
- Illinois Space Institute
- Northwestern University

IOWA SPACE GRANT COLLEGE CONSORTIUM

- * University of Iowa
- Iowa State University
- University of Northern Iowa

THE JOHNS HOPKINS SPACE GRANT CONSORTIUM

- * The Johns Hopkins University
- Space Telescope Science Institute
- Morgan State University

* MASSACHUSETTS INSTITUTE OF TECHNOLOGY

MICHIGAN SPACE GRANT COLLEGE PROGRAM

- * University of Michigan
- Michigan Technological University
- Saginaw Valley State University
- Wayne State University

NEW MEXICO SPACE GRANT CONSORTIUM

- * New Mexico State University
- Space Center

OHIO AEROSPACE INSTITUTE

- * Case Western Reserve University
- * Ohio State University
- Cleveland State University
- University of Akron
- University of Cincinnati
- University of Dayton
- Ohio University
- University of Toledo
- Wright State University

* PENNSYLVANIA STATE UNIVERSITY

ROCKY MOUNTAIN SPACE GRANT CONSORTIUM

- Utah State University
- University of Denver
- University of Utah

TENNESSEE VALLEY AEROSPACE CONSORTIUM

Vanderbilt University
University of Tennessee/Knoxville
Fisk University
Tennessee State University
University of Tennessee Space Institute

TEXAS SPACE GRANT CONSORTIUM

* Texas A&M University
* University of Houston/Clear Lake
* University of Texas/Austin
* University of Houston/Houston
Rice University
University of Texas/Dallas
UT Health Science Center, Houston
Baylor University
University of Houston Downtown
Lamar University
Prairie View A&M University
Southern Methodist University
University of Texas/Arlington
University of Texas/El Paso
University of Texas/San Antonio
UT Health Science Center, San Antonio
UT Medical Branch/Galveston
UT Southwestern Medical Center, Dallas
Texas A&I University
Texas A&M University/Galveston
Texas Christian University
Texas Southern University
Texas Technological University

VIRGINIA SPACE GRANT CONSORTIUM

* Old Dominion University
* Virginia Polytechnical Institute and State
University
University of Virginia
College of William and Mary
Hampton University
State Council of Higher Education
Center for Innovative Technology

* UNIVERSITY OF WASHINGTON

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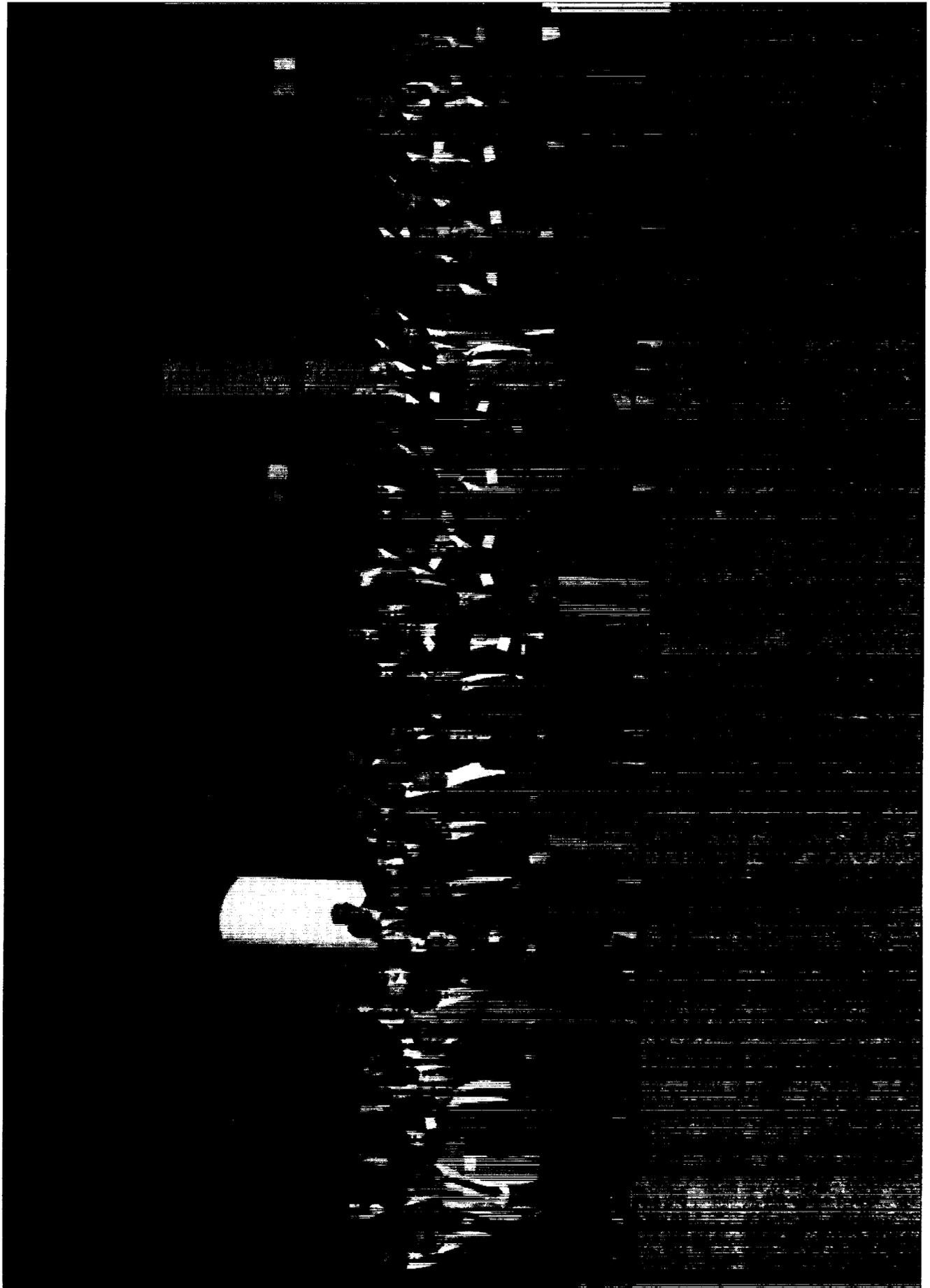
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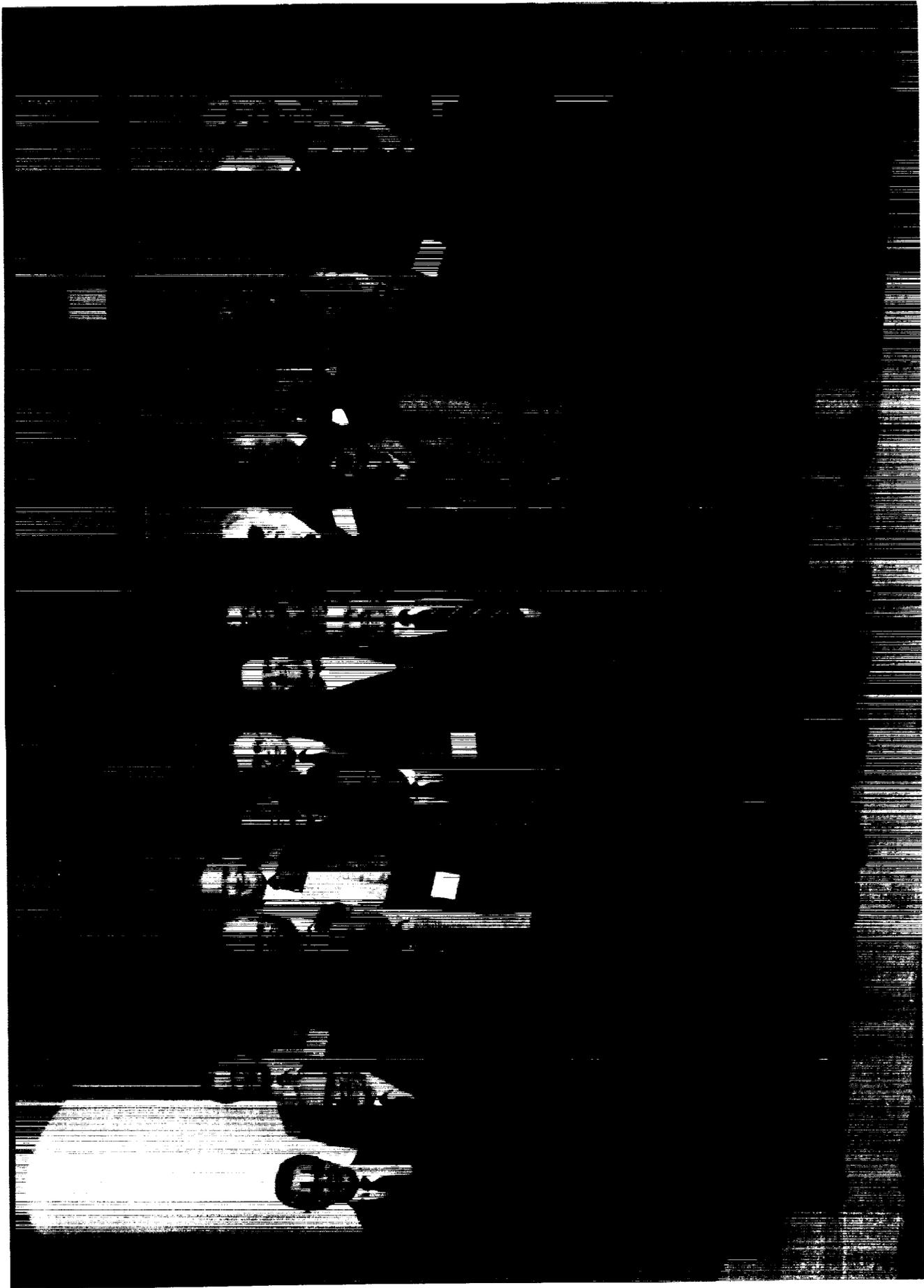
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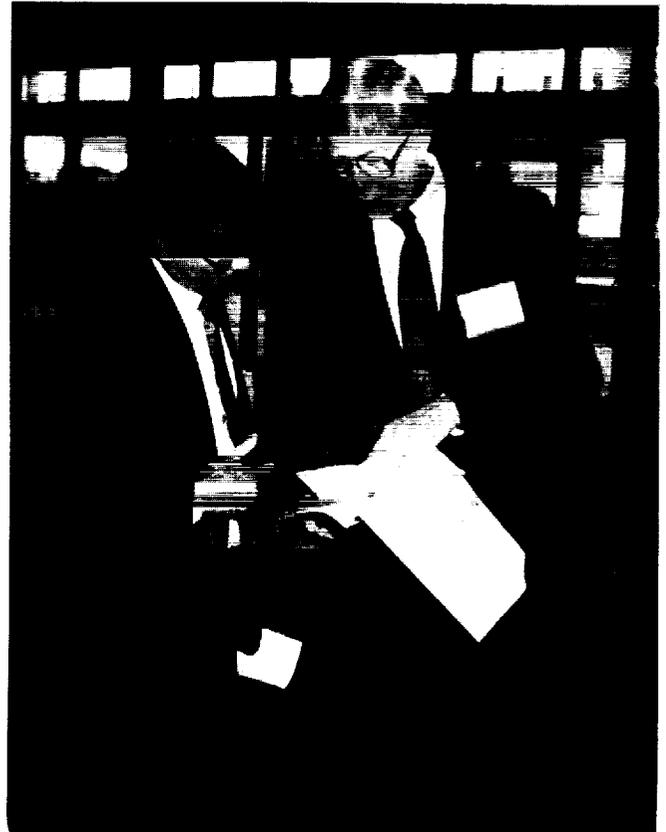
First National Space Grant Conference participants. NASA Administrator Admiral Richard H. Truly, front row, center.



Space Grant Program Directors or their designees. NASA Administrator Admiral Richard H. Truly, front row, center.



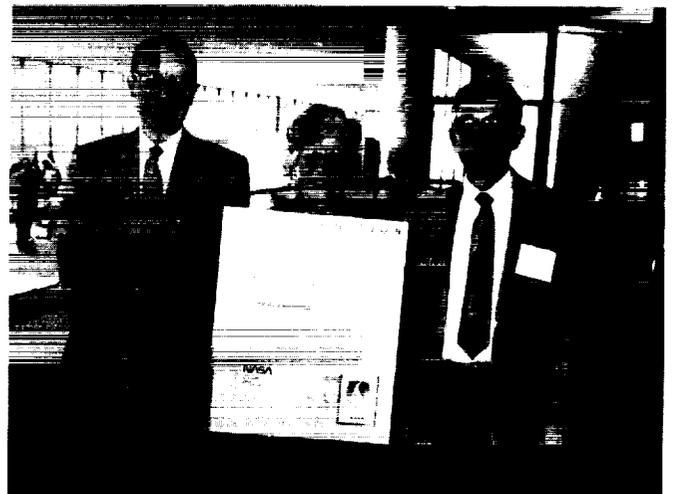
NASA Administrator Admiral Richard H. Truly addressing the First National Space Grant Conference.



Dr. Phillip J. Sakimoto, Assistant Program Director, The Johns Hopkins Space Grant Consortium and member of the local planning committee; and Dr. E. Julius Dasch, program Manager and Conference Chair, NASA Headquarters.



Members of the Virginia Space Grant Consortium: Dr. Michael W. Miller; Program Director Dr. Dennis W. Barnes; Dr. Demetrius Venable; and Dr. Suzanne M. Stuart.



Members of the Pennsylvania State University Space Grant College: Dr. Wes C. Hymer; Dr. Sylvia Stein; and Dr. Richard L. McCarl.



NATIONAL SPACE GRANT COLLEGE AND FELLOWSHIP PROGRAM

FIRST NATIONAL CONFERENCE

January 16-19, 1990

Kossiakoff Center

The Johns Hopkins University
Applied Physics Laboratory

Columbia, Maryland

PROGRAM

Tuesday, January 16

7:00 - 9:00 p.m. Welcoming Reception (Cash Bar) and Registration
Columbia Hilton Hotel, Columbia, Maryland

Wednesday, January 17

8:00 - 8:30 a.m. Late Registration/Continental Breakfast
Kossiakoff Center North Dining Room

8:30 - 8:45 a.m. Welcome and Introductions
Kossiakoff Center Auditorium

—**Dr. E. Julius Dasch**
Conference Chair
Space Grant Program Manager
University Programs Branch
Office of External Relations
NASA Headquarters

—**Dr. James E. Colvard**
Associate Director
Applied Physics Laboratory

8:45 - 9:00 a.m. *NASA's External Community*

—**Mr. Kenneth S. Pedersen**
Associate Administrator
Office of External Relations
NASA Headquarters

9:00 - 9:30 a.m. *National Setting for the Space Grant Program*

Keynote Speaker
—Admiral Richard H. Truly
NASA Administrator

9:30 -10:15 a.m. Break

Group Photograph

Kossiakoff Center North Dining Room

10:15 -11:15 a.m. *Second Golden Age of Exploration: Flight Programs to 2010*

—Dr. Geoffrey A. Briggs
Director
Solar System Exploration Division
Office of Space Science and Applications
NASA Headquarters

Kossiakoff Center Auditorium

11:15 -12:15 p.m. Panel Discussion: *Space Grant Program Expectations*

—Chair: Ms. Elaine T. Schwartz
Chief
University Programs Branch
Office of External Relations
NASA Headquarters

—Panel: NASA Center University Affairs Officers

Kossiakoff Center Auditorium

12:15 - 3:00 p.m. Lunch and NASA Center Discussions

Lunch
Kossiakoff Center South Dining Room

Free Time for Discussions at NASA Center Tables
Kossiakoff Center North Dining Room

*2:00-3:00 p.m. — *Space Grant Program Directors Meeting* — concurrent with break*
Kossiakoff Center classroom

3:00 - 4:00 p.m. *The Space Grant Program: Structuring Phase II*

—Chair: Mr. Melvin J. Hartmann
Director of University Programs
NASA Lewis Research Center

Kossiakoff Center Auditorium

4:00 - 5:00 p.m. Tour of Applied Physics Laboratory

 —**Dr. Vincent L. Pisacane**
 Head
 Space Department
 Applied Physics Laboratory

 Tour begins in Kossiakoff Center Auditorium

5:00 p.m. Bus leaves Kossiakoff Center for hotel

6:00 p.m. Bus leaves hotel for reception

7:00 - 9:30 p.m. Reception (Open Bar)

 Maryland Science Center
 Baltimore Inner Harbor

9 :45 p.m. Bus leaves for hotel

Thursday, January 18

- 8:30 - 9:00 a.m. Charge and Guidance to Workshops
—**Dr. E. Julius Dasch**
Kossiakoff Center Auditorium
- 9:00 - 10:30 a.m. Workshop Sessions
First Group of Topics
Kossiakoff Center classrooms
Coffee and tea available in North Dining Room
- 10:30 - 12:00 p.m. Workshop Reports to Conference
Kossiakoff Center Auditorium
- 12:00 - 1:00 p.m. Lunch
Kossiakoff Center South Dining Room
- 1:00 - 2:30 p.m. Workshop Sessions
Second Group of Topics
Kossiakoff Center Classrooms
Coffee and tea available in North Dining Room
- 2:30 - 4:00 p.m. Workshop Reports to Conference
Kossiakoff Center Auditorium
- 4:00 p.m. Bus leaves Kossiakoff Center for hotel
- 5:00 p.m. Bus leaves hotel for tour
- 6:00 - 7:00 p.m. Welcome and Tour
The Space Telescope Science Institute
—**Dr. Riccardo Giacconi**
Director
Space Telescope Science Institute
—**Dr. Eric Chaisson**
Director of Educational Programs
Space Telescope Science Institute
- 7:00 p.m. Bus leaves Institute for banquet
Morgan State University
McKeldin Center
- 7:30 - 8:00 p.m. Cocktail Party (Open Bar)

8:00 - 9:00 p.m.

Dinner

9:00 - 9:15 p.m.

Welcoming Remarks

—**Dr. Earl S. Richardson**

President

Morgan State University

—**Dr. Robert W. Brown**

Director

Educational Affairs Division

NASA Headquarters

9:15 - 10:15 p.m.

Manned Exploration of the Moon and Mars

—**Dr. Franklin D. Martin**

Assistant Administrator

Office of Exploration

NASA Headquarters

10:30 p.m.

Bus leaves for hotel

Friday, January 19

8:30 - 9:00 a.m. Baggage checking available in Kossiakoff Center classroom

9:00- 10:30 a.m. Workshop Sessions
 Third Group of Topics

 Kossiakoff Center classrooms

 Coffee and tea available in North Dining Room

10:30 - 12:00 p.m. Workshop Reports to Conference

 Kossiakoff Center Auditorium

12:00 - 1:00 p.m. Lunch

 Closing Remarks

 —**Dr. E. Julius Dasch**

 Kossiakoff Center South Dining Room

1:00 p.m. Bus leaves Kossiakoff Center for NASA tour

1:30- 2:30 p.m. Tour of NASA/Goddard Space Flight Center

 —**Dr. Gerald Soffen**
 University Affairs Officer
 NASA Goddard Space Flight Center

 *1:30 - 3:00 p.m. — *Role of NASA
 Centers in the Space Grant Program —
 Center University Affairs Officers and
 Headquarters personnel - concurrent with
 tour**

 Kossiakoff Center classroom

2:30 p.m. Bus leaves NASA Goddard Space Flight Center for
 Kossiakoff Center

3:00 p.m. Bus leaves Kossiakoff Center for airport

FIRST NATIONAL SPACE GRANT CONFERENCE

	Name		Home Institution	Space Grant Affiliation or Title
1	ADAMS	Clara I.	Morgan State University	Vice President, Academic Affairs
2	ANDERSON	Eddie	NASA Headquarters	Chief, Elem & Sec Programs
3	ANIKIS	Anne	JHU Applied Physics Laboratory	MESA Program Coordinator
4	ASHER	Muriel	National Inst of Mental Health	
5	ASHKENAS	Harry	Jet Propulsion Laboratory	Dir, University Affairs Office
6	AYERS	Anne L.	NASA Headquarters	Elem & Secondary Programs
7	BACON	Pamela M.	NASA Headquarters	Elem & Secondary Programs
8	BAKER	Doran	Utah State University	Rocky Mountain Consortium
9	BARNES	Dennis W.	University of Virginia	Virginia Consortium
10	BERES	Kathleen	Westinghouse Electric Corp	The Johns Hopkins Consortium
11	BILBROUGH	Larry B.	NASA Headquarters	Elem & Secondary Programs
12	BLAKEY	Kristina	NASA Headquarters	University Programs
13	BOETTINGER-LANG	Ellie	Space Telescope Science Inst	Conference Assistant
14	BOETTINGER-LANG	John	Space Telescope Science Inst	Guest
15	BOSTROM	Carl O.	JHU, Applied Physics Lab	Director
16	BREMMER	Dale A.	NASA Headquarters	Coll Lecturers, Aeronaut & Sp Sci
17	BRIGGS	Geoffrey	NASA Headquarters	Dir, Solar System Expl Div
18	BROWN	Myrtle	NASA Headquarters	Guest
19	BROWN	Robert W.	NASA	Dir, Educational Affairs Division
20	BUSBY	Michael	Tennessee State University	Tennessee Valley Aerospace Cons
21	BYTHROW	Peter F.	JHU Applied Physics Lab	Tour Host
22	CAMP	Warren L.	Kennedy Space Center (NASA)	KSC Focal Point
23	CHAISSON	Eric	Space Telescope Science Inst.	The Johns Hopkins Consortium
24	CHANDLER	Trevor L.	University of Washington	University of Washington
25	CHEN	Ching Jen	University of Iowa	Iowa S.G. College Consortium
26	CLARK	Louis	NASA HQ	Sr. Scientist
27	COHON	Jared	The Johns Hopkins University	Vice Provost for Research
28	COHON	Maureen	The Johns Hopkins University	Guest
29	COLVARD	James E.	JHU Applied Physics Laboratory	Associate Director
30	COULTER	Gary	Colorado State University	Flight Program Mgr
31	CRISWELL	David R.	Univ of California, San Diego	California Consortium
32	DASCH	E. Julius	NASA Headquarters	Program Manager
33	DASCH	Patricia	NASA Headquarters	Conference Assistant
34	DELOACH	Sarah	NASA Headquarters	University Programs

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	Name		Home Institution	Space Grant Affiliation or Title
35	DELOATCH	Eugene	Morgan State University	Dean, School of Engineering
36	DURDEN	William	The Johns Hopkins University	Ctr for Gifted & Talented Youth
37	EAST	Thomas D.	University of Utah	Rocky Mountain Consortium
38	EISENBERG	Martin A.	University of Florida	Florida Consortium
39	EISLEY	Joe G.	University of Michigan	Michigan S.G. College Program
40	EISLEY	Paul	Guest of Joe Eisley	
41	ENGLAND	Anthony	The University of Michigan	Michigan S.G. College Program
42	FABER	Jack A.	University of Colorado	Colorado Consortium
43	FOGG	Beverly	Morgan State University	Conference Assistant
44	FOGG	Percy	Morgan State University	Guest
45	FOSHA	Charles E.	U of Colorado, Colorado Springs	Colorado Consortium
46	FRAIN	William E.	JHU Applied Physics Lab	Tour Host
47	FREEMAN	Michael	The University of Alabama	Alabama Consortium
48	GIACCONI	Riccardo	Space Telescope Science	Director
49	GIERASCH	Peter	Cornell University	Cornell College Consortium
50	GOLDEN	Howard S.	NASA Headquarters	Chief, Educ Publ & Special Serv
51	GOLDSTEIN	Stanley H.	Johnson Space Center	Director, University Programs
52	GRAGG	Francis	Martin Marietta	Massachusetts Inst Technology
53	GRANT	Davld G.	Applied Physics Lab	Tour Host
54	HAMMOND	Ernest	Morgan State University	The Johns Hopkins Consortium
55	HANLE	Paul	Maryland Academy of Sciences	Director
56	HANSEN	Elaine B.	University of Colorado	Colorado Consortium
57	HARRIS	Jessie J.	NASA Headquarters	Executive Officer
58	HARTMANN	Melvin J.	NASA Lewis	Director, University Programs
59	HASTINGS	Barbara	NASA-Ames Research Center	University Affairs Officer
60	HASTINGS	Daniel	MIT	Massachusetts Inst of Technology
61	HAWKINS	Edwin	Mesa State College	Colorado Consortium
62	HAYDON	William G.	NASA Headquarters	Photographer
63	HENRY	J. Patrick	University of Hawaii at Manoa	University of Hawaii at Manoa
64	HENRY	Richard C.	The Johns Hopkins University	The Johns Hopkins Consortium
65	HOLLAND	Dolores A.	NASA Headquarters	Off. of Space Sci & Applications
66	HOOKER	Lisa	The Johns Hopkins University	Senior Media Relations
67	HOPP	Michael A.	Martin Marietta Corporation	The Johns Hopkins Consortium
68	HORAN	Sheila	New Mexico State University	Guest

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	Name		Home Institution	Space Grant Affiliation or Title
69	HORAN	Stephen	New Mexico State University	New Mexico Consortium
70	HOWARD	Edward G.	University of Denver	Rocky Mountain Consortium
71	HYDER	A. K.	Auburn University	Alabama Space Grant
72	HYMER	Wes	Penn State University	Director, National Space Grant
73	ISABELL	Doug	Washington Technology	Staff Writer
74	JARRETT	Ronald E.	Morgan State University	Director of Corporate Relations
75	JETER	Wanda	Georgia Institute of Technology	Georgia Tech Consortium
76	JOHNSTON	Gordon I.	NASA Headquarters	Program Mgr, Space Tech. Univ.
77	KEFFER	Lynne	NASA Headquarters	Program Assistant
78	KILGUS	Charles C.	JHU Applied Physics Lab	Tour Host
79	KNAPPENBERGER	H. Allan	Wayne State University	Michigan S.G. College Program
80	KREISEL	Elmer	Towson State University	Department of Physics
81	KRUPSAW	Janet	JHU Space Grant Consortium	Conference Administrator
82	KULLGREN	Thomas E.	Saginaw Valley State University	Michigan S.G. College Program
83	LAWSON	Denise	Jet Propulsion Laboratory	Prg Mgr Spacecft Sys, NASA HQ
84	LAZAR	James	Argonne National Laboratory	Aerospace Illinois Consortium
85	LORETAN	Phil	Tuskegee University	Georgia Tech Consortium
86	MAHON	Rita	The Johns Hopkins University	Guest (R.C. Henry spouse)
87	MARTIN	Franklin D.	NASA Headquarters	Office of Exploration
88	MASSENBERG	Samuel E.	NASA/Langley Research Center	University Affairs Officer
89	MCCALLUM	Debbie	NASA/GSFC	Photographer
90	MCCARL	Richard L.	The Pennsylvania State Univ.	The Pennsylvania State University
91	MCCARTY	Thomas A.	Applied Physics Lab	Tour Host
92	MCGEE	A. Sherri	NASA Headquarters	University Programs
93	MENCHAN	Dillard	NASA/Goddard Space Flight	ECP
94	MEREDITH	Julia D.	NASA Headquarters	Legislative Affairs
95	MILLER	Michael W.	Center for Innovative Technology	Virginia Consortium
96	MILLER	Sam	NASA Ames Research Center	Grad & Summer Faculty Coord
97	MONTEGANI	Francis J.	NASA Lewis Research Center	Chief, Office of University Affairs
98	MOOS	Doris	The Johns Hopkins University	Guest
99	MOOS	Warren	The Johns Hopkins University	Dir, Center for Astrophys. Sci.
100	MORGAN	Steven H.	Fisk University	Tennessee Valley Aerospace Cons
101	MURCRAY	David G.	University of Denver	Rocky Mountain Consortium
102	NAGIB	Hassan	Illinois Institute of Technology	Aerospace Illinois Consortium

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103 NELSON George D.	University of Washington	University of Washington
104 NEWTON Jeffrey	The Johns Hopkins University	Corporate & Foundation Relations
105 NICHOLS Steven P.	University of Texas at Austin	Texas Consortium
106 NICKS Oran W.	Texas, A & M University	Texas Consortium
107 NOVAK Rachel	Freelance Writer	
108 OWENS Frank C.	NASA	Dep Dir, Educational Affairs Div.
109 PARKS George K.	University of Washington	University of Washington
110 PEDERSON Kenneth	NASA Headquarters	Assoc Adm., External Relations
111 PERRY Wayne D.	Pairie View A & M	Texas Consortium
112 PETERS David. A.	Georgia Institute of Technology	Georgia Tech Consortium
113 PETERSON George D.	Morgan State University	The Johns Hopkins Space Grant
114 PISACANE Lois	Applied Physics Laboratory	Guest
115 PISACANE Vincent L.	JHU/Applied Physics Lab	The Johns Hopkins Consortium
116 PRATHER Edward	Univ. of Cincinnati	OAI
117 PRICE Donald R.	University of Florida	Florida Consortium
118 PROCTOR Frank	JHU Applied Physics Laboratory	Public Relations
119 RADER Pat	NASA/Goddard Space Flight	Conference Assistant
120 RAVERA Virginia	NASA Headquarters	University Programs
121 RAWIE Ineke	Guest of J. Easley	
122 REDD Frank J.	Utah State University	Rocky Mountain Consortium
123 RHUE Reginald	JHU Applied Physics Lab	Tour Host
124 RICHARDSON Earl S.	Morgan State University	President
125 ROTH Mary	Cornell University	Cornell College Consortium
126 SADEH Willy Z.	Colorado State University	Colorado Consortium
127 SAIGO Roy H.	Univerisity of Iowa	Iowa S.G. College Consortium
128 SAKIMOTO Philip J.	The Johns Hopkins University	The Johns Hopkins Consortium
129 SAKIMOTO Susan	The Johns Hopkins University	Conference Assistant
130 SALKIND Michael	Ohio Aerospace Institute	Ohio Aerospace Institute
131 SANDERS Wallace	Iowa State University	Iowa S.G. College Consortium
132 SASSER Lisa	MIT	Massachusetts Inst of Technology
133 SCHMIDT David K.	Arizona State University	Arizona College Consortium
134 SCHWARTZ Elaine	NASA Headquarters	Chief, Univ. Programs Branch
135 SHAHROKHI F.	The Univ. of Tenn. Space Inst.	Tennessee Valley Aerospace Cons
136 SHEPPARD Sallie	Texas A & M University	Texas Consortium

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Name		Home Institution	Space Grant Affiliation or Title
137 SINDELAR	Theresa G.	NASA Headquarters	Media Services Division
138 SIX	Frank	NASA/MSFC	University Affairs Officer
139 SOFFEN	Gerald A.	Goddard Space Flight Center	University Affairs Officer
140 SOFFEN	Kazuko	NASA/GSFC	Guest
141 SOLOMON	Wayne C.	U of Illinois, Urbana-Champaign	Aerospace Illinois Consortium
142 STEIN	Sylvia	Penn State University	Exec Dir, Natl Space Grant Prog.
143 STOUFFER	Donald	University Cincinnati	Ohio Aerospace Institute
144 STRAUSS	Alvin M.	Vanderbilt University	Tennessee Valley Aerospace Cons
145 STREETER	Bill	Space Center	New Mexico State University
146 STUART	Suzanne	Peninsula Graduate Eng. Ctr.	Virginia Consortium
147 TAPLEY	Byron D.	University of Texas at Austin	Texas Space Grant Consortium
148 THOMPSON	Linda	JHU Applied Physics Lab	Conference Assistant
149 THORNTON	J. Ronald	University of Florida	Florida Consortium
150 TILTON, III	Lee	NASA/Stennis Space Center	Dir, Science & Technology Lab
151 TREMER	Walt	NASA	Space Ambassador
152 TRIFFET	Terry	University of Arizona	Arizona Consortium
153 TRULY	Adm. R.H.	NASA Headquarters	Administrator
154 VALENTINE	Daniel T.	Clarkson University	Cornell Consortium
155 VANDELINDE	David D.	The Johns Hopkins University	Dean of Engineering
156 VENABLE	Demetrius	Hampton University	Virginia Consortium
157 WARREN	Lewin S.	NASA Headquarters	Dep Asst Admin, EOP
158 WEBB	David	University Central Florida	Florida Space Grant
159 WEHINGER	Peter A.	Arizona State University	Arizona Consortium
160 WILSON	Harold J.	Univ of Alabama in Huntsville	Alabama Consortium
161 YANG	Robert L.	NASA Langley Research Center	