National Aeronautics and
Space Administration

Office of Human Resources
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Education Division
Higher Education Branch
EP-296/October 1993

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Charting Future Courses

Third National Space Grant Conference Report

NASA

Charting Future Courses

Third National Space Grant Conference Report

Cohosted by:
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NASA Johnson Space Center

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National Aeronautics and
Space Administration

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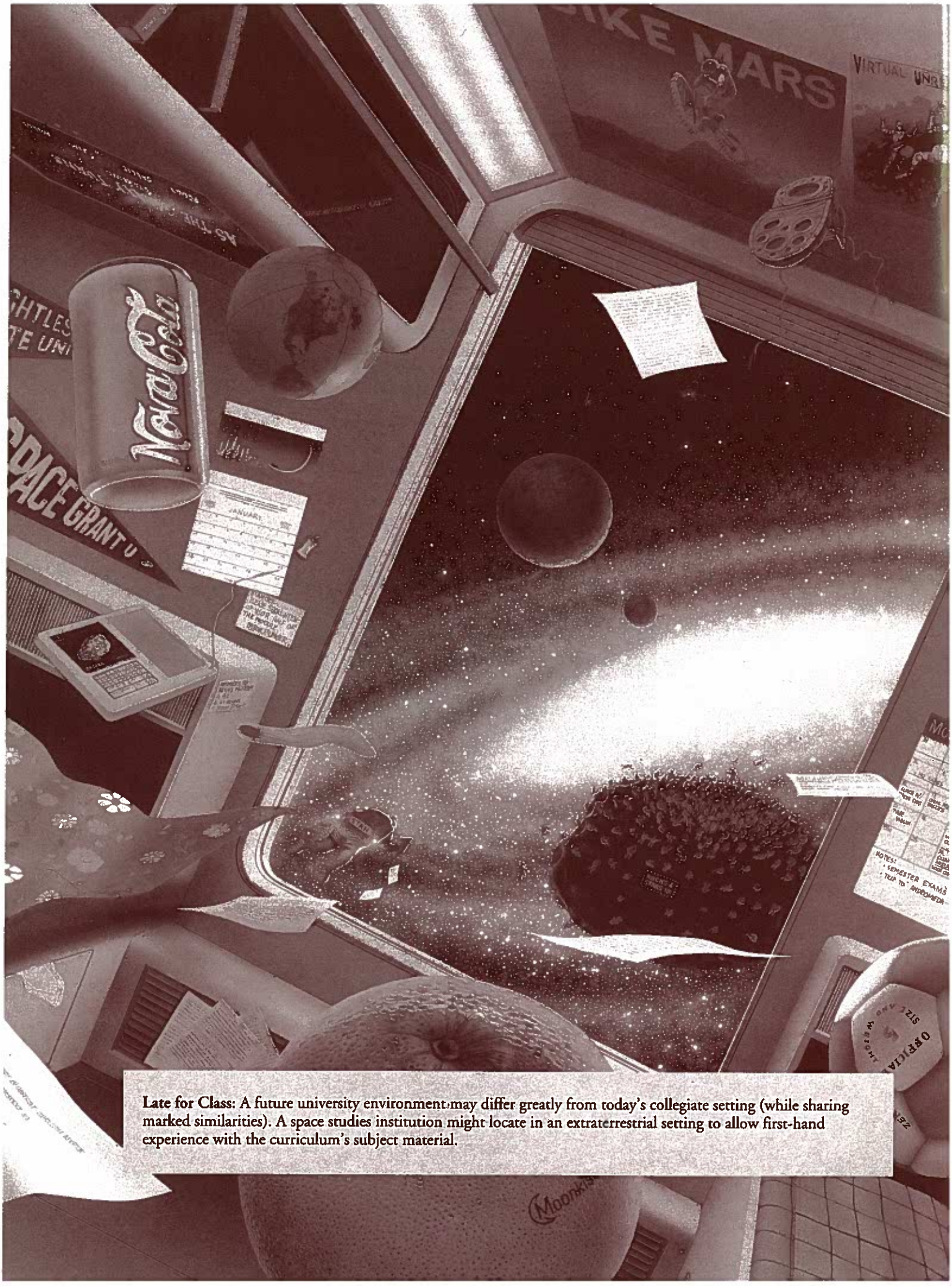
Sylvia Stein
1923-1993

Bruce Cramer

"Sylvia Stein was program director for the Pennsylvania Space Grant Consortium from the program's beginning in 1989. In her many endeavors, she earned the respect and admiration of everyone lucky enough to meet her. Sylvia was energetic, creative and dynamic. It was a pleasure to work with her and to learn from her. Sylvia was a leader and a friend. We will miss her."

Elaine T. Schwartz
Chief, Higher Education



Late for Class: A future university environment may differ greatly from today's collegiate setting (while sharing marked similarities). A space studies institution might locate in an extraterrestrial setting to allow first-hand experience with the curriculum's subject material.

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Sunday, January 10

8:00 - 5:00 ..... Registration Open
Exploring Houston Area on Your Own

8:00 - 5:00 ..... Meeting of Council of Space Grant Directors
Chair: Dr. Martin J. Eisenberg, Director, Florida Space Grant Consortium

1:30 - 5:00 ..... Space Grant Consortium Management Information System Workshop
Facilitator: Dr. Richard Devon, Director, Pennsylvania Space Grant Consortium

6:30 - 7:00 ..... Icebreaker Reception/Cash Bar, Entertainment by Mariachi Continental

7:00 - 8:30 ..... Fiesta Kick-off Dinner
Speakers: Dr. E. Julius Dasch, Program Manager, National Space Grant College and Fellowship Program, "Space Grant: Charting Future Courses"; and Mr. R. Gilbert Moore, Outreach Coordinator, Rocky Mountain Space Grant Consortium, "High Altitude Research"

Monday, January 11

6:30 - 8:00 ..... High Altitude Research
Balloon Launch by Rocky Mountain Space Grant Consortium, on grounds immediately south of conference hotel. In case of inclement weather, launch will be at the same time Tuesday or Wednesday.

6:30 - 5:00 ..... Registration Open

6:30 - 8:00 ..... Continental Breakfast

8:00 - 8:15 ..... Conference Welcome
Presiding: Dr. E. Julius Dasch, Program Manager, National Space Grant College and Fellowship Program

Remarks: Mr. Aaron Cohen, Deputy Administrator, NASA, and Director, NASA Johnson Space Center; and Dr. Byron Tapley, Director, Texas Space Grant Consortium

Monday, January 11 (continued)

8:15 - 9:50 ..... Plenary Session I
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8:15 - 8:30 ..... Gen. Spence M. (Sam) Armstrong, Associate Administrator, Office of Human Resources and Education, "NASA and Human Resources"

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9:00 - 9:15 ..... Ms. Angela M. Phillips, Special Assistant to the Vice-Chair, Committee on Education and Human Resources (CEHR), "The Federal Coordinating Council for Science, Engineering, and Technology (FCCSET)"

9:15 - 9:30 ..... Ms. Sarita E. Brown of the University of Texas at Austin, Vice-Chair, Space Grant Review Panel, "First Meeting of the Space Grant Review Panel"

9:30 - 9:45 ..... Dr. Joseph P. Allen, President, Space Industries International, Inc., Member, Space Grant Review Panel, "Industry-Space Grant Relations: A Conference Focus"

9:45 - 9:50 ..... Introduction to Workshops and Poster Sessions, Presented by Dr. E. Julius Dasch

9:50 - 10:10..... Break

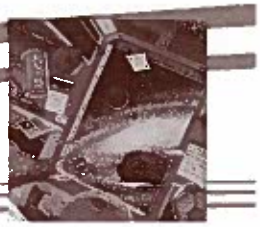
10:10 - 11:50..... Breakout Session I: Three Concurrent Workshops

A. Industry-Space Grant Relations I: Space Grant Resources
Facilitator: Dr. John C. Gregory, Director, Alabama Space Grant Consortium

B. Research and Research Infrastructure
Facilitator: Dr. Richard Devon, Director, Pennsylvania Space Grant Consortium

C. Land Grant, Sea Grant, Space Grant Relations: Cooperative Extension
Facilitator: Ms. Mary L. Sandy, Director, Virginia Space Grant Consortium

11:50 - 12:15 ..... Group Photograph



Monday, January 11 (continued)

12:15 - 1:30..... Luncheon
Speaker, Dr. Jeffrey D. Rosendhal, Special Assistant to Associate Administrator, Office of Space Science and Applications, "NASA Opportunities in Science"

1:30 - 2:00 ..... Group Photographs

2:00 - 3:45 ..... Breakout Session II: Three Concurrent Workshops

A. Industry-Space Grant Relations II: Industry Resources
Facilitator: Dr. Alvin M. Strauss, Director, Tennessee Space Grant Consortium

B. Capability Enhancement and Other EPSCoR-like Programs
Facilitator: Dr. Gaylord Northrop, Director, Arkansas Space Grant Consortium

C. K-12 and Other Public Service Programs
Facilitator: Dr. Wayne Solomon, Director, Illinois Space Grant Consortium

3:45 - 5:00 ..... Poster Session I
Featuring 21 Space Grant Consortia and NASA Centers: Alaska, Arizona, California, Colorado, Connecticut, Delaware, District of Columbia, Idaho, Maine, Maryland, Massachusetts, Nevada, New Hampshire, New York, Oklahoma, Rhode Island, South Carolina, Washington; Ames Research Center, Goddard Space Flight Center, Jet Propulsion Laboratory

Representatives from each Consortium and Center will be available for discussion

5:00 - 5:15 ..... Board buses for Dinner

5:15 Buses depart for Dinner

6:00 - 7:30 ..... Dinner, Lakewood Yacht Club
Speaker: Rear Adm. Alan B. Shepard, U.S. Navy Retired, and President, Seven Fourteen Enterprises, "The Space Program: A Personal Perspective"

7:30 Buses Depart Lakewood for Space Center Houston

8:00 - 11:30..... Tour of Space Center Houston
Buses return to South Shore on the half hour from 9:30 - 11:30

Tuesday, January 12

7:00 - 5:00 ..... Registration Open

7:00 - 8:00 ..... Continental Breakfast

8:00 - 9:45 ..... Plenary Session II

8:00 - 8:30 ..... Dr. Martin A. Eisenberg, Chair, Council of Space Grant Directors, and Director, Florida Space Grant Consortium, "Mission to America — A Report on the Woods Hole Conference"

8:30 - 9:15 ..... Dr. Leonard A. Harris, NASA Chief Engineer and *Ex-officio* Member, Space Grant Review Panel, "NASA Opportunities in Engineering and Technology"

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9:45 - 10:05..... Break

10:05 - 11:45..... Breakout Session III: Three Concurrent Workshops

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Facilitator: Mr. Robert Dalton, Maine Space Grant Consortium

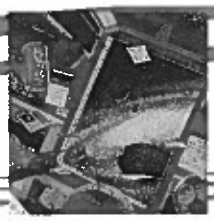
B. Evaluation Mechanisms for Space Grant Consortia
Facilitator: Dr. George K. Parks, Director, Washington Space Grant Consortium

C. Grantsmanship
Facilitator: Dr. William D. Lakin, Co-Director, Vermont Space Grant Consortium

12:00 - 1:15 ..... Luncheon

Breakout Meetings for Regional Consortia

New England (Northeastern) Regional Space Grant Consortium
Presiding: Dr. Daniel E. Hastings, Director, Massachusetts Space Grant Consortium



Tuesday, January 12 (continued)

Mid-Atlantic Regional Space Grant Consortium
Presiding: Ms. Mary L. Sandy, Director, Virginia Space Grant Consortium

Southeastern Regional Space Grant Consortium
Presiding: Dr. John C. Gregory, Director, Alabama Space Grant Consortium

Midwestern Regional Space Grant Consortium
Presiding: Dr. Wallace W. Sanders, Jr., Director, Iowa Space Grant Consortium

Western Regional Space Grant Consortium
Presiding: Mr. John A. Gardner, II, Coordinator, Nevada Space Grant Consortium

1:15 - 1:30 ..... Board Buses for Optional Tours

1:30 - 1:45 ..... Buses Depart for Optional Tours

Option One: NASA Johnson Space Center Facilities

Option Two: Industry Facilities: McDonnell Douglas (Space Station maintenance and testing) and Space Industries International (commercial mission control center)

1:45 - 4:15 ..... Tours of Selected Options

4:15 - 5:00 ..... Board Buses and Return to Conference Hotel

6:00 - 7:00 ..... Poster Session II
Cash Bar
Featuring 21 Space Grant Consortia and NASA Centers: Alabama, Florida, Georgia, Hawaii, Iowa, Kansas, Kentucky, Louisiana, Nebraska, New Jersey, New Mexico, North Carolina, North Dakota, Oregon, Pennsylvania, Vermont, West Virginia, Wisconsin; Johnson Space Center, Kennedy Space Center, Langley Space Center

Representatives from each Consortium and Center will be available for discussion

7:30 - 9:30 p.m..... Keynote Banquet
Speaker: Col. Charles F. Bolden, Jr., USMC, "The Course of Human Spaceflight"

Wednesday, January 13

7:00 - 4:00 p.m..... Registration Open

7:00 - 8:00 a.m..... Continental Breakfast
Breakfast meeting of Capability Enhancement Program Directors
Presiding: Dr. John Wefel, Director, Louisiana Space Grant Consortium

8:00 - 10:15..... Plenary Session III: NASA Updates

8:00 - 8:45 ..... Mr. Barry Epstein, User Development Program Manager, NASA Headquarters, Office of Space Flight, Spacelab/Space Station Utilization User Integration Division, "Space Station Freedom: Research Opportunities"

8:45 - 9:45 ..... Lt. Col. Sidney Gutierrez, Astronaut, NASA Johnson Space Center, "STS-40/SLS-1"

9:45 - 10:15 ..... Mr. Pat Rawlings, Space Artist, Science Applications International Corporation, "Art, Technology and the Space Frontier"

10:15 - 10:30..... Break

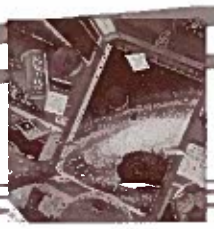
10:30 - 11:45..... Poster Session III
Featuring 19 Space Grant Consortia and NASA Centers: Arkansas, Illinois, Indiana, Michigan, Minnesota, Mississippi, Missouri, Montana, Ohio, Puerto Rico, South Dakota, Tennessee, Texas, Utah, Virginia, Wyoming; Lewis Research Center, Marshall Space Flight Center, Stennis Space Center

Representatives from each Consortium and Center will be available for discussion

11:45 - 1:00 p.m..... Luncheon
Speaker: Dr. Diana Natalicio, President, the University of Texas at El Paso, "Special Problems Involving the Recruitment and Retention of Hispanic Students in Science and Engineering"

1:30 - 3:30 ..... Breakout Session IV, Three Concurrent Workshops

A. Underrepresented Groups: Special Focus on Hispanic Students
Facilitators: Dr. Juan Gonzales, Director, Puerto Rico Space Grant Consortium; Dr. Eugene H. Levy, Director, Arizona Space Grant Consortium



Wednesday, January 13 (continued)

B. Undergraduate Training
Facilitator: Dr. G. Jeffrey Taylor, Associate Director, Hawaii Space Grant Consortium

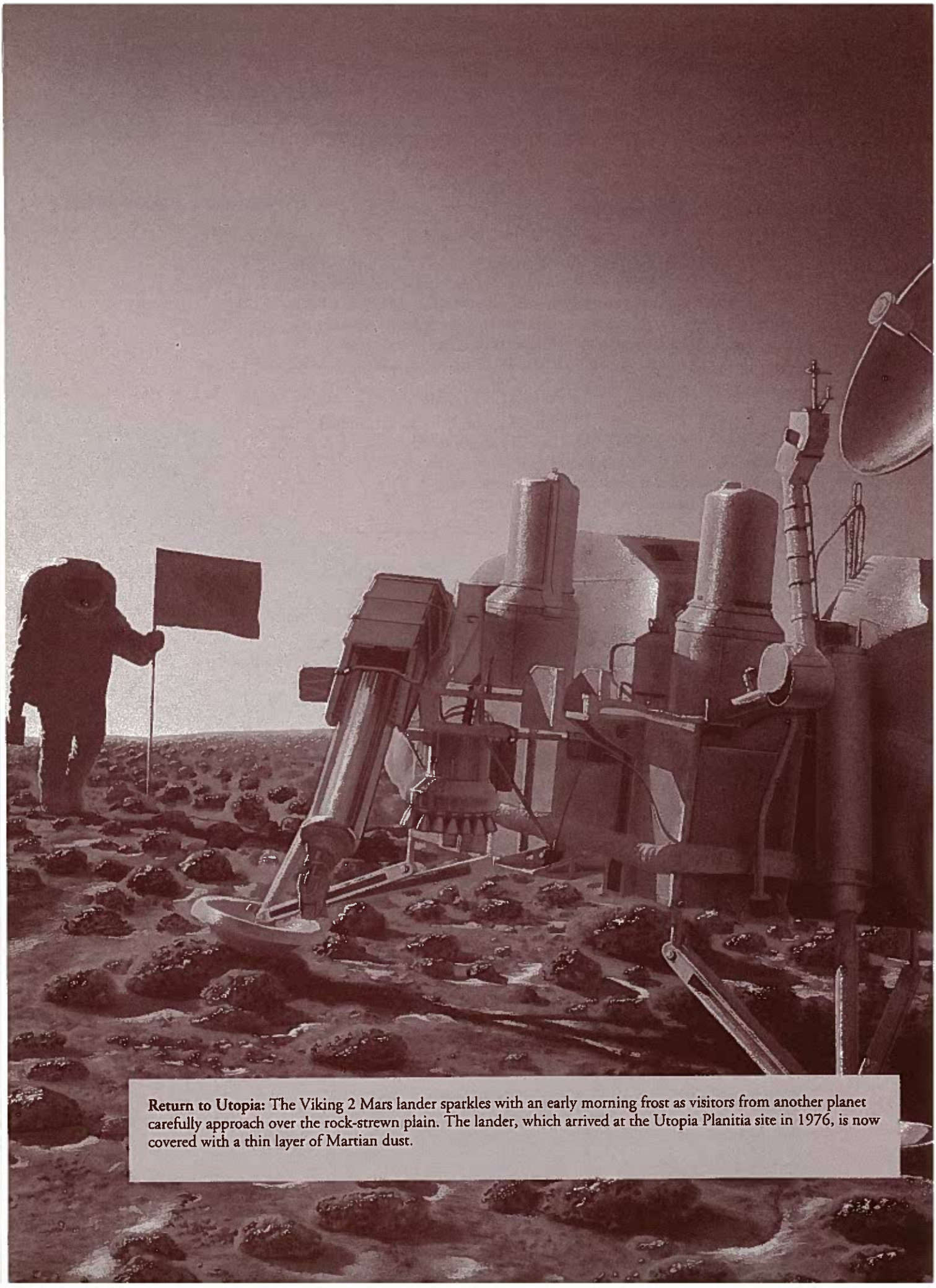
C. Community College Initiatives
Facilitator: Dr. Michael R. Dingerson, Director, Mississippi Space Grant Consortium

3:30 - 4:00 ..... Plenary Session IV: Concluding Remarks
Discussion led by Dr. E. Julius Dasch

4:05 Conference Adjournment

Thursday, January 14

9:00 - 4:00 ..... Space Grant Review Panel Meeting
Presiding: Dr. John V. Byrne, Chair, Space Grant Review Panel; President, Oregon State University



Return to Utopia: The Viking 2 Mars lander sparkles with an early morning frost as visitors from another planet carefully approach over the rock-strewn plain. The lander, which arrived at the Utopia Planitia site in 1976, is now covered with a thin layer of Martian dust.

First National Space Grant Conference

The First National Space Grant Conference was held January 17-19, 1990, at the Kossiakoff Center on the grounds of the Johns Hopkins University Applied Physics Laboratory (APL) in Columbia, Maryland. It marked the beginning of the Space Grant Program for the 21 Designated Space Grant Colleges and Consortia.

The conference was organized by the NASA Education Division, Higher Education Branch (formerly Educational Affairs Division, University Programs Branch), in conjunction with the Maryland Space Grant Consortium — Johns Hopkins University, Morgan State University, and the Space Telescope Science Institute (STScI) — and the NASA Goddard Space Flight Center (GSFC), which cohosted the meeting.

One hundred forty-eight representatives from the 21 designees met with Headquarters personnel and University Affairs Officers from NASA Field Centers: Ames Research Center, Moffett Field, California; Goddard Space Flight Center, Greenbelt, Maryland; Jet Propulsion Laboratory, Pasadena, California; Lyndon B. Johnson Space Center, Houston, Texas; Kennedy Space Center, KSC, Florida; Langley Research Center, Hampton, Virginia; Lewis Research Center, Cleveland, Ohio; and, Stennis Space Center, SSC, Mississippi. Space Grant recipients and Field Center personnel were encouraged to establish associations and share resources where feasible.

Conference goals were: 1) to provide a setting for Space Grant leaders to meet and discuss program plans; 2) to provide participants with updates on major NASA science and engineering programs and NASA Education activities; 3) to hold workshops on themes of critical importance to the program; and, 4) to provide tours of GSFC and STScI.

The conference agenda focused primarily on a series of 15 workshops that program directors or their designees discussed components of the Space Grant program. These components — outreach, pre-college education, publicity, and organization, to name a few — 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 discussed with Headquarters officials how the Space Grant program itself should be evaluated.

Evening activities during the conference included a reception at the Maryland Science Center at Baltimore's Inner Harbor district, and a banquet hosted by Morgan State University, where conference attendees enjoyed a presentation by Dr. Franklin D. Martin, Assistant Administrator, NASA Office of Exploration. Participants also were treated to tours of the APL facilities, STScI on the Johns Hopkins Homewood Campus, and GSFC.

The "First National Space Grant Conference Report" (EP-275) is available by contacting:

NASA Headquarters
Code FEH
Washington, DC 20546

Second National Space Grant Conference

During the First National Space Grant Conference (January 17-19, 1990) invitations were received to host succeeding Space Grant conferences in Huntsville, Alabama — cohosted by the Alabama Space Grant Consortium and the NASA Marshall Space Flight Center — and in Houston, Texas — cohosted by the Texas Space Grant Consortium and the NASA Johnson Space Center. The invitation received first was accepted for the Second Space Grant Conference to be held in Huntsville.

The Second National Conference was delayed by about two months to allow selection of Phase II State Consortia and their subsequent participation in the conference. Owing to the much broader range of participating institutions and programs, the conference agenda was modified from that of the first conference. Additionally, several suggestions resulting from the first conference (to hold all workshops as meetings-of-the-whole, so that all could attend, and to allow time for presentations by all Phase I programs) were incorporated. Conference goals, however, remained much the same as before: 1) to provide a setting for Space Grant 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 education activities; 3) to hold discussions on themes of critical importance to the program; and, 4) to provide tours of NASA Marshall Space Flight Center, the University of Alabama in Huntsville, and Alabama A&M University.

The "Second National Space Grant Conference Report" (EP-278) is available by contacting:

NASA Headquarters
Code FEH
Washington, DC 20546

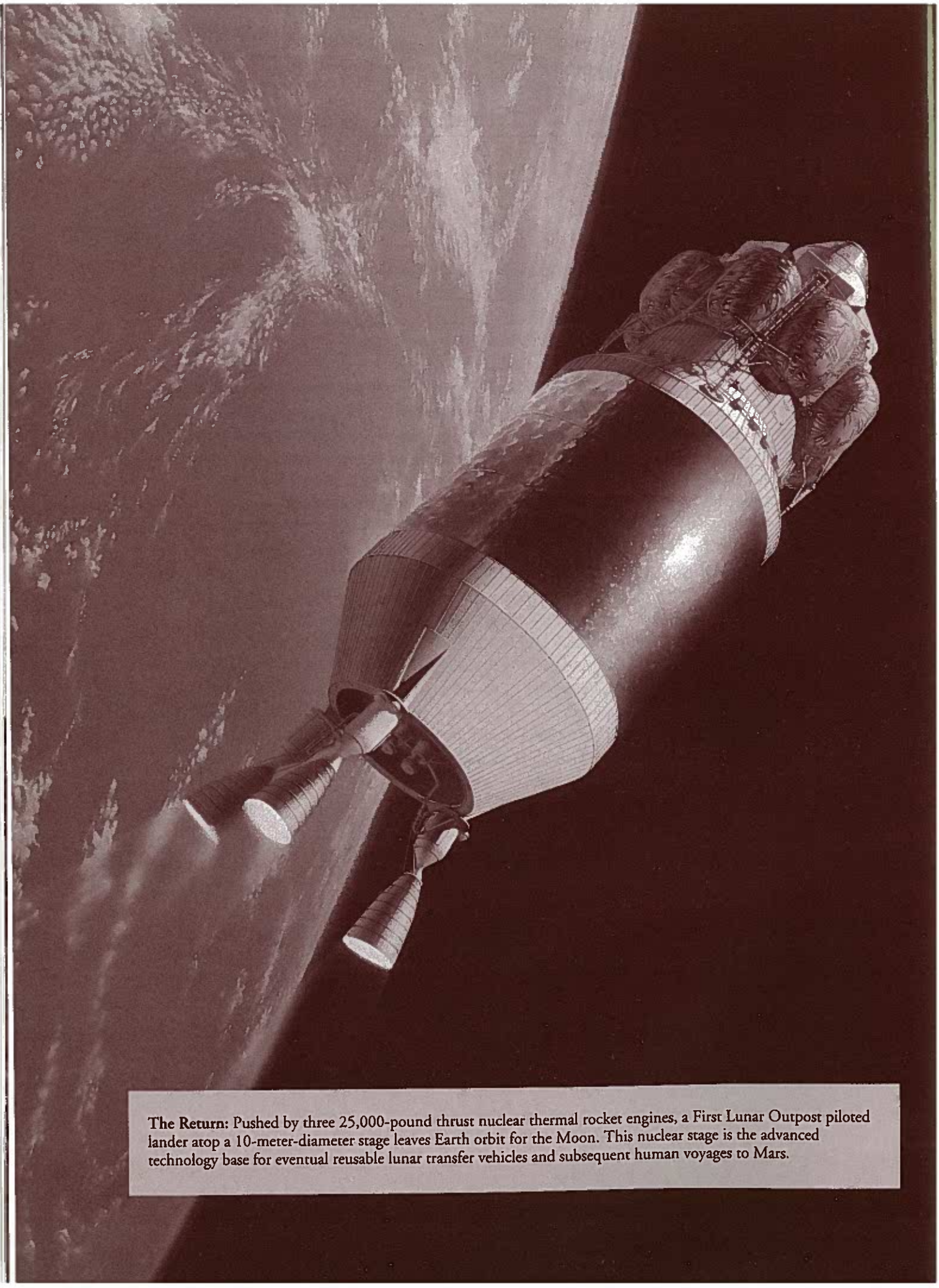
Third National Space Grant Conference

The Third National Space Grant Conference was held January 10-13, 1993, in Houston, Texas. The conference — cohosted by the Texas Space Grant Consortium and the NASA Johnson Space Center — brought together for the first time Space Grant personnel from 50 states, the District of Columbia, and the Commonwealth of Puerto Rico.

The conference theme, "Charting Future Courses," prevailed throughout the four-day event, as conference participants attended workshops on topics such as evaluation, industry interaction, underrepresented groups and extension. Three poster sessions featured program presentations by the 52 Space Grant Consortia and the nine NASA Field Centers. Among the many highlights of this year's program were appearances by Rear Admiral (Retired) Alan B. Shepard, astronaut on the *Mercury* 3 and *Apollo* 14 missions; Lt. Col. Sidney M. Gutierrez, USAF, pilot on STS-40/SLS-1, the first shuttle mission devoted to the study of the human body in space; Col. Charles F. Bolden, Jr., USMC, training to fly in November 1993 as commander of STS-60 aboard the Space Shuttle *Discovery;* and Dr. Diana Natalicio, president of the University of Texas at El Paso. In addition, participants witnessed the exciting launch of a high altitude research balloon.

Conference goals promoted the overall mission of the National Space Grant program. The meeting provided opportunities: 1) for Space Grant leaders to meet, exchange ideas, and discuss plans; 2) for NASA personnel to furnish updates on major science and engineering programs, and education activities; 3) to address themes of primary importance to the program; and, 4) to supply a first-hand look at selected NASA facilities and industries affiliated with the Texas Space Grant Consortium.

Evening activities included the kick-off fiesta dinner, a banquet at the Lakewood Yacht Club and a tour of Space Center Houston.



The Return: Pushed by three 25,000-pound thrust nuclear thermal rocket engines, a First Lunar Outpost piloted lander atop a 10-meter-diameter stage leaves Earth orbit for the Moon. This nuclear stage is the advanced technology base for eventual reusable lunar transfer vehicles and subsequent human voyages to Mars.

Meeting of the Space Grant Directors' Council

The Council of Directors, comprised of Space Grant program directors from nearly every consortium, convened an all-day meeting prior to the conference. Earlier, a breakfast meeting of the Executive Committee of the Directors' Council took place.

Dr. Martin A. Eisenberg, Chair of the council, convened the meeting. He welcomed the group of about 50 and made some introductions. Members approved the minutes of the previous meeting (August 28, 1992) and reviewed last year's significant events. A revised charter was approved and an election for offices of Secretary-Treasurer, Executive Committee (three members), and Nominating Committee (six members), was held. Eisenberg noted that he had been asked to serve as an *ex-officio* member of the Space Grant Review Panel, which was to hold its second meeting on Thursday, January 14, directly after the conference.

Dr. E. Julius Dasch, NASA Program Manager for Space Grant, made a few remarks that were followed by a brief discussion period.

Dr. David Criswell reported on the Woods Hole Workshop, a meeting convened by the Council August 24-28, 1992. A copy of the report from the workshop, "Mission to America," was included with each conference registrant's materials. Much of the remainder of the meeting was devoted to a discussion of recommendations which resulted from the Woods Hole Workshop.

The meeting closed with presentations by Dr. Stanley Goldstein, University Affairs Officer, Johnson Space Center, and Dr. Gerald Soffen, University Affairs Officer, Goddard Space Flight Center.

Consortium Management Information System Workshop

Facilitators:

Dr. Richard Devon, Director, Pennsylvania Space Grant Consortium

Ms. Katherine Pruzan, Assistant Program Manager, National Space Grant College and Fellowship Program

The Consortium Management Information System (CMIS) workshop consisted of a demonstration of the new software preceded by a presentation of its history, purpose, philosophy and logistics.

History, Philosophy, Evaluation

Devon described the history and philosophy of data collection procedures operated by NASA Headquarters for the Space Grant program. He described the process of going from hand-written reports submitted to NASA Headquarters (describing the first full year's activities) to the first

annual report software used in 1992, and finally to the development of CMIS.

Analyzing and evaluating handwritten reports was found to be time-consuming and tedious, made more so by both the inability to quickly access information, and the obvious limitations of obtaining non-standardized information. Compilation of national statistics and comparable trends are virtually impossible in this setting.

The annual report software first distributed to consortia overcame many of these problems. The drawback, however, was the inability of the system to provide any practical or meaningful information for use by the consortia. It was primarily a one-way system to obtain data for NASA Headquarters.

Introducing the Consortium Management Information System

From feedback obtained on the annual report software, it was generally perceived that a system to serve the information needs of both the consortia and Headquarters was needed. As such, it was decided that the software should be both an annual report mechanism for Headquarters and a reporting and data retrieval system for directors.

The various Space Grant information needs can be summarized as follows:

1) to establish a computerized contacts and communications system. This would include names, addresses, phone and fax numbers, and e-mail addresses for all contacts in Space Grant;
2) Headquarters' need for data and annual reports from the consortia to comply with Space Grant legislation;
3) national descriptions and statistics on Space Grant programs;
4) a standard mechanism for evaluation of consortium activities and management at all levels;
5) tracking and maintenance of individual program information, fellows, budgets and contacts lists.

In response to the above concerns, last year it was decided that a complete contacts and communications database would be provided in the new software. Reporting capabilities, individual tracking of fellows, a sophisticated budget submission system, and year-to-year tracking of programs, also would be included. In addition, it was decided to fully field test the software before implementation, in order to allow a smooth transition and to obtain full feedback from consortia on the software.

Devon stressed that the primary expectation of the software is to provide program descriptions rather than a format for strict evaluations of consortia. The primary usefulness of the data collection will serve as a description for interested parties, both within and outside NASA. Evaluations from data collections will be viewed in respect to general trends, balance and the stated objectives of the Space Grant program. NASA Headquarters does not intend to evaluate individual programs using *only* CMIS.

CMIS Structure and Capabilities

The software will contain sections for programs — fellowships, higher education, research infrastructure, kindergarten through twelfth grade (K-12), general public service and external relations — budgets, expenses, communications and management information.

Included will be the ability to provide to Headquarters annual data dumps and the ability to obtain printouts of data. A national database will be maintained at NASA Headquarters.

Because the system is being developed in FoxPro (a popular database software package) it will be available for different operating systems and will be exportable to other popular personal computer platforms. The system will eventually be available for UNIX and Macintosh platforms.

General Concerns

There was some concern about computerized descriptions of programs for evaluation, although the benefits of standardized descriptions far outweigh any negatives. Suggestions on improving the system included: differentiating K-12 programs for teachers from K-12 programs for children; providing a place to describe industry activities and contributions; and, having the reporting period match the grant period. (Headquarters personnel agreed that the reporting period and the grant period should coincide. This will go into effect for 1993 data collection.) Finally, on-line help will be incorporated into the software along with definitions of terms.

Timelines—Software and Data Collection

The new software will be phased in slowly with ample opportunity for feedback from the consortia. Group data on fellowships, as done previously, will be required for 1992 data (which will be submitted on hard copy). The use of CMIS for annual reports will be required in early 1994 for 1993 data collection.

The nearly 60 workshop attendees were asked to provide comments on data collection forms. It is anticipated that revisions will be incorporated into the forms, with consortia having provided data to Headquarters by mid-March 1993. It is further anticipated that a personal computer version of CMIS will be available by June 1993, and a Macintosh version by late 1993. Full implementation of the system is expected in early 1994.

Budget

A demonstration of the budget submission was presented, followed by discussion. Some concerns were raised over the philosophy of the budget system. One participant was apprehensive that the budget system would be an auditable accounting system. NASA personnel explained that the budget system was for the NASA Space Grant Office and the NASA Grants and Contracts Office use only, and was not intended as a strict accounting system. NASA also agreed to revise certain troubling terminology. There also was a concern about how to include levels of obligated moneys — committed, encum-

bered, expended — and how to accurately report such moneys in budget and expense reports without double counting.

Fellowships

Currently, the fellowships section stores applicant, award and completion data for fellowship recipients. Full tracking will be implemented for fellows receiving $800 or more, while awardees receiving less than $800 will not be tracked. CMIS provides report capability; thus, a director's report will provide a printout on awardees, which will include demographics, disciplines and money sources.

Many participants considered collecting information on applicants to be burdensome, a view of the larger consortia more so than smaller consortia. A majority, however, supported tracking awardees.

Like budgets, there were some questions about terminology changes or additions. It was suggested that Headquarters add "Unreported" options in lieu of "Unknown," and include "Not Applicable" options.

Equipment

Each consortium will be required to have a computer system with the basic features required to operate CMIS. Requirements for an IBM personal computer will include a 386 processor, a mouse and four megabytes of memory. In addition, a color monitor and a printer are highly recommended for optimal use of the system. This standard personal computer system can be purchased for less than $1,000 (not including a printer). Requirements for the Macintosh are currently being compiled.

Kick-off Fiesta Dinner

The Third National Space Grant Conference officially began with a fiesta dinner, followed by remarks by NASA Program Manager Dr. E. Julius Dasch.

A Tex-Mex motif predominated during the banquet, which featured a mariachi band, a buffet with beef and chicken fajitas, and the breaking of a piñata filled with chili peppers, small bottles of tabasco, bluebonnet seeds and coconut-candy Mexican flags.

Dasch introduced NASA representatives and key officials. During his address, which introduced the conference theme, "Space Grant: Charting Future Courses," Dasch noted that this conference was the first national meeting attended by representatives from all 52 consortia. Included in those consortia are more than 400 affiliated institutions.

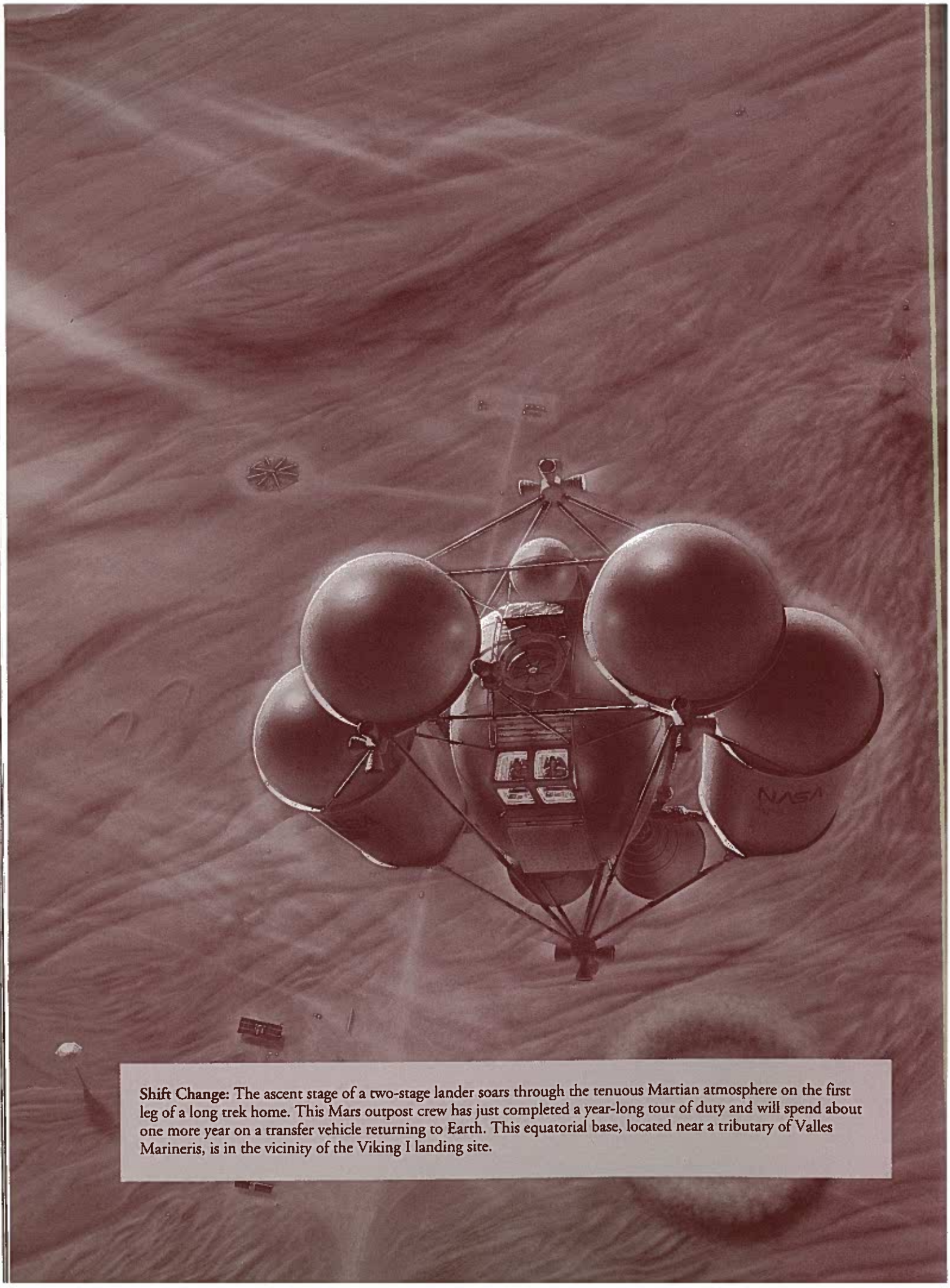
Dasch focused on the scope of responsibility of the Space Grant program. He suggested that the national program encompasses diverse activities that encourage social and economic reform while enhancing the goals of higher education.

Dasch noted that the conference program included workshops on industry-Space Grant relations; Land Grant and Sea Grant programs, on which Space Grant is modeled; building relations with community colleges; and, the recruitment and retention of underrepresented groups, particularly Hispanics.

Dasch introduced Mr. R. Gilbert Moore of the Rocky Mountain Space Grant Consortium, outreach coordinator and scientist responsible for the high-altitude balloon launch scheduled to take place during the conference. Moore described the experiment and urged conference attendees to participate as spectators. (See pages 35-36 for a full report on the launch.)

Finally, Dasch informed attendees that Mr. Pat Rawlings, noted space artist who designed the Space Grant conference poster, would be available one evening to sign the posters. Each conference attendee received a copy of the poster along with other registration materials. (See page 59 for more information on Rawlings and page ii for a depiction of the poster.)

At the conclusion of the banquet, Dr. Norman Ness, Director, Delaware Space Grant Consortium, was chosen to break open the large, donkey-shaped piñata suspended from the ceiling.



Shift Change: The ascent stage of a two-stage lander soars through the tenuous Martian atmosphere on the first leg of a long trek home. This Mars outpost crew has just completed a year-long tour of duty and will spend about one more year on a transfer vehicle returning to Earth. This equatorial base, located near a tributary of Valles Marineris, is in the vicinity of the Viking I landing site.

New Horizons: The Promise and Potential of America's Space Exploration Program

Following breakfast, Mr. Aaron Cohen, Deputy Administrator, NASA, and Director, NASA Johnson Space Center (JSC)* welcomed conference participants. JSC and the Texas Space Grant Consortium cohosted the conference.

Cohen said that the National Space Grant College and Fellowship Program is one of the most effective ways of stimulating young minds and preparing the United States for what he termed "the fascinating future that awaits us in the 21st Century."

"The Space Grant program is becoming an increasingly important vehicle for helping us meet our national goals in education," Cohen said, remarking that the program helps provide a basis for improving national awareness and competence in science, mathematics and technology.

Despite what he called the many ups and downs, those involved in the space program are excited about their work. "Space exploration is simply the latest example of the fundamental human need to learn and discover," Cohen said, "and space exploration satisfies that drive just as similar exploits have done throughout history."

He pointed to the similarities between modern-day space travel and the great voyages of the 15th and 16th centuries. "For all the achievement and progress we have made in nearly 35 years of space flight," he observed, "we know that in many ways space exploration is still in its infancy. There is much to come that will change the future in a way we can only begin to comprehend."

Cohen touched on U.S. achievements in placing communications and weather satellites in orbit, and noted other promising areas of research, commenting that "a whole host of new insights about the human body are unfolding as we continue our research in weightless conditions. We are still learning, and the greatest payoff from this new knowledge is still in the future." Cohen pointed to the potential of using weightlessness and vacuum to process new materials that cannot be duplicated on Earth.

"Each space flight adds to our store of knowledge and increases our ability to take advantage of this new frontier," Cohen said. Efforts at JSC, he explained, are geared to increasing the amount of time humans can spend in space. "In the process," he said, "we will come to learn more about our planet, more about the universe around us, and, perhaps most importantly, more about ourselves."

*Cohen retired from NASA in August 1993, to assume an endowed chair at Texas A&M University, College Station, Texas.

OFFICIAL MEMORANDUM
STATE OF TEXAS
OFFICE OF THE GOVERNOR

The National Space Grant College and Fellowship Program, under the direction of the National Aeronautics and Space ...istration (NASA), is dedicated to enhancing the role of the ...space research, exploration, and applications. ...elp colleges and universities across the ...research and education programs ...chnology, and aeronautics. ...public and

Space Grant is providing important opportunities for young scientists and scholars, through universities and affiliated industries, to participate in a meaningful way in the national space program. Their work will benefit all Americans in our quest to understand and explore space and all it has to offer.

...quest to ...

In January of ... the nation will gath... Center for the Third National... by the Johnson Space Center and the...

The people of Texas are proud of the work... state's Space Grant colleges and affiliates and of Te... participation in the National Space Grant Program, and we wel... guests and visitors to this important conference.

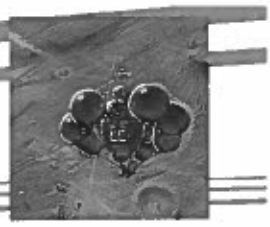
Therefore, I, Ann W. Richards, Governor of Texas, do hereby proclaim the week of January 10 through January 16, 1993, as:

NATIONAL SPACE GRANT PROGRAM WEEK

in Texas and urge the appropriate recognition thereof.

In official recognition whereof I hereby affix my signature this 7th day of December, 19 92.

Governor of Texas



Welcome from Texas Space Grant Consortium

Dr. Byron Tapley, Director, Texas Space Grant Consortium, welcomed the participants on behalf of the consortium, saying he was pleased to have the opportunity to collaborate with the NASA Johnson Space Center in hosting this event.

Tapley stated that Texas Governor Ann Richards has a strong interest in space activities, not only in Texas but across the nation. Richards would have liked to address the meeting directly, he said, but the convening of the Texas state legislature prevented her from doing so. Tapley noted, however, that in recognition of the importance Governor Richards attached to this meeting, she issued a proclamation designating the week of January 10-16, 1993, "National Space Grant Program Week."

Tapley further noted that the week would focus predominately on industrial and minority participation in the Space Grant program, saying that these areas are of considerable interest and concern to the Texas Space Grant Consortium. During the past year, he noted, the Texas Space Grant Consortium has been attempting to develop a strategic plan. "These two topics," he said, "have permeated a major amount of the dialogue that we have had in attempting to focus the plan."

Tapley added that the conference is convening at a time he termed "of significant importance to the space program as a whole, with important forces at work on the national and international scene that will influence both the academic and industrial programs in the aerospace area." He urged participants to focus on "a reassessment of the national priorities and its impact as we conduct our activities this week."

NASA and Human Resources

General Spence M. (Sam) Armstrong, Associate Administrator, Office of Human Resources and Education, welcomed conference goers, then went on to assure attendees that the Clinton Administration and congressional leaders are supportive of NASA. He said NASA is looking forward to working with the new executive and legislative bodies.

Armstrong described the Space Grant program as crucial in upholding NASA's strong commitment to excellence in education. He characterized what he termed the program's great strength as the breadth and depth of its activities. His remarks were received enthusiastically by conference participants as he challenged them to begin "charting future courses." He urged Space Grant to move toward increased partnerships with industry.

Armstrong thanked conference planners and organizers, noting that the quality of preparation and planning plays a critical role in the outcome of a large conference. He predicted a successful conference and challenged the Space Grant directors to continue to move forward with their programs.

New Directions in Education

Mr. Frank C. Owens, Director, Education Division, spoke to conference attendees on a strategy for change. He described the NASA Strategic Plan for Education, and spoke of the NASA "vision" to promote excellence in America's education through enhancing and expanding scientific and technological competence. He outlined the necessary goals: to review and maintain the base in science, mathematics and technology; to implement new strategies and initiatives encompassing education reform through the Federal Coordinating Council on Science, Engineering, and Technology Committee on Education and Human Resources (FCCSET-CEHR); and, to expand impact through partnership.

To enable the systems supporting each goal, Owens said, program evaluations must be performed. He further maintained that adequate educational technology must be available, and urged a NASA presence throughout every state, through Space Grant, NASA Select (which broadcasts mission coverage and education programs) and Teacher Resource Centers.

Owens described management priorities that will be used to guide the change process. They include the strategic plan as a programmatic and management tool; the implementation of an agencywide formal program planning and, budgetary process; a significant increase in ethnic and gender diversity; and, comprehensive staff development.

Mr. Frank C. Owens, Director, NASA Education Division

Ms. Elaine Schwartz, Chief, Higher Education Branch, began her remarks by referring briefly to the retreat attended by the Education Division management team in August 1992 at Harpers Ferry, West Virginia. The purpose of this meeting was to draft the Education Division strategic plan. The Higher Education part of the strategic plan will concentrate on specific items that relate to FCCSET priorities, she said.

Schwartz noted that, while Space Grant is relatively new, most of NASA's education programs — the Faculty Fellowship Program, the National Research Council Post-Doctoral Program, and the Graduate Student Researchers Program — have been around nearly as long as NASA.

She noted that technology and dissemination were two important and, as yet, undeveloped components of the Space Grant program. She explained further that a major thrust of the Higher Education Branch was to broaden the base of universities where NASA does research, and observed that the NASA EPSCoR (Experimental Program to Stimulate Competitive Research) and community

college initiative were two ways in which this goal could be accomplished. "There is just so much that you can help us with, for which you have the talent," she told participants. In closing she said, "that when I share with you...the Higher Education strategic plan...you will see yourselves prominently featured."

The Federal Coordinating Council for Science, Engineering and Technology (FCCSET)

Ms. Angela M. Phillips, Special Assistant to the Vice-Chair, Committee on Education and Human Resources (CEHR), addressed the first conference plenary session on the recently published report from the Federal Coordinating Council for Science, Engineering and Technology (FCCSET). Phillips explained that FCCSET-CEHR is charged with developing a Federal strategy for science, mathematics, engineering and technology education that will ensure the United States world leadership in science and technology, build a highly trained work force, and increase public understanding of science.

Phillips went on to describe how CEHR, through 16 member agencies, has identified priorities for Federal initiatives designed to improve science, mathematics, engineering, and technology education from kindergarten through adulthood. In so doing, CEHR has fostered interagency cooperation and collaboration while developing a strategy to reach the National Education Goals set in 1990 by former President George Bush and the Nation's governors. That strategy is contained within a report entitled "Pathways to Excellence," and contains a five-year planning framework and associated milestones that focus Federal agency resources toward achieving the goals.

The report has been circulated to Congress, state and local government leaders, teachers and parents, industrial, educational, and community leaders, the media, and others interested in the Federal government's role in achieving the National Education Goals, Phillips said. She described the report as a living document and welcomed comments and suggestions from attendees.

Copies of "Pathways to Excellence" may be obtained by writing to:

NASA Headquarters
Code FEH
Washington, DC 20546

Space Grant Review Panel

Ms. Sarita Brown of the University of Texas at Austin is Vice-Chair of the Space Grant Review Panel. The formation of the Panel is required by the same legislation that established the Space Grant program. The Panel is to advise the Associate Administrator of Human Resources and Education or a designee on the progress of the program. Brown briefed conference attendees on the initial meeting of the Panel, which took place on May 20, 1992, in Washington, D.C.

The Panel consists of 10 voting members, four from other Federal agencies and six from nonfederal sources, including Space Grant institutions. In addition, the Panel sat four *ex officio* members drawn from NASA personnel. (The Panel now seats a fifth *ex officio* member, Dr. Martin J. Eisenberg, Director, Florida Space Grant Consortium, and Chair, Council of Space Grant Directors.)

Brown discussed program objectives, and noted some issues that confront the Panel, including those of program balance and evaluation; determining mechanisms that better facilitate interaction between universities; and strategies to increase participation by underrepresented groups. She also touched on site visits as a means of evaluation, with Panel members playing an important role in the process. Brown noted that Panel members had been invited to participate in the conference, as the second meeting was to take place in Houston shortly after its conclusion, on Thursday, January 14.

Industry-Space Grant Relations: A Conference Focus

Dr. Joseph P. Allen, former astronaut and President of Space Industries International, Inc., welcomed conference attendees to League City and encouraged them to attend industry tours scheduled by conference staff later in the week.

Meanwhile, Allen, a member of the Space Grant Review Panel, suggested attendees consider how cooperation and mutual support between the academic community and industry can be garnered and strengthened.

Allen suggested that industry personnel will take a more active role in academia and university research if they have some influence in a number of areas, including recruitment and in identifying new technologies, and if, in the process, they can identify new contract and business opportunities.

Further, Allen pointed out the issue of timeliness, describing the process of the 1958 NASA *Mercury* project, and the one-year turnaround time from proposal to delivery of the rocket equipment. Similar cycles exist today in space industries, he said. This cycle produces a "rhythm" in industry, to which NASA officials and the academic community should be sensitive.

Allen also touched on NASA's current role, stressing the need for revitalizing relations between government, space industries, and universities. He said economic viability is, and will continue to be, an important factor in determining interest in space-related projects.

Industry-Space Grant Relations I: Space Grant Resources

Facilitator:
Dr. John C. Gregory, Director, Alabama Space Grant Consortium

The first of the industry-Space Grant relations workshops to be held drew about 65 participants, eager to discuss how universities and industry could promote mutually constructive, resourceful and efficient relationships.

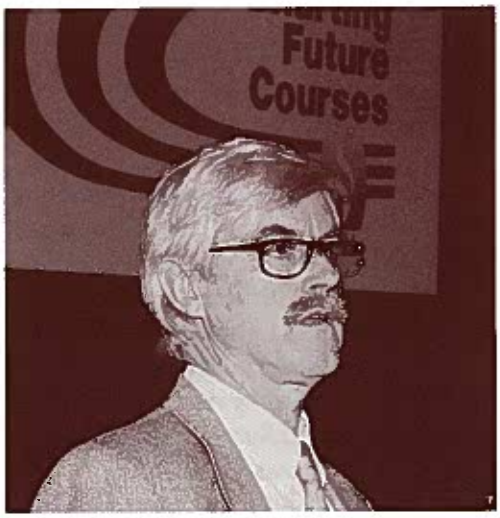
Panelists:
Dr. John Yost, Provost, University of Alabama in Huntsville

Dr. Harvey Willenberg, Chief Scientist, Boeing Defense and Space Division, Huntsville, Alabama

Dr. George Lebo, Space Grant Faculty Fellow, NASA Marshall Space Flight Center

Workshop Report

A special topic of the Houston conference was to explore the extent of interaction of industry with Space Grant programs and activities. To this end, three workshops were planned. The first workshop was to examine the expectations and interests of industry in its involvement with Space Grant universities. The second and third workshops were to explore universities' perceptions of industry's role and finally to suggest ways of satisfying both sets of requirements by synthesizing new ways of interaction or by expanding the working exemplars. While the moderator explained the limited objective of the first workshop, the participants did not feel constrained to limit their remarks, and the discourse ranged across the fields.



Dr. John C. Gregory, Director, Alabama Space Grant Consortium

To begin, short presentations of five to eight minutes were given by Yost, Lebo and Jim Lang of McDonnell Douglas. Yost's ideas emphasized a much greater effort for universities and industry to understand each other's culture, and a need for many more new avenues for two-way exchange of people and ideas.

Lebo pointed out the basic facts: universities produce students, teach special courses, and have special research capabilities and access to new technologies. Industry is very interested in all of these, but sometimes is frustrated either by not getting the students or courses it wants, or not being able to access or influence how research is conducted at universities. Lebo suggested three ideas for improvement of understanding: 1) extension of the co-op program; 2) organization of special industry meetings within the consortia; and 3) development of paid-membership "clubs" for university and industry.

Lang listed several programs that his company supports in academia. These

include foundation and scholarship funds, capital funds for equipment, co-op and intern programs, advisory panel membership and visiting professorships.

Rick Custer of Rocketdyne agreed that industry had these programs and failed to see the value being added to this effort by Space Grant.

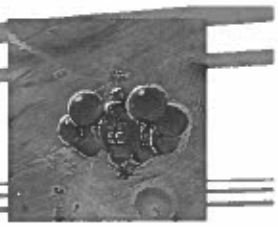
The group discussed preparation of students by universities for jobs in industry. The arguments fell along traditional lines. Brian Barnes of Oklahoma argued that students were ill-prepared for the actual jobs they were hired to do; special training had to be organized by the employer. On the other hand, Al Strauss, program director for the Tennessee Space Grant Consortium, held that the university's job was to develop creative, competent members of society, able to function at a human level and to adapt to changing conditions.

The discourse turned frequently to involvement in science and technology research in which many of the participants clearly had a major interest. It was necessary to remind the audience that Space Grant was a training grant and did not contain funds to support research in any major way. (There is a clear disparity here between the expectations of participants and the reality of the Space Grant program. As Space Grant evolves, this should receive more attention.)

Willenberg pointed out that it is not useful to regard industry solely as a source of funds (Boeing gives small grants). He explained that sometimes it is difficult for industry to get a special course taught with the desired flavor (another example of poor understanding of the different cultures.) In several ways, his points echoed those of Lang and Custer: his company generally had excellent relations with academia, therefore, what can Space Grant add?

In the research and technology area, Willenberg made a new point: large industry generally avoids joint critical research activity with universities. Reasons cited included lack of industry control, sensitivity of data, schedules, etc. and a wish to have its own experts properly supported. Industry does get involved when it needs a new area of expertise which it does not have in-house and the expertise is available locally. He pointed out that these "windows of opportunity" are narrow and selective. Also, if the need for the special expertise was sustained over several years, the company would probably reduce or discontinue the university portion as it built up its own capability. Willenberg pointed out that this did not apply to small business which could not afford large in-house R&D overhead, and that there were many opportunities for such research interaction between small high-tech companies and universities.

In summary, while there are many successful interactions between individuals and activities in industry and academia, there seems to be a general precept or belief that there would be benefit in having many more. If there is a single reason that this does not occur it would be a failure of communication and a lack of understanding of the other's motivation, philosophy or culture. Clearly, in many cases, these barriers to understanding and symbiosis have been broken down. It is equally true that many individuals on both sides of the house would like to forge working relations, but do not have the time, the connections, or the overall perspective to make them happen. Both enterprises must increase their understanding of the other's culture, and modify their



own cultures to meet the changing societal needs. Perhaps there is a role for Space Grant in this regard.

Some specific ideas included:

- An up-to-date directory of research capabilities and needs for both university and industry
- More industry representation on the Space Grant Review Panel
- Encouragement of joint industry-university proposals
- Recognition by the home university of faculty efforts with industry which do not result in publication (remove disincentives)
- More master's level research students working on industry problems
- Allocation of a portion of Space Grant funds toward promoting the two-way exchange of industry and university technocrats with a focus on multidisciplinary problem-solving aerospace research.

Research and Research Infrastructure Workshop

Facilitator:

Dr. Richard F. Devon, Director, Pennsylvania Space Grant Consortium

This workshop was one of three concurrent sessions kicking off conference activities. Attended by about 60 people, it opened with a review of data on research infrastructure activities gathered from the 1991 Space Grant program annual reports, followed by presentations on the research program of the Florida Space Grant consortium, which includes collaboration among researchers at institutions more accustomed to competition, and the undergraduate research program of the Colorado Space Grant Consortium.

Panelists:

Dr. Martin A. Eisenberg, Director, Florida Space Grant Consortium

Ms. Elaine Hansen, Director, Colorado Space Grant Consortium

Workshop Report

Seventy-four activities were reported under the research infrastructure category by the 47 consortia for 1991. Of these 74 activities, 44 were described as new programs, while the remaining 30 supplemented existing projects and programs. A total of $1,268,401 was spent on these activities, of which 46 percent was NASA funds, 31 percent university, and 17 percent industry. Research infrastructure, therefore, represents only about five percent of the total Space Grant consortia expenditures. Phase I consortia, while representing 62 percent of the total national Space Grant consortia expenditures, represented less than half — 41 percent — of the total expenditures for research infrastructure.

Capability Enhancement consortia represented 36 percent of research expenditures, although these consortia represent only about 18 percent of total expenditures. This is encouraging given the con-

sortia's special mission [to build research capabilities]. Program Grant consortia represent 21 percent of total expenditures and 23 percent of research expenditures.

Research infrastructure activities in 1991 reached 6,866 faculty, 1,061 administrators, 632 graduate students, 69 postdocs and almost 300 other people. These large numbers were partly due to 16 conferences and workshops held. Twenty-nine faculty were given seed money for research, and 173 were funded for such activities as giving papers, attending conferences, bringing in visiting scholars and traveling to establish research collaborations.

Although it is a little early to measure research output, 29 paper submissions to, and six publications in, refereed journals, were reported. The local research climate is more amenable to early assessment than research publications, and half the consortia — 24 states — reported that, as a result of Space Grant activities, intramural support for research increased. Thirteen consortia reported more in-house funding, eight consortia reported more release time, and eight reported being given more equipment.

The 47 consortia reported submitting 90 proposals, with 42 being funded by the time of the annual report. However, 32 of the submissions, and 27 of the funded projects, were in-house.

A very encouraging finding for the future was the 119 research collaborations established. In fact, collaborations reported by activity, rather than for each consortium as a whole, resulted in 250 cases of collaboration. (The difference between the two figures is one of specificity: the larger number refers to all research infrastructure activities and the smaller number just to those involving research per se.) The most commonly reported collaborations were with other institutions of higher education, other departments in the same institutions, NASA Centers, colleagues in the same department and industry. Most collaborations were reported by Phase I consortia and Capability Enhancement consortia. Few were reported by Phase II Program Grant consortia.

Eisenberg described Florida Space Grant Consortium faculty/industry/graduate student-oriented programs currently taking place. They include the Interinstitutional Space Research Program, co-sponsored by the Technological Research and Development Authority of Florida. The program benefits faculty researchers while stimulating cooperative activities among universities and between universities and industry. The consortium and the Technological Research and Development Authority fund small seed money grants for the development of space-related research. Funding is intended to initiate new programs, to foster the growth of exploratory programs, to bring into existing programs investigators from other institutions, and to provide resources necessary to develop proposals for significant long-range support extramural to the consortium. Projects that enhance university interaction with Spaceport Florida Authority are particularly encouraged, but such interaction is not a condition for application. Typically, the Interinstitutional Space Research Program annually awards seven competitive grants of $20,000 each.

Under the Space Grant fellowship program, the consortium undertakes activities that enhance cooperation between universities and industry and between universities and government laboratories. Fellowships are coupled with summer internships at aerospace-related industries, the Kennedy Space Center and other NASA Centers, and other Florida Space Grant Consortium programs. Fellows

receive a stipend of $12,000 for full-time doctoral study and a supplemental summer traineeship stipend from a participating non-university consortium affiliate.

The Space Research Assistantship Program provides supplemental funding for graduate assistants participating in aerospace-related programs, thereby improving retention rate in key academic programs and providing crucial support for research programs of particular promise. Students compete for one of five $8,000 grants.

Hansen described the Student Research Program of the Colorado Space Grant Consortium, which provides Colorado students hands-on experience in real space experiments. Experience spans experiment design, development, integration, flight, operations, data analysis, and experiment update. A profusion of student research opportunities exists with rocket experiments, ground telescopes and instrumentation, shuttle payloads, spaceflight operations, and spacecraft experiments. The program in Colorado takes advantage of the strong, established space research program at the University of Colorado and the growing program at Colorado State University.

Student research projects include the Colorado Student Ozone Atmospheric Rocket (CSOAR), developed to demonstrate the use of sounding rocket flights as a valuable educational tool for undergraduate and graduate students. The Colorado and Virginia Space Grant Consortia, along with the NASA Wallops Flight Facility, collaborated on CSOAR, launched successfully in September 1992. Meanwhile, students are working on the Cooperative Student High Altitude Research Project (CSHARP), a collaborative project involving the Colorado, Virginia, and Alaska Space Grant Consortia, in which a refurbished, enhanced student rocket will be launched in 1993. In addition, a student Get Away Special Payload, ESCAPE I (Extreme Ultraviolet Solar Complex Autonomous Payload Experiment) is manifested as a secondary payload on Atlas II, scheduled for launch in March 1993.*

These and other Colorado programs provide high quality student research on a shoestring. Project emphasis is on low-cost, short-term, real flight experiment opportunities. Projects afford students hands-on experience in many phases of a real NASA investigation, while providing exposure to science, engineering, technology, and programmatics, thus helping to produce scientists and engineers ready for interdisciplinary careers in space.

A strong infrastructure — a research support system consisting of people, equipment, facilities, information networks, and a good academic environment — is needed to enable these student research opportunities. Experts are needed to give direction, inspiration and review, and come from academia, industry and government. Equipment can take the form of hardware, software, interfaces and a variety of tools. Facilities include labs and meeting rooms. Information networks disseminate information on opportunities, available resources and potential partners. Finally, the university environment should be supportive of students, by giving credit for research participation, and faculty, by providing release time for proposal writing.

*Atlas II met with some delays, but was launched in April 1993.

Land Grant-Sea Grant-Space Grant Relations: Cooperative Extension

Facilitator:
Ms. Mary Sandy, Director, Virginia Space Grant Consortium

Sixty interested participants attended this workshop on cooperative extension. Panelists presented overviews concerning the efficacy of developing an extension component for the Space Grant program.

Panelists:
Dr. E. Julius Dasch, Program Manager, National Space Grant College and Fellowship Program, NASA Headquarters

Dr. Lynne Thibodeaux, Assistant Director for 4-H and Youth, Texas Agricultural Extension Service

Dr. Tony Cook, 4-H Program Specialist, Alabama Cooperative Extension Program

Dr. David Duane, Director, National Sea Grant Program, National Oceanic and Atmospheric Administration (NOAA)

Dr. Dixon Butler, Director, Modeling, Data and Information Systems, Earth Science and Applications Division, NASA Headquarters

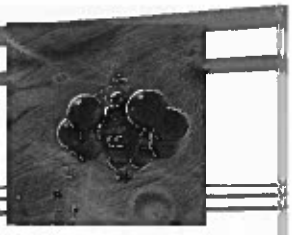
Workshop Report

Survey of Cooperative Programs

Sandy presented the results of a survey she conducted in November 1992 to gather data on the cooperative programs currently taking place among Space Grant, Sea Grant, and Land Grant Cooperative Extension Service programs.

Personnel from 14 Space Grant programs responded to the survey. Four indicated they were considering collaborative projects. Nine reported undertaking collaborative activities in five general areas:

1) Cooperative educational programs. Several Space Grant programs reported using global change as a theme, with space as a platform for monitoring Earth resources. Activities included teacher workshops focusing on global change, such as those offered by the Washington Space Grant program. In conjunction with both the Virginia Sea Grant and Cooperative Extension programs, the Virginia Space Grant program is planning a model cooperative project to develop Earth science curriculum resources for educators.
2) Cooperation with 4-H leaders and programs. The New York Space Grant program has coordinated a number of aerospace-related programs for teens and elementary students and has sponsored 4-H specialists for relevant training opportunities.
3) Data gathering and dissemination. The South Carolina Space Grant program is conducting a Coast Watch program in conjunction with South Carolina Sea Grant. Similarly, several Space Grant programs are using students to gather rain data for the Pacific Islands.
4) Sea Grant and Cooperative Extension as resources for Space Grant workshops and programs. Both the Virginia and Pennsylvania Space Grant programs indicated that they have successfully used



these groups as speaker and program resources.

5) Joint Fellowships. The Alaska Space Grant program is offering a trial fellowship jointly funded by the Alaska Space Grant and Sea Grant programs.

Cooperative Extension Service

Thibodeaux presented an overview of Cooperative Extension:

Land Grant legislation in 1862 gave Land Grant institutions three different components: teaching, research and extension. Seventy Land Grant institutions now exist. The purpose of Cooperative Extension is to provide practical information for Americans to apply to critical issues that have an impact on their daily lives.

Cooperative Extension is charged with serving agricultural and public needs by extending the knowledge of research agencies to people in need of this information. In turn, users identify gaps in the knowledge base they need to address problems of today. Cooperative Extension offers professional faculty support in conjunction with a highly-trained volunteer work force.

The role of Cooperative Extension has significantly expanded from its original agricultural focus in response to public desire for information related to social, economic and environmental problems. A unique three-way cooperative relationship with the Department of Agriculture, and state and local government, exists in Cooperative Extension, with most states receiving about one-third of their funding from the Department of Agriculture. Thibodeaux noted that 80 to 90 percent of funding goes to providing people and agents as resources.

The 4-H is designed for youth development. The organization no longer focuses on "future farmers," but instead focuses on "youth at risk" issues. Thibodeaux noted that about one-third of 4-H youth may fit this category. Most collaborative efforts between Cooperative Extension and Space Grant have been in 4-H programming. With about one-third of youth dropping out of school, Thibodeaux sees developing the future United States work force as a shared area of interest between Space Grant and Cooperative Extension, along with the desire to interest youth in science and technology as part of everyday life.

"We see Space Grant and our cooperation with them as a real asset in interesting young people in science and technology and helping them to understand and master something that they can be involved in for a lifetime," Thibodeaux said.

4-H and Aerospace Education

Cook believes that these are exciting times for Space Grant, 4-H and education. For Cook, who provides 4-H educational programs in science and technology, aerospace offers a theme that is motivating, exciting, fun and relevant. The goal is to inspire young people to try harder and "to get some vision of where they may be headed." The program is voluntary, so children participate because they are interested and the activities are fun.

The 4-H system is comprised of 4,300 staff and is linked to 3,150 counties nationwide. The 4-H mission is to develop youth by providing supportive environments that allow culturally diverse youth and adults to reach their full potential. Youth learn by doing, and science and technology fit the 4-H mission well. 4-H uses the excitement of space to stimulate learning more about mathematics, science and technology in an ever-changing world. Aerospace education in 4-H is not new, with programs on topics such as rocketry, occurring for the past 30 years.

Volunteers implement programs at the grass roots level, often using science or

aerospace clubs as access. Space Grant can be involved in 4-H programs involving science, technology and environmental education. Cook said, "through the excitement of the space program, young people and adults can become more interested in the world around them."

Cook showed video clips of "Blue Skies Below My Feet," a video series jointly developed by 4-H and NASA in the mid-1980s. He also presented the 4-H "Missions in Space" program which provides youth and adults the opportunity to participate in Space Camp, a program at the United States Space and Rocket Center in Huntsville, Alabama. Space Camp activities offer 4-H attendees the opportunity to train like astronauts, take part in shuttle and space station simulations, sleep in a simulated space station, and conduct experiments in the Discovery Lab.

Cook expressed a wish to work with Space Grant to provide support materials and encourage students to succeed in math and science courses.

The National Sea Grant Program

Duane provided an overview of the National Sea Grant Program:

While Space Grant is organized within the education component of NASA, the National Oceanic and Atmospheric Administration (NOAA) Sea Grant Office is located in a line component, Ocean and Atmospheric Research. The program's principal responsibility is research.

Sea Grant was created in 1966 by an act of Congress and was patterned after the Land Grant model. The Sea Grant College program is a unique partnership between the public and private sectors that combines research, education and technology transfer for public service. It represents a unique mix of government and university people working to develop marine resources.

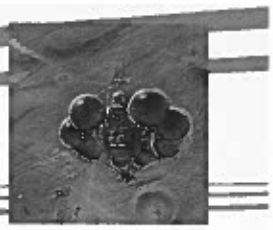
The National Sea Grant program is the principal national source of research and technology transfer for marine aqua culture and marine biotechnology. It is a major source of research and expertise in the areas of fisheries recruitment, seafood product improvement and safety, estuarine processes, critical habitats, coastal processes, ocean technology, and marine policy issues. The program's educational and training component ensures a cadre of professionals trained to solve ocean, Great Lakes and coastal water problems.

The technology transfer component seeks to speed the transfer of knowledge to the user community. Twenty-nine core Sea Grant programs work closely with the user community to identify problems or opportunities that warrant research. The programs leverage between 200 and 300 different universities and support projects beyond coastal states.

The Sea Grant Advisory Program has regional networks and often shares resources and expertise to be cost effective. The program frequently buys specialist time from faculty.

Since 1981, Sea Grant has had an annual budget of about $40 million, and has experienced erosion in all elements of the program, due to lack of budget growth. The program requires one matching dollar for every two Federal dollars. Sea Grant was organized to develop and conserve marine resources leading to new knowledge, business, markets and products, with economic benefits in one recent year to be more than $800 million. Education, training and technology transfer (or extension) are components. Resources are allocated through competitive proposals, and research ranges from basic to turn key and is both multidisciplinary and multifaceted.

Sea Grant supports activities in science, engineering, law, social sciences and politics. About $25 million is devoted annual-



ly to direct research science or management infrastructure, with the remaining $15 million spent on education and technology transfer.

The education component seeks to improve capabilities in science and mathematics, general marine literacy and continuing education. The program supports graduate students directly and is involved with curriculum development at the K-12 levels. Sea Grant has assisted with the development of marine programs in 4-H. Special efforts occur in programs that link Sea Grant and Space Grant with climate and global change, offering strong intraprogram links. Sea Grant works closely with clientele groups in education, research and outreach. Duane sees opportunities for Cooperative Extension, Space Grant, and Sea Grant to work together, and sees the space perspective on Earth resources as an "area where the three programs meet." He noted that the oceans are explored with many of the same technologies that are used in space, such as unoccupied and occupied probes, remote sensing and acoustics technologies.

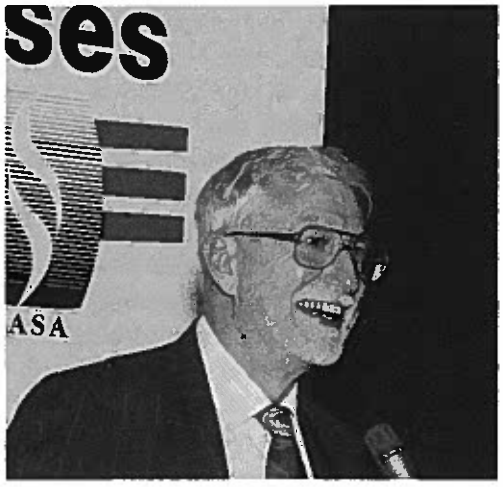
Gathering Earth Data from Space

Butler stated that NASA has embarked on a Mission to Planet Earth, in which the agency will be collecting a long-term data set and making it widely available. "Given the expenditures and the value of the information already being collected, it behooves us to put that information in the hands of our country in every way possible," Butler said. "In the concept of an extension service to Space Grant as in USDA and Sea Grant, there is a real opportunity to reach out through every county in the country." This process reflects a process of trying to "think globally and act locally," that is, to apply the global space view and use it more immediately in meeting the "here and now needs" of the local community.

Butler presented an overview of selected Earth resources data sets, as well as background on the Earth Observing System Data and Information System (EOSDIS) sponsored Data Centers. The range of data is extensive and includes climate, meteorology, ocean biology, geophysics, land processes, oceanography, sea surface, hydrologic cycle, biogeochemical dynamics and socio-economic data.

Butler also presented selected on-line information resources that provide Earth data. A handout provided detailed information on the data centers and the data sets available. Butler used a series of "eye grabbing" images to show the kinds of information available from spacecraft which can be used for monitoring Earth resources. Images included those obtained by synthetic aperture radar, which can see through clouds to get high resolution images used digitally to see water-related changes.

Substantial synthetic aperture radar data on Alaska, related to sea ice, has strong ties to Sea Grant. Airborne systems and space devices provide global perspectives. It is the only way, for example, to track ozone and ozone holes. Additional environmental variables with more immediate payoffs may exist through extension. The vegetation index, currently available down to 1 km resolution, will soon improve to 1/2 km resolution, which will aid in species identification on land and in the ocean, tracking of fires, and offer a variety of atmospheric and meteorological data. He noted that "climate change is always coming. We need to anticipate the changes so that we can adapt." Understanding the change assists in anticipating and dealing with the economic impact.



Dr. E. Julius Dasch, Program Manager, National Space Grant College and Fellowship Program

The data can be used in a local context. EOS is planning to have the largest data system NASA has undertaken. Researchers can access data through the National Research Education Network (NREN) and high school students should ultimately have access to the data through NREN as well. "Access to the data is one thing; being able to deal with and track it are matters for many different levels of problems," Butler said.

A Space Grant extension service can offer help with walking the end user through the system and "holding the user's hand until he or she gets smart." Butler expressed his excitement for a Space Grant extension component, noting that he has spent more than a decade planning Mission to Planet Earth and EOS, with a desire for user-friendly applications. An extension component would capitalize on the Federal investment in research. The extension idea is timely in the political sense: Vice President Al Gore, who has also sponsored NREN, has stated that Mission to Planet Earth should be the highest priority program of the space program in the United States.

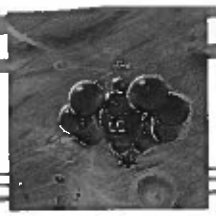
NASA acquires information and disseminates information, and the dissemination system should reach every American who needs it. Taking lessons from existing Land Grant, Sea Grant and Space Grant models, extension can be made to happen on a large scale in a reasonable time frame and with relatively marginal investments. Butler sees "no excuse" for not getting the information out, as NASA will spend more than $2 billion before the end of the decade on developing a data system. In this information age, "our economic well-being as a nation should be considerably supported by people who have the best global and local access to information on the environment," he concluded.

A View To Space Grant Extension

Space Grant Program Manager E. Julius Dasch said he is excited about an extension component for Space Grant. The Space Grant legislation provides for the program to undertake extension activities and Dasch believes that Space Grant extension "could represent the most important populist movement; that Space Grant could become well known as a provider of information for space-age people with everyday problems."

The ties to Sea Grant and Land Grant networks would be strong. Furthermore, the Space Grant program will always have a strong educational focus. He noted that discussions on an extension component for Space Grant are very preliminary; however, he sees two major areas where NASA could provide a focus:

1) Education, through the lure and excitement of space as an educational vehicle, and
2) Mission to Planet Earth and EOS data. This would involve using data currently available on Earth



resources and planning for the wealth of information that will be available from Mission to Planet Earth and EOS data in the near future.

Sandy stated that Space Grant's network of more than 400 institutions could exponentially increase NASA's information delivery system. (NASA's charter calls for the widest practical dissemination of information to its public.) An extension component for Space Grant could allow for the most practical application of NASA Earth resources data and technology to solving problems at the local level. She cited a November 23, 1992, *Time* magazine article that presented the Clinton Administration's strong interest in the success of the Cooperative Extension model as one that could solve local problems "with a speed that would make a Japanese car manufacturer envious."

Wallace Sanders, Director, Iowa Space Grant Consortium, briefly introduced a "Model for Space Extension" at Iowa State University. The model seeks to link NASA facilities and knowledge to Iowa capabilities and needs through the Iowa State University Extension Service. The model is built on four client-based modules that can stand alone or be developed together, plus a core unit based within the extension system at Iowa State. Separate modules would deal with K-12 education, higher education, Iowa businesses and industries, and the general public.

Sandy reported on an advisory group in Virginia which met in October 1992 for preliminary discussions with Dasch on extension. The group, composed of Sea Grant, Cooperative Extension, and Space Grant agents and managers, agreed that the three programs offer good opportunities for collaboration. The group saw joint programs as offering a remarkable dissemination network that could offer direct applications of NASA data to local problems.

Sea Grant and Cooperative Extension representatives emphasized the need for timeliness of information to solve problems at the local level. One example was the Suffolk, Virginia, peanut farmers who need very timely moisture data to determine when crops should be harvested. The consensus was that assigning at least one extension agent to each Space Grant program would be an effective approach to implementing an extension component for Space Grant.

The group advised starting small and building for success. They also noted that there would be other statewide organizations with a strong interest in the kind of information and assistance a Space Grant extension component could offer.

Panel Discussion on Space Grant Extension

Sandy asked the panelists to react to Butler's presentation by indicating what type of information and format would be of greatest interest to their individual programs.

Thibodeaux responded that Global Information Service data are most helpful in vegetative/soils/weather cycle information, estuarine changes and crop success. Farmers are the ultimate environmentalists because of their very direct connection to and investment in the land. Environmental cognizance could be greatly expanded by the Space Grant connection and would be of immense value. Cooperative Extension would also be interested in training people who serve as local leaders to promote science and technology. She would like to see greater Space Grant involvement in 4-H hands-on education programs.

Cook added that the extension system works well in dissemination of information and its application at the local level: many players can take advantage of satellite communications and computer networking technologies, such as Internet, which permit global communication.

Duane suggested that, because of the Sea Grant management structure, the principal source for data in space extension will probably come from local program management. Information that is generated could have two purposes. One is in real-time or near real-time data that complements the Sea Grant mission of resource development, for example, sea surface temperature data for commercial and sport fishermen, or estuarine water quality data in fisheries/oceanography investigation. It would even be possible to have interactive centers for real-time use of data. The second area that would make best use of Space Grant would be in education opportunities.

Butler noted real value in making real-time or near real-time data accessible to the classroom, the public, and to those who are "actors in the economy." Use of Landsat data will become more economical when the government takes back the program at the start of Landsat 7. Mission to Planet Earth will use images to track change. He suggested that value can quickly be derived from the data.

A workshop attendee asked how Cooperative Extension and Sea Grant evaluate the educational component of their programs. Duane noted that Sea Grant tracks numbers of students and follows graduates for a number of years after their fellowships are complete. Theses and research publications are also measurements of educational productivity. He stated that trying to put a "value added" on a student who graduates from a program and goes on to industry is not easy to quantify. Sea Grant is looking at its evaluation process and he will have more information to offer in about eight months.

Thibodeaux reported that Cooperative Extension is working with social scientists in evaluation and that a rigorous evaluation process is difficult and expensive to do. USDA currently focuses on "change data," using figures provided by school principals on increases in standardized test scores, changes in frequency and type of behavioral problems, and changes in attendance. She noted that change data is not easy to acquire.

Mitchell Colgan, Director, South Carolina Space Grant Consortium, noted that we live in an information age, but information is power and money. He said he frequently runs into proprietary issues with respect to data that has economic worth, and asked how NASA is addressing this issue in its planning. Butler responded that NASA is trying to work with Congress to come up with a reasonable approach; however, this is an issue that is "a real policy conundrum." The public has the right to harvest the results from a public investment. He sees that money is to be made in interpretation: adding value to the data, not owning it. There will be a lot more inventiveness if a reasonable stream of data is provided that people can afford and on which they can depend. He noted that environmentalists need access to data that is both proprietary and commercial.

Charting Future Courses In Space Science and Applications

Dr. Jeffrey D. Rosendhal, Special Assistant to the Associate Administrator, Office of Space Science and Applications (OSSA), gave the luncheon address to some 300 conference attendees. He noted the importance to NASA and the nation of Space Grant's diverse educational activities, saying, "Nothing is more important to the long-term health of the country than it's investment in education," particularly scientific and technical education.

Rosendhal recalled that he had recently returned to NASA after a spending a year on Capitol Hill, and five years previously inside and outside NASA. He remarked that much had changed during his absence, and noted that anticipating changes and understanding their implications are critical in considering the theme of the conference. One noteworthy change, he declared, is the resumption of a vigorous program of flight activities, the "Second Golden Age of Space Science."

Rosendhal described OSSA from its past to the present.* He noted that OSSA's program contains a diverse set of activities across a wide range of scientific disciplines, and therefore affords many types of opportunities for the university community. He cited accomplishments such as the Cosmic Background Explorer (COBE), the Hubble Space Telescope (HST), the Compton Gamma Ray Observatory (GRO), the Extreme Ultraviolet Explorer (EUVE) satellite, as well as the Magellan, Galileo, and Space Shuttle and Skylab missions, among others. He described OSSA activities planned for 1993 and beyond as a "vigorous program which sustains an exciting level of activity up to nearly the end of the century."

He reminded the audience, however, that such programs are determined by budget prospects. He recalled that in the 1980s, NASA enjoyed healthy growth, the budget having doubled between 1982 and 1992 from $7 billion to $14 billion, with the OSSA budget nearly doubled as well. Planning for that period, he explained, was based on the assumption of continued real growth. However, concerns about the budget deficit forced the leveling of NASA's budget at the fiscal year 1991 level. He noted that the impact of this new budget environment on the program has been substantial, and predicted no immediate softening by lawmakers. As a result, OSSA restructured a number of programs, such as Cassini, the Advanced Xray Astrophysics Facility (AXAF), and Earth Observing System (EOS), or cancelled programs, such as the Comet Rendezvous Asteroid Flyby (CRAF) mission.

"For the near term," Rosendhal said, "there is likely to be far more emphasis placed on more focused, smaller-scale missions than there has been in the past." The profound results obtained from COBE clearly show that superb science can be done with smaller scale missions. Rosendhal challenged the audience to find new and innovative ways of carrying out essential science on smaller missions.

Rosendhal asserted that changes in NASA's larger political environment must be considered when addressing the subject of "Charting Future Courses." He recalled that NASA was a creation of the Cold War following the launch of the Russian satellite *Sputnik*. He noted that the competition between the United States and the former Soviet Union was one of political as well as military superiority, placing NASA and the space program at the center of the country's political agenda, unlike now.

In closing, Rosendhal posed this question: "What does NASA have to do in order to become part of the political mainstream once again?" He cited the economy, the role of technology in the economy, industrial competitiveness, and the environment, as central concerns of the Clinton Administration, and asserted, "The answer to this central question will be the key to understanding what NASA's future course will be."

*OSSA is now three offices: the Office of Space Science; the Office of Life and Microgravity Science and Applications; and, the Office of Mission to Planet Earth.

Industry-Space Grant Relations II: Industry Resources

Facilitator:
Dr. Alvin M. Strauss, Director, Tennessee Space Grant Consortium

This workshop was attended by 60 conference participants, including 12 industry representatives. Strauss established the direction and objectives for the workshop — developing relationships with industry — after which attendees participated in a lively brainstorming session, exploring issues raised during an earlier workshop on industry and Space Grant relations, which focused on Space Grant resources.

Panelists:
Dr. Harvey Willenberg, Chief Scientist, Boeing Defense Space Division

Mr. Homer Reihm, President and General Manager, ILC-Dover

Mr. Joseph Genovese, Research Coordinator, Space and Sea Systems, United Technologies

Dr. Charles Stapper, Senior Engineer, IBM Technical Products

Mr. Grant Schaffner, Aerospace Engineer, Weaver Aerospace

Dr. Jim Lang, Director of F-15 and F-4 Programs, McDonnell-Douglas Aerospace

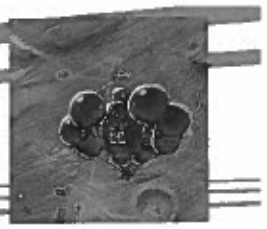
Mr. Charles Ciali, Consultant, Digital Equipment Corporation

Dr. Gerald R. Karr, Professor and Chair, Department of Mechanical and Aerospace Engineering, University of Alabama in Huntsville

Workshop Report

The overall thrust of the workshop was that there can be more positive interaction between industry and Space Grant institutions. However, the interaction must be focused and mutually beneficial.

Willenberg reminded participants that there are both small start-up companies and large aerospace companies with differing needs. The small companies tend to use universities as breeding grounds for new ideas since they have no research and development or engineering staff, while large aerospace industries survive from large project to large project with a small window of opportunity for seeking new technology. He further stated that in the existing economic environment, compa-



nies have limited discretionary funds and may have to choose between promoting research in a university and preserving an existing job within the company.

Reihm suggested a number of ideas that could be used for mutual benefit of industries and universities. They included:

- Joint use of special facilities for projects
- Curriculum selection, course tailoring
- Industry speakers for on-campus seminars
- Industry's need for directed research
- Research and development
- Joint ventures
- Personnel training.

Reihm was one of several speakers to stress the need to develop relationships with key decision makers within industry. The relationships should be nurtured over time.

Genovese agreed that there were opportunities for cooperation on joint proposals and university access to specialized equipment and facilities. He also commented that industry can help guide universities to the NASA Centers that are most receptive to certain projects. In addition, he mentioned that there were probably opportunities for graduate students to do short-term work on particular projects.

Stapper enumerated IBM's current programs with universities, including the faculty loan program at Historically Black Colleges and Universities, co-op programs, programs to send IBM employees for degrees at universities, teacher internships, where teachers work at IBM in the summer and receive college credit, and career development for high school students. He did not expect greater emphasis on these programs, due to IBM's business difficulties in the area of large computers.

Schaffner offered the services of his business to universities who would like to run experiments in an environment of microgravity at affordable prices.

Lang thought that universities and industries should help invent new ways of interacting, emphasizing that alternate networks should be created. He cited a consortium of five companies, which historically were competitors, working together with NASA and the Department of Defense on an aerospace plane project. He also noted the excellent industry-university relations enjoyed by the Society of Automotive Engineers with their Ralph Teeter awards.

Ciali pointed out that decisions are being made at every level as businesses become more structurally horizontal. In addition, he commented that companies are doing much more outsourcing as downsizing continues. With the prevalence of these conditions, there may well be some opportunities for industry-university cooperation.

Karr outlined a number of possible industry-university interchanges:

- Direct contributions, e.g., an endowed chair
- Co-op programs
- Graduate students working in industry and taking classes simultaneously
- Employee recruitment
- Industry representatives on university advisory committees
- Faculty-industry interchanges
- Joint research proposals
- Use of industry employees as adjunct faculty.

One attendee asked whether it would be useful for government to provide incentives in requests for proposals (RFPs) for industry-university cooperation. The

point was made that many Space Grant institutions are in areas that have little or no aerospace industry, making it very difficult to establish industry relationships.

There was general agreement, however, that more communication and networking are absolutely essential to developing mutually beneficial relationships.

Capability Enhancement and Other EPSCoR-like Programs

Facilitator:
Dr. Gaylord M. Northrop, Director, Arkansas Space Grant Consortium

Nearly 50 participants — most representing Capability Enhancement State Consortia — attended this workshop to learn more about new EPSCoR initiatives and continue networking activities.

Workshop Report

The session opened with an update from Elaine T. Schwartz, Chief, Higher Education, on the congressional authorization of a NASA EPSCoR (Experimental Program to Stimulate Competitive Research) infrastructure-building program, which will begin implementation in fiscal year 1993. This $5 million program will be supported by $4 million from NASA's Office of Space Science, with the remainder from the Office of Human Resources and Education. Schwartz requested that ideas for the "look and feel" of the new program come from Space Grant Capability Enhancement states, which are predominately National Science Foundation (NSF) EPSCoR states. Most importantly, she asked them to define barriers to implementation and describe the environment and criteria for a successful program.

Northrop next presented a brief overview of the history of EPSCoR, beginning with the specification by Congress in 1980 of the first five EPSCoR states: Arkansas, Maine, Montana, South Carolina and West Virginia. These were the states receiving the least amount of NSF grants at that time. Congress continued to designate EPSCoR states until, by 1991, the program had grown to 18 states and the Commonwealth of Puerto Rico.

With the 1991 implementation of Phase II of NASA's National Space Grant College and Fellowship Program, 15 NSF EPSCoR states and Puerto Rico were designated as Capability Enhancement states, along with Connecticut (not an NSF EPSCoR state). The NASA EPSCoR program will be directed to these states, plus the remaining three NSF EPSCoR states: Alabama, a Phase I Designated Space Grant state, and Kansas and Mississippi, both of which successfully competed for Phase II Program Grants.

This brief introductory background was followed by a 45-minute presentation and question-and-answer period conducted by James Hoehn, NSF program director for EPSCoR. Hoehn detailed the objectives, history, and some future plans for the NSF program. Between 1979 and 1994, NSF will have committed $93 million to its EPSCoR program, matched by $254 million in non-Federal funds. In addition, Congress has passed legislation creating EPSCoR-like programs in other major Federal agencies, including the Departments of Energy, Defense and

Agriculture, and the Environmental Protection Agency. Recently, Congress designated $5 million of NSF funds to be used for coordination of the numerous EPSCoR programs. This will become a major NSF effort during fiscal year 1993.

Following Hoehn's presentation, Space Grant directors from EPSCoR states, who serve on their state's EPSCoR committees, were asked to give informal presentations of their experiences and impressions, and comment on what might be preferable for the NASA EPSCoR program. One of the major concerns of many workshop participants was the anticipated difficulty of competing for NASA EPSCoR funds against states that have for decades received considerable NASA funding (although they may have received little in the way of NSF grants, thereby qualifying them as EPSCoR states). For example, in fiscal year 1990, Alabama received more than $24 million in NASA support; Oklahoma, nearly $3 million; and, eight other states — Idaho, Mississippi, West Virginia, Kansas, Louisiana, Connecticut, Kentucky and South Carolina — more than $1 million. (The remaining states are ranked in descending order based on NASA funding: Nebraska, with just under $700,000, Montana, South Dakota, Nevada, Puerto Rico, Wyoming, Maine, Arkansas, Vermont and finally, North Dakota, at $62,000.)

Frank Six of the NASA Marshall Space Flight Center, and key administrator of NASA's JOVE (JOint VEnture) program, a pilot infrastructure-building program, commented on the nonrestrictive nature of the JOVE matching fund requirements. Under the JOVE program, funds from other NASA sources can fulfill the program's matching fund requirement. The recommendation, that a NASA EPSCoR-type program copy the JOVE example of fewer restrictions on the origin of matching funds, was clear.

K-12 and Other Public Service Programs

Facilitator:
Dr. Wayne C. Solomon, Director, Aerospace Illinois Space Grant Consortium

This workshop included several presentations by personnel from Space Grant institutions and others, who provided overviews of some of their most innovative programs. Nearly 100 persons attended, an indication of the interest that exists in capitalizing on precollege students' curiosity about space and related topics.

Panelists:
Ms. Sandy Barnes, University of Texas at Austin

Dr. Paul Boehm, NASA Crew Integration Office

Ms. Karen Wynn, Pennsylvania Space Grant Consortium

Ms. Diane Jeffers, Aerospace Illinois Space Grant Consortium

Ms. Elaine Hansen, Colorado Space Grant Consortium

Dr. Bill Smith, Wisconsin Space Grant Consortium

Dr. Malcom Phelps, Chief, Education Technology and Evaluation

Workshop Report

Kindergarten through grade 12 (K-12) programs are important in realizing the National Space Grant program objectives. There is considerable variation in the programs and approaches of the various consortia. Many programs are innovative in bringing the aerospace message and its educational applications to K-12 education. Often the K-12 programs are using the NASA funding as seed money and have a leverage effect in expanding the programs.

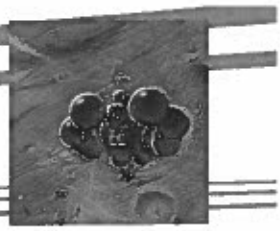
Barnes spoke about "Stardate," a daily radio program from McDonald Observatory concerning astronomy. Currently, this program is broadcast on about 180 (mostly public broadcasting) radio stations, and is often underwritten by businesses. "Stardate" reaches a significant number of people (at this time about 65 percent of the country), and could reach even more with increased support. Barnes suggested that the Space Grant consortia work with radio stations to support "Stardate." The cost per year would be about $1,400 on commercial stations and $1,000 on public stations.

Boehm presented excerpts from the "Lift-Off to Learning" series. Six videos have been released, with three more expected this year. The videos are a combination of in-flight footage and historical footage, graphics and animation. Videos are available through the NASA Teacher Resource Centers, and can be seen on NASA Select. A research guide comes with each video.

Wynn noted that Pennsylvania State University conducts several K-12 programs. One of their most popular is "Thinking Like a Scientist," a program for 3rd-5th grade students which tries to convey facts and dispel myths about scientists. Rural area schools are the primary focus. Graduate students serve as presenters and are seen as role models. In one year, "Thinking Like a Scientist" reached 8,000 students in 75 schools. The program is expanding to inner-city schools with minority presenters. An evaluation of the success and impact of the program is difficult. One evaluation technique used was to ask the students to draw and describe their view of a scientist, both before and after they attended the program. Comparisons of pre- and post- responses indicate some new understanding about scientists and the scientific process.

Jeffers recounted how the Harvard Park Project, implemented by Southern Illinois University, was based on utilizing children's excitement for aerospace material to promote academic excellence in regular school areas. The program's strategy is to enhance existing curricular subjects, not to add materials. Following a course in aviation and space education, nine Harvard Park Elementary teachers developed an eight-week curriculum with an aeronautics and space theme for K-4 students. Since spring 1990, the curriculum has been used throughout Harvard Park School. The program also has been incorporated into several other Springfield schools. An offshoot of this program has been the development of a graduate-credit bearing course for teachers to provide them with the background and training to enable them to effectively use the curriculum.

Hansen noted that the Colorado Space Grant Consortium has an integrated program of research, classroom activities and outreach. Each of the 14 members of the consortium has its own outreach program designed for its local school situation. Hansen described several programs, including a mobile space science lab created out of an old school bus, space seeds, mentoring, tours and presentations. The state of Colorado has been supportive in



designating a Colorado Space Education Day (expanded to a week in 1993) and repeating a space exhibit at the state fair. To support these outreach activities, Colorado Space Grant Consortium has a service requirement of all students who receive Space Grant support.

Smith related how the Wisconsin Space Grant Consortium is developing a Satellite Technology Education Program. The strategy of this program is to use satellite data to capture the interest of K-12 students in Earth sciences. A link-up between Watertown Science and Math Center, the University of Wisconsin at Madison, and a commercial satellite, will be put in place. By 1997, nine additional high schools will be part of the Satellite Technology Education Program. In 1998, an evaluation will take place prior to development of a statewide plan. It was said that Utah has five such systems in use, at a cost of about $3,000 per school to implement.

Finally, Phelps noted the need to distribute information about consortia programs throughout the country. Resources also are needed. NASA's Regional Teacher Resource Center network can serve this purpose. Meanwhile, a number of other resources exist:

- Spacelink — an electronic information system for educators and students;
- NASA Select — a C-band satellite communication, with school reception via antenna or participating cable system; and
- Teacher Resource Centers — NASA Field Centers and regional centers.

Phelps said he wanted to see these three systems integrated into Space Grant.

Four questions were posed for discussion following the presentations:

1) What are the most effective incentives for getting people involved in K-12 programs?
2) How do we separate fact and fiction about how K-12 programs are initiated and are working?
3) How are successful programs translated and transported from one area to another?
4) What are the mechanisms for communication of results and experiences among Space Grant Consortia?

In the short amount of time remaining, three topics were discussed: 1) evaluation, 2) dissemination, and, 3) communication. Several attendees commented that evaluation is becoming an increasingly important part of their programs; in fact, some funding sources are requiring it. In conjunction with this, it was remarked that education proposals must show the same careful background research and the same competence as any science proposal. Phelps noted that the Federal Coordinating Council on Science, Engineering and Technology (FCCSET) is looking at setting evaluation criteria.

A national electronic bulletin board was suggested as a method for information dissemination and exchange. Phelps remarked that many are linked up through Internet, and that someone is needed to explore the further use of this. Moreover, jumping one hurdle is to ensure that people use a system once it is in place. Comments were made that we may be spending too much energy developing new programs and not enough time looking at good existing programs and disseminating information about them, thereby utilizing the existing programs as resources.

Poster Sessions

Consortia were asked to present information on programs and accomplishments through the use of poster sessions. Three poster sessions were scheduled at various times throughout the conference, and involved representatives from all 52 consortia. In addition to these displays, NASA Center representatives provided displays highlighting Center activities. Exhibits included a miniature mockup of the Space Shuttle and Space Station *Freedom*, a special display by the Texas Space Grant Consortium, which cohosted the conference, and a demonstration booth for representatives of Information Network Systems, a NASA contractor, to demonstrate the Consortium Management Information System (CMIS) software. On Tuesday evening, Mr. Pat Rawlings, artist for the Space Grant Conference poster, autographed posters.

The poster sessions were welcomed by consortia and industry representatives alike. This free time provided opportunities for attendees to mingle, exchange ideas and information, and become better acquainted with one another's programs.

The Space Program: A Personal Perspective

Rear Admiral Alan B. Shepard addressed the Monday evening banquet, held at the Lakewood Yacht Club, in Seabrook, Texas. Shepard was one of the original seven *Mercury* astronauts and was aboard the first U.S. human space flight in May 1961. He commanded *Apollo* 14, the third lunar landing mission in 1971, during which he spent nine hours on the moon. He now serves as president of 714 Business Enterprises, a Houston investment company, and as president of the Mercury Foundation. Shepard shared several humorous and lighthearted stories of his experiences in the space program.

Reflecting on the "good old days," Shepard described his relationship with astronaut John Glenn (now Democratic senator from Ohio). He recalled that his flight — a 15-minute suborbital flight aboard a Redstone booster — took place chronologically between that of a chimpanzee and Glenn, which prompted

Speaker, Rear Admiral Alan B. Shepard

Glenn in later years to refer to Shepard as the link between monkey and humans. Shepard further explained that it was not for his skills that he was chosen to pilot *Freedom 7* that day, but because the scientists and engineers could not get the monkey to cooperate. By being the only one in

the astronaut room, he said, he was a "victim" of being in the right place at the right time.

Shepard expressed his sincere belief in, and personal commitment to, aerospace and technology, and to the opportunities provided through Space Grant Consortia for traditionally under-served students. In closing, he encouraged and challenged Space Grant personnel to continue providing opportunities for student research and advancement through NASA and its industrial and academic counterparts.

Space Center Houston Visit

After dinner, conference attendees were given exclusive access to Space Center Houston, the new visitors center located at the NASA Johnson Space Flight Center. Participants explored the Space Center and enjoyed such activities as viewing the films, "On Space Exploration," which depicted the history of America's space program; and, "To Be An Astronaut," which described what is involved in becoming an astronaut. Visitors were free to explore and enjoy numerous exhibits, including Space Shuttle landing simulators; a satellite deployment simulator, which allowed a guest to attempt to retrieve a satellite through computer simulation; displays of astronaut suits and helmets; a demonstration by Space Center personnel of an astronaut's daily routine on the Space Shuttle; and, a mock up of the Space Shuttle nose.

Dr. Harry Ashkenas was presented with a California state flag, flown in October 1992 aboard mission STS-52, Space Shuttle Columbia, in recognition of outstanding and sustained dedicated performance in the development and continuing support of the NASA Educational and University Affairs Programs. Ashkenas retired from the Jet Propulsion Laboratory, California Institute of Technology, on March 31, 1993, after 42 years of service.

Leaving Home: About nine billion miles from Earth, Voyager 2 leaves the influence of Sol and enters interstellar space. Voyager could encounter the turbulent boundary between the solar wind and the flow of the interstellar medium, known as the termination shock, as early as 1996.

Research Balloon Launch

A High-Altitude Research Balloon Launch was sponsored by the Rocky Mountain Space Grant Consortium, and conducted by Mr. R. Gilbert Moore, adjunct professor of physics and consultant to the Utah State University Space Dynamics Laboratory, and personnel from Winzen, International, Inc. The launch was intended to measure ozone distribution and horizontal wind velocities in the stratosphere, and demonstrate to participants the usefulness of unoccupied scientific ballooning as both a research and an outreach tool.

The balloon was scheduled for launch on Monday, January 11, at 6:00 a.m., from an area just outside the conference hotel. Due to inclement weather, the launch took place Tuesday morning at approximately 7:58 a.m. Despite low cloud cover, the climate was deemed right for launch.

Once launched, the 230,000 cubic foot, helium-filled nylon, super-pressure balloon was visible for about two minutes before it disappeared into the overcast sky. Onlookers cheered as the balloon began its ascent toward the upper atmosphere.

The balloon and its attached 50 pound payload ascended to an unexpectedly low float altitude of 83,700 feet (predicted preflight to be 110,000 feet) and proceeded in a northeasterly direction along the Texas and Louisiana Gulf Coasts, while transmitting reports on its latitude, longitude, and altitude, together with solar ultraviolet intensity data and subsystem health status, to a Utah State University chase van. In addition, volunteer amateur radio operators located near the launch site and along the coast recorded and relayed similar data to the van by VHF radio.

At sunset, the balloon began to descend, and by 12:00 a.m., some 16 hours after launch, the balloon had entered FAA-controlled airspace at an altitude of 59,000 feet. At this point, the chase team made the decision to terminate the flight. A radio command was sent to sever the payload from the balloon, and a 12-foot parachute lowered the instrument gondola to the ground in an arm of the Atchafalaya Swamp at a point about 25 miles northwest of Baton Rouge, Louisiana, touching down at 12:35 a.m. on January 13.

The payload's global positioning system (GPS) receiver, telemetry transmitter and radio locator beacon continued to operate after touchdown, so the chase team members were able to determine the payload's location within 100 yards. They initiated physical recovery operations after daylight, assisted by local amateur radio operators who had recorded transmissions from the payload during the previous night. Dense undergrowth and numerous sloughs prevented the combined team from physically recovering the payload on Wednesday. However, a deer hunter discovered the payload and parachute lying in a briar patch in fully operational condition that evening. He brought them out of the swamp later that night and left them with the local landowner, who returned them to the recovery party on Thursday morning, January 14.

The flight yielded detailed measurements of circulation of stratospheric winds at northern mid-latitudes in the altitude interval between 60,000 and 80,000 feet. It also made measurements that will provide mid-winter daylight ozone total column density above 80,000 feet along the Gulf of Mexico from Galveston Bay, Texas, to Lake Charles, Louisiana. In addition, it proved that a two-person chase team, assisted by volunteer amateur radio

operators who can be alerted in real time by the chase team as the flight progresses into unexpected territory, can retrieve data from the balloon's instrument package throughout the flight, from liftoff to touchdown. Finally, the flight served to stimulate the imaginations of numerous Space Grant university researchers and outreach coordinators regarding future applications for high-altitude, unoccupied balloons.

Launch costs associated with this flight were paid for by a supplemental grant from NASA's Space Grant program office to the Rocky Mountain Space Grant Consortium. Helium for the balloon was furnished by the NASA Johnson Space Center. The balloon was donated by Winzen International, Inc. The payload was designed and built by a coalition of personnel from Utah State University's Space Dynamics Laboratory and the Bridgerland Amateur Radio Club, using equipment and materials donated by individuals and by the Space Dynamics Laboratory. Data retrieval and recovery assistance were supplied by amateur radio operators along the flight path. In addition, substantial recovery preparations were organized by amateurs in northern and central Florida in anticipation that the balloon would arrive in their area on Wednesday morning. As a result of the altitude under-performance of the balloon, however, it operated in an altogether different wind field than was forecast. Possible reasons for the balloon's altitude under-performance, the most likely being envelope damage at liftoff, are under investigation.

This zero-pressure balloon, with similar payload and rigging, was launched from Utah State University in Logan around 1:00 p.m., on September 23, 1992.

Data from the gondola were continuously recorded by the chase van and by radio amateurs in the region. Disks containing these data have been mailed to Utah State University and analysis is under way. For more information on data pertaining to this launch, or on implementing a similar program, contact:

R. Gilbert Moore
801-750-3561

Mission to America—A Report on the Woods Hole Conference

For nearly a week in August 1992, Space Grant program directors and NASA personnel met in Woods Hole, Massachusetts, to develop a shared vision for the Space Grant program. The workshop resulted in a report entitled, "Mission to America—Report of the National Council of Space Grant Directors."

Dr. Martin A. Eisenberg, Chair, National Council of Space Grant Directors; Director, Florida Space Grant Consortium; and *ex officio* member, Space Grant Review Panel, addressed attendees on the activities and outcomes of the Woods Hole conference. He began by describing the role of the Directors Council and recalled the Council's formation during the first Space Grant Conference. He described the Council as a voluntary association of program directors created to 1) aid in the development of the Space Grant program, 2) increase communication among the directors,3) provide a forum for mutual support, 4) identify areas of common interests in which cooperation and collaboration among programs may prove beneficial, and, 5) develop mechanisms to accomplish such cooperation. He noted that the Council considers itself a support agency for the development of the Space Grant program.

Eisenberg noted that at the Woods Hole meeting, task forces consisting of directors, their staffs, and NASA Headquarters personnel were assigned to: 1) develop a vision for the Council for the year 2000 and beyond, 2) assess where the Council is now and what could be done to get it started in the right direction, 3) assess the nature of the gap that exists between where the Council is and where it wants to be, and determine how to bridge the gap, and 4) determine how the Council may achieve its goals.

He noted the shared vision of the Space Grant program, developed at Woods Hole by the Council and NASA as follows:

> *By the year 2000, NASA will have a prominent and permanent presence throughout the nation's academic institutions. The Space Grant program will be NASA's agent for change, coordination, and cooperation in technical education, enhancement of research infrastructure, and promotion and inspiration of lifelong learning of math, science, engineering and technology.*

Eisenberg suggested that the report will provide a better understanding of "who we are and where we are going."

Copies of "Mission to America — Report of the National Council of Space Grant Directors," may be obtained by writing:

Mail Code FEH
NASA Headquarters
Washington, DC 20546

NASA Opportunities in Engineering and Technology

Dr. Leonard A. Harris, NASA Chief Engineer, and *ex officio* member of the Space Grant Review Panel, gave participants a brief overview of NASA's engineering research activities, the budget for fiscal year 1993, and the vision and strategic thrusts for NASA's aeronautics program.

Harris described areas of special focus, which include the study of aging aircraft and research into their behavior, high performance aircraft research, and materials and structures research and technology.

Harris gave an overview of the mission for his division and outlined some of its major thrusts as follows: space flight research and technology systems analysis activities, research into detectors and coolers for space vehicles, and emphasis on propulsion research and technology, Earth to orbit propulsion, and upper stage of propulsion devices.

Harris then gave participants an overview of NASA installations. He cited the Research and Technology Objectives and Plans Summary (RTOPS), which is published annually, as an ideal source of information on the research and technology program.

Applications of Educational Technology in Higher Education and Space Grant

Dr. Malcom V. Phelps, Chief, Technology and Evaluation, provided background information and statistics on the progression and uses of educational technology, and shared opportunities for Space Grant involvement in other NASA programs. The goal of the presentation was to forge links between Space Grant and educational technology, especially with respect to dissemination mechanisms for materials and products developed by Space Grant Consortia.

Phelps stressed the scope and availability of educational technology, acknowledging that the critical task is to establish effective communication with students and teachers. The innovation occurs when technology serves as the enabling capability or means to share quality products such as ideas, courses, etc., he said.

Consistent with the Federal Coordinating Council on Science, Engineering and Technology Committee on Education and Human Resources (FCCSET/CEHR) objectives, students should be provided the opportunity to "do science" in the proper environment, using appropriate equipment, Phelps said. In addition, NASA's Strategic Plan for Education provides a framework where systems are developed for teacher enhancement, and products are developed that meet national standards and address national goals, and can be integrated into the curriculum.

Phelps cited the following as opportunities for Space Grant involvement:

- NASA Classroom of the Future (Challenger Learning Center, Teacher Resource Center, Satellite and Distance Learning Center, Software and Multimedia Development Center, and 21st Century Classroom)

- Spacelink
  - Access via Internet, direct line, and toll free
  - Electronic dissemination of materials and products
- NASA Select
  - Agency satellite communications system
  - Interactive video conferences for teachers
  - Programming and creation of educational video materials

Phelps commended the Virginia Space Grant Consortium for working with NASA to disseminate interactive educational programs and urged other Space Grant Consortia to develop models that meet the unique needs of their states. Finally, he challenged Space Grant to develop a distance education center for excellence (based on the National Technological University satellite network) where Space Grant faculty and industry representatives would provide expert lectures to students via satellite transmission.

Space Grant Program Directors

Industry-Space Grant Relations III: Mechanisms of Resource Exchange

Facilitator:
Mr. Robert Dalton, Executive Director, Center for Technology Transfer (member, Maine Space Grant Consortium)

About 40 attendees separated into small groups, where they discussed a number of issues that focused on obstacles to the mutually-beneficial exchange of resources between Space Grant universities and industry, and explored mechanisms by which they may be overcome. Representatives from each group then presented the group's observations and recommendations to the workshop as a whole.

Workshop Report

Participants agreed that greater exchange of resources would benefit both the university and industry communities. Implementing mechanisms that foster such exchange, however, involves breaking so-called cultural barriers. Industry and university officials agreed that industry representatives often view university personnel as always "having their hands out for money," while unwilling to embark on collaborative ventures. In addition, small industry views the university as competing for diminishing research dollars. On the other hand, university personnel sometimes view collaborating with industry as "beneath" them.

Another apparent obstacle was the lack of time on the part of university and industry personnel to explore thoroughly the possibilities for resource exchange. University and industry organizations frequently are large, bureaucratic institutions, which, participants noted, can make it difficult for interested parties to sustain efforts to find the right personnel with whom to begin a dialogue.

One mechanism valuable in overcoming these obstacles included the establishment of additional exchange programs for students, such as internships and co-op programs, research experiences for undergraduate and graduate Space Grant fellows, and the providing of enrichment opportunities for faculty.

The conference itself was noted as having provided a forum where industry and university personnel could begin the exchange of ideas.

Evaluation Mechanisms for Space Grant Consortia

Facilitator:
Dr. George K. Parks, Director,
Washington Space Grant
Consortium

Over 50 participants representing some 40 consortia attended this workshop on evaluation. The issue of evaluation prompted intense discussion among the participants.

Parks provided a list of questions to initiate discussion on two issues: 1) the evaluation of individual Space Grant consortia; and, 2) evaluation of the national program.

Questions

How do we evaluate if a program is successful?

What standards do we use?

Should we evaluate how well we have met the original NASA goals?

Should the individual programs define their own objectives and be held to those standards?

Should the standards be the same or different for Phase I and II programs?

Should we evaluate each other?

Should evaluation include site visits?

What other criteria do we use?

Evaluation of the national program requires information on:

- How successful the national program has been in accomplishing the objectives and goals of the program;
- How we deal with the "evolution, expansion and flexibility" issues; and,
- Strengths and weaknesses of the national program as a whole.

Workshop Report

Generally, participants agreed on a number of issues:

Some form of evaluation would be necessary. No consensus, however, was reached concerning what form evaluation should take.

Different criteria should be used for evaluating Phase I and II programs.

Evaluation criteria should be based on each consortium's individual characteristics rather than on uniform nationwide standards. Consortia should establish their own goals and measurable standards and document them for NASA management.

Many of the programs are evolving. Hence, rather than adopting a fixed evaluation format, NASA should adopt the concept of an evolving evaluation process.

Short- and long-term evaluation standards should be considered.

Statistical database information should not be over-emphasized.

Site visits to individual programs would not be necessary but NASA program managers are urged to visit the individual programs as a way to be in touch with individual consortium activities.

Parks noted that many of the opinions expressed are covered in the Evaluation Recommendations of the Woods Hole Report (see next page).

Woods Hole Report: Consortia Evaluation and Review

Purpose

The primary function of an evaluation process is to validate and continuously improve what is done and how it is done. In industrial terms, this maps to both the process and the product.

Core and Cafeteria Evaluation Categories

We recognize that meaningful evaluation is a daunting process when surveying the 52 diverse consortia. Yet, enough common themes permeate to allow identification of six areas that may be included in evaluation. In this section, we list and expand upon each of these areas. It is important to note that this list is NOT intended to be a template for consortia activities. These areas were identified as a likely basis for a meaningful statistical database of consortia achievements. Readers of this document should exercise care that the items listed herein do not stifle innovation. We suspect that only items I and II will be common to all consortia. Other items would be selected cafeteria style as appropriate for a given state's consortium activities.

The following areas were identified as areas upon which to build a consortium evaluation tool:

Core Items

Scholarships and Fellowships

- Dollar amount of support
- Number of students supported
- Number of nontraditional students and students from underrepresented demographic groups
- Tracking of student participants
- Leveraging effect for moneys expended
- Number of applicants
- Distribution of moneys within and beyond consortium
- Mentoring activities or other value added activities

Management

- Evidence of participation and democratic representation by all consortium members
- Analysis of money spent on administration and overhead
- Evidence of accountability to constituents (teachers, students, industry and faculty)
- Expansion of consortium membership
- Evidence of networking: number of cooperative relationships internal and external to the consortium

Cafeteria Items

Educational Programs

Courses

- Number of courses developed and/or modified
- Number of students served
- Number of faculty involved
- Number of schools involved, including community colleges and non-consortium institutions
- Presence of built-in review process or other feedback mechanisms
- Leverage

Faculty development

- Number of faculty
- Number of institutions involved, including community colleges and nonconsortium institutions
- Leverage
- Nature of development activity

Research and Infrastructure Development
- Grant dollars
- Number of grants
- Number of faculty
- Number of fellows
- Number of papers and talks
- Number of collaborative developments with NASA Centers, consortium members and other institutions
- New equipment and facilities

Public Service and Outreach Activities

Teacher training
- Number of teachers involved in the program
- Multiplier (how many teachers are taught by these teachers)
- Follow-up (programs should be followed by surveys for one to two years afterwards)
- Supporting workshops, resources, etc.
- Leverage with money and in-kind
- Materials distributed
- Money spent

Direct training of students
- Number of students involved
- Money spent
- Leverage
- Length and type of program
- Demographic and geographic distribution of program
- Number of faculty and staff involved in program

Adult education
- Number of students involved
- Money spent
- Leverage
- Length and type of program
- Demographic and geographic distribution of program
- Number of faculty and staff involved in program

Industry
- Description of industrial internships
- Description of cooperative ventures
- Technology transfer.

Evolving Strategic Plan

Continuous improvement of the program of each Space Grant Consortium, both in terms of "products" and methodology, can be facilitated through the combination of an annual peer review (a constructive advisory process) and self-review of the Space Grant Consortium's objectives and progress toward those objectives. The self-review should include evaluation input from the constituents served by the Space Grant Consortium during the year, such as students, teachers, researchers, schools, colleges, industries and businesses. The envisioned process provides an opportunity to evaluate the effectiveness and appropriateness of consortium activities in the particular situation of each Space Grant Consortium, effecting a continuous evolution of its objectives to meet its existing and changing needs. Some activities that initially seemed promising might need to be de-emphasized or eliminated in subsequent years, while new ideas might find a place in accomplishing the Space Grant Consortium's mission as circumstances change or as participants become aware of them. As a part of the introspective process, the exchange of ideas, experiences, and recommendations among peers in Space Grant Consortia with similar missions can infuse ideas that maintain and revitalize the program.

Operationally, it would be helpful for the Space Grant Consortia to prepare preliminary reports for use in exchanging information on the past year's activities at a meeting held early in the calendar year. Following this exchange of information and ideas, including opportunities for discussions and recommendations, each consortium could incorporate ideas and suggestions from the interchange to draft a strategic plan for the following year. In some cases, it may be desirable to use site visitation(s) among Space Grant Consortium personnel (possibly in either direction) to facilitate the exchange of ideas. Following the review and interchange of ideas and suggestions, each Space Grant Consortium would prepare in the spring an annual report that would include both the details of its accomplishments for the previous year and its updated strategic plan. In addition to reporting accomplishments and plans to NASA, the report would provide guidance for the activities of the Space Grant Consortium in the subsequent year and a basis for communication and description of its purposes and functions to other interested parties, such as associated industries, state EPSCoR (Experimental Program to Stimulate Competitive Research) committees, and sources of matching funds.

Overall, the effect of periodic reassessment of objectives and evaluation of outcomes should lead to continuous improvement of what the Space Grant Consortia do and how they do it to accomplish the goals of the program.

Grantsmanship

Facilitator:

Dr. William D. Lakin, Co-Director, Vermont Space Grant Consortium

This workshop focused on strategies for success in submitting research grant proposals to national funding agencies. The workshop stressed that inexperienced principal investigators do not know that writing a proposal for research funding is one of the last steps in the grantsmanship process, and not the way in which the process is initiated.

Panelists:

Dr. Dianne Robinson, Director, Interdisciplinary Science Center, Hampton University, and member, Virginia Space Grant Consortium

Ms. Tracy Perez, Program Manager, Maine Science and Technology Commission, and member, Maine Space Grant Consortium

Dr. Jim Hoehn, Director, EPSCoR Program, National Science Foundation

Workshop Report

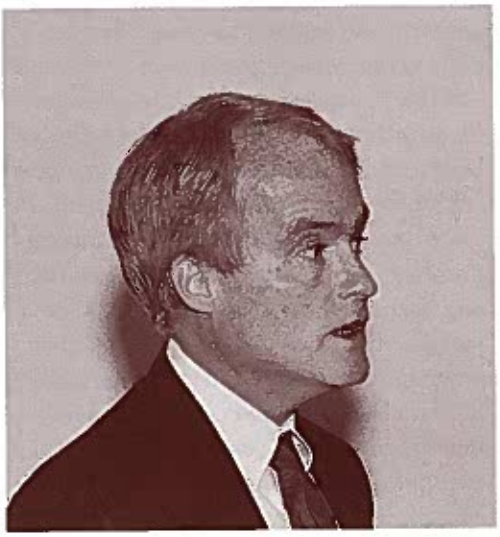
Because the strategy for obtaining funding may vary widely by potential funding agency, the format adopted for this workshop involved four presentations that explored the process from different perspectives. Lakin's presentation considered individual research grants with the primary target agencies being NASA and the

National Science Foundation (NSF). Robinson discussed multi-investigator, interdisciplinary proposals dealing with educational research. Perez then continued the discussion of strategies for large proposals involving multiple projects. Finally, Hoehn gave workshop attendees a view of the process as seen by a program director at a funding agency.

Although the presentations were designed to highlight and deal with diversity in the grantsmanship environment, presenters identified a number of common elements that crossed presentation boundaries. Key among these were attention to detail, finding the right program for a proposal, and actively making contact with others to seek comments and input prior to writing the proposal.

Presentations were followed by a lively question and answer session. In the latter portion of the workshop, the group then considered how Space Grant Consortia might assist faculty in their states in successfully securing external funding for research.

In the lead-off presentation, Lakin made use of both the questions for thought sent to participants by NASA Space Grant Program Manager E. Julius Dasch in his December 21, 1992, letter to attendees, and a brief outline on grantsmanship strategies prepared by Dr. Sylvia Stein of the Pennsylvania Space Grant Consortium, the original facilitator for this workshop. To emphasize the need to do more than simply have a good idea, write a proposal, and then send it off to a number of funding agencies, Lakin first gave a realistic appraisal of the potential for getting a proposal funded anywhere. Because of budget constraints and increasing requests for funding, even well-established investigators are now having to cope with dramatically reduced success rates. This reinforces the importance of paying attention to detail, doing everything possible to maximize funding potential before a proposal is written and sent off, and maintaining a positive outlook if proposals are declined.



Dr. Jim Hoehn, Director, EPSCoR Program, National Science Foundation

This short report will not allow inclusion of all points made during the presentations. However, Lakin stressed the need to closely match a research topic and new idea with a program interested in funding that type of research. If a proposal is sent to a place where it is not of interest, the sender should not assume that the proposal will be forwarded to a more appropriate program. It might simply be assigned a low priority and then declined. Examples were given of reference materials, such as NASA's Research and Technology Objectives and Plans Summary (RTOPS) and NSF's Program Descriptions and Summary of Awards booklets, which can aid a prospective proposal writer in determining the best match between an idea and a potential funding source.

The importance of making contact with program directors to brief them on the contemplated research and solicit input that might strengthen the proposal,

or make it more appropriate for their programs, also was discussed. In the case of "unsolicited proposals" to NASA, Lakin noted the necessity of discussing contemplated work with NASA researchers before beginning to write, much less submit, a proposal.

Several practical matters unrelated to the research content of a proposal also were considered during Lakin's segment. For example, is the project really worth doing? Is the potentially available funding sufficient? Does the researcher have sufficient time to devote to the project? If the project is large and requires administration, is there someone both willing and able to run it? Have all of the requirements of the funding agency been met? Care must be taken that all criteria specified by the program for a proposal are followed exactly. Incorrect margins or a typeface which is too small may cause a proposal to be rejected without review. Keywords here are detail, detail and detail.

Strategies that can strengthen proposals, such as leveraging program funds by obtaining matching funding locally, and drawing in others who have an interest in the work, also were discussed. Other points covered included the need to "think like a reviewer," create an abstract that will make a reviewer want to read the rest of the proposal, and the use of different fonts and underlining to be certain that key ideas are not missed.

In her presentation to the workshop, Robinson considered the development of interdisciplinary proposals concerning K-12 issues. She noted that before putting such a project together and submitting it for possible funding, it is essential to make contact with those groups in the community who will be affected by the project. Such contacts may lead to a modification of project goals and a more accurate assessment of community needs.

Establishing rapport with community groups, listening to their concerns, and developing sensitivity to their cultural perspectives, also can help foster community participation in the project and dispel any perception that the university-run project has no relevance to the real issues in the community. The need in such projects to have a working relationship with the university's education department and teachers was also noted. Robinson also stressed that having information on what has worked in the past is essential before attempting to develop a future project.

Perez approached the grantsmanship process from the viewpoint of a program manager. She urged the audience not to be intimidated by the prospect of participating in a large grant. At the same time, she remarked that all grants have a number of complications, and even the development of proposals for a small grant should not be left until the last minute. Perez noted that for larger grants, the planners had to develop ways to bring people together and allow them to participate. However, getting collaborators to produce their individual portions of a proposal in a timely manner is often difficult, and it is necessary to generate and maintain a sense of excitement among participants.

Other practical matters brought up by Perez included the advantages of being as brief and concise as possible when describing a project in a proposal. Paying sufficient attention to details, e.g., adequately proofreading the proposal's text, also was emphasized. Proposal writers should be specific about the amount and nature of any matching funds. They also should be honest about program components involving human resource development. For example, if a state does not have a large enough minority population to support a targeted development component, this should be stated in the proposal. Finally,

Perez noted that grant funds come with strings. Participants in a project are going to be asked to go to meetings, provide reports and information on the status of their projects, and complete appropriate documentation. Red tape is common with large grants and should be expected.

Hoehn alerted the workshop to some of the points a program director looks at when a proposal is received for possible funding. He noted that proposals to NSF are now sent back automatically if they do not conform to page limitations and other guidelines. Hoehn also related that reviewers will take a hard look at the proposed budget to see if estimates of costs are reasonable. Everyone is aware that a proposal will suffer if the requested budget is excessive. However, Hoehn told the workshop that a budget also can hurt a proposal if the costs are thought to be underestimated, as reviewers may get the impression that the proposer does not have a good understanding of what it will take to actually complete the project. Finally, he noted the diminished success rate for proposals at NSF, and urged the audience not to become discouraged if funding doesn't come quickly.

After a brief question and answer session, the remainder of the workshop considered how Space Grant might help less experienced researchers increase their research competitiveness and become more successful in acquiring research funding. A number of specific ideas were put forward.

It was noted that researchers at smaller schools did not have ready access to information on funding opportunities and the topics of interest to programs at the funding agencies. One suggestion was that, as such data is usually available at the larger research universities, state consortia develop ways to share this information with interested faculty at smaller affiliates.

Space Grant Consortia also might sponsor local grantsmanship workshops featuring experienced grant writers from the major institutions. By providing a central place where information on research interests across affiliates is known, consortia might be able to facilitate collaborations of inexperienced and experienced researchers, both within a state and across state boundaries. By acting as a conduit for information between Space Grant affiliates, consortia can make Space Grant a resource.

Dasch remarked that when an inexperienced researcher has written a proposal, Space Grant might be able to provide reviewers who will look at the proposal and help the proposer prior to the proposal's submission. Consortia also may aid inexperienced researchers through research infrastructure development programs that provide small amounts of "seed money" needed to develop preliminary data and results prior to seeking funding from more conventional sources.

Space Grant Regional Consortia

The majority of states involved in the Space Grant program are also active in regional consortia. State and NASA Center representatives meet periodically to exchange information, share ideas, and occasionally embark on collaborative efforts. The Tuesday afternoon lunch break was set aside for meetings of the five regional consortia established so far: New England (Northeastern), Mid-Atlantic, Southeastern, Midwestern and Western.

New England Regional Space Grant Consortium

Eighteen conference participants represented Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont Space Grant Consortia. Also in attendance were Dr. Gerald A. Soffen, Director, University Programs, Goddard Space Flight Center, and his assistant, Ms. Mabeline S. Burrell.

The meeting was chaired by Dr. Daniel Hastings, Director, Massachusetts Space Grant Consortium.

Discussion indicated that the group prefers to be called the Northeast rather than the New England Regional Space Grant Consortium, in order to include New York.

Participants gave brief summaries of their programs and initiatives, and reviewed the previous meeting in which the six New England states and New York participated.

Among the issues discussed were a Space Grant regional resource library, and the designation of someone to steer its establishment. Another issue concerned the implementation of a faculty exchange program where larger institutions, such as Harvard and Yale, would provide growth opportunities for faculty from smaller Space Grant institutions. It was agreed that NASA should be more supportive of this type of an initiative.

The group then discussed projects and activities that could be undertaken at little expense. They included faculty exchange programs, the sharing of research information, use of industry laboratories, and visits by NASA Center personnel (at no cost, when done in conjunction with existing travel plans.)

Participants agreed to the following: 1) all members should be placed on Internet for quick dissemination of information; 2) a posterboard publicizing the consortium should be placed at Goddard Space Flight Center (to be discussed further at the next meeting, with specific objectives to be determined); 3) each consortium would write summaries of space-related research and academic activities, and forward them to Soffen to be compiled into a publication; and, 4) a list of current e-mail addresses of consortium members would be circulated by Headquarters through its Consortium Management Information System.

Rhode Island was chosen to host the next meeting at a time and date to be determined.

Mid-Atlantic Regional Space Grant Consortium Meeting

Representatives from member states of the Mid-Atlantic Regional Space Grant Consortium focused on the coordination of a group project to be implemented among members. About 20 participants attended this third meeting held by the Mid-Atlantic consortium, with representatives from Delaware, the District of

Columbia, Maryland, New Jersey, Pennsylvania and Virginia on hand to discuss possible themes.

Dr. Richard Henry, Director, Maryland Space Grant Consortium, suggested that the project center on the Chesapeake Bay. Ms. Mary Sandy, Director, Virginia Space Grant Consortium, agreed, and suggested a one-day symposium at a prominent educational institution.

Other suggestions included having a political official present; conducting a workshop for teachers; collaborating with science supervisors and assistant associates of education (remote sensing and satellite expertise could be included); requesting Goddard Space Flight Center to host the function; and focusing on students isolated from technology. Finally, discussion of where to obtain the money for a one-day workshop led to the conclusion that a registration fee of an undecided amount would be collected.

Southeastern Regional Space Grant Consortium

The meeting of the Southeastern Regional Space Grant Consortium, with Dr. John C. Gregory, Director, Alabama Space Grant Consortium, presiding, focused on reports from each of four working groups:

- Land and Sea Interface/Gulf Resources/Earth System Sciences working group, Dr. Mitchell Colgan, Director, South Carolina Space Grant Consortium, reporting;
- Precollege Education/System Change/K-12 Programs working group, Dr. Majid Jaraiedi, Director, West Virginia Space Grant Consortium, reporting;
- Student Experiments in Space working group, Dr. John Gregory, Director, Alabama Space Grant Consortium, reporting;
- University Education Programs working group, Dr. Erian Armanios, Director, Georgia Space Grant Consortium, reporting.

Each group was asked to prepare a one to two page plan for subsequent consideration by the Southeastern group.

Forty Space Grant representatives from Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, West Virginia and Puerto Rico were present. In addition, NASA Center representatives included Dr. Frank Six and Dr. George Lebo, Marshall Space Flight Center; Mr. Bill Martin, Kennedy Space Center; and, Dr. Armond Joyce, Stennis Space Center.

The next meeting for the Southeastern Regional Consortium was tentatively planned for March or April 1993 at the Stennis Space Center, Mississippi.

Midwestern Regional Space Grant Consortium

This was the first meeting of the Midwestern Regional Consortium. Preliminary discussions led by Dr. Wallace Sanders, Director, Iowa Space Grant Consortium, were held concerning whether the consortium should be created, what its purpose should be, and who should be included in the consortium. Those present included representatives from Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, Ohio, Oklahoma and Wisconsin.

Discussion centered on the issue of whether to form a regional consortium or concentrate on topical interests instead.

Several possible benefits resulting from the establishment of a regional consortium were suggested: 1) a regional consortium would provide a mechanism to pool resources; 2) it would provide a forum for student interchange; and, 3) it would promote affiliate involvement, since affiliates are more likely to attend regional meetings than national ones.

The group also discussed the practicality of forming smaller regional groups. Those present, however, favored meeting as the larger group. In addition, participants favored allowing peripheral states (such as North and South Dakota and Oklahoma) the freedom to join the consortium or refrain from involvement.

Dr. E. Julius Dasch, NASA Space Grant Program Manager, commented that NASA does not insist on regional consortia, but pointed out that some of these affiliations were working extremely well — e.g., the Western Regional Space Grant Consortium and the Southeast Regional Space Grant Consortium. Dasch speculated that NASA in the future may support regional meetings, where consortia programs are discussed, as well as national meetings, where policy is more of a focus. In addition, he pointed out that obtaining funding for regional consortia might be possible in the future, if such consortia meet program needs.

Sanders volunteered to act as initial coordinator for the group. He asked each participant to write a short assessment of what the group should be doing and how it should go about doing it, and to provide a list of several contacts from each state consortium. From these, he will provide a summary of objectives and logistical information, and then distribute them for discussion.

Participants proposed a second meeting for October 1993.

Western Regional Space Grant Consortium

The meeting of the Western Regional Space Grant Consortium, led by Mr. John A. Gardner, Nevada Space Grant Coordinator, provided members an opportunity to prepare for a regional meeting scheduled to take place September 16-17, 1993, in Las Vegas, Nevada. Participants were asked to contemplate the thrust of the two-day gathering. They were then briefed on action items from the previous meeting — September 12-13, 1992, in Jackson Hole, Wyoming — which included the status of ongoing efforts to facilitate electronic networking among group members. Space Grant White Pages and Help Guide currently are available to the members, with other items, such as a bulletin board, to be made available in the future. Members representing Arizona, California, Colorado, Nevada, New Mexico, Texas and Utah, discussed several new ideas, including one that would involve the sharing of summer interns, and a unique idea for the development of a Master of Science curriculum in Space Grant Program Design.

NASA Johnson Space Flight Center Facilities

Conference attendees on Tuesday afternoon were given a tour of the NASA Johnson Space Center. The first stop: the Center's Medical Sciences Division. This division provides for the health and safety of the Space Shuttle flight crews. The Medical Sciences Division employs 34 civil servants and 385 contractors, and encompasses three branches: Medical Operations, which provides health care for astronauts and their families; Biomedical Operations and Research, concerned with how the human body reacts to a space environment; and Space Medical Institute, used for the study of cardiovascular physiology. Participants visited the Image Analysis Lab, where personnel study the effects of radiation on astronauts using computer software to dissect chromosomes; the Toxicology Lab, where scientists monitor Shuttle air quality using Ion Mobility Spectrometry; the Exercise Physiology Lab, used for the study of light-headedness and muscle function loss after space flight; and the Cardiovascular Lab, which monitors post-flight changes in astronauts' cardiovascular systems.

The tour continued on to Johnson Space Center's Building 29, the Anthropometry and Biomechanics Lab, the only facility of its kind, used by the Space Shuttle crew and space biomedical personnel to study ways to overcome the deleterious effects of space flight. This facility also is responsible for the KC135 research aircraft, used to test human performance ratings in zero gravity.

The Weightless Environment Training Facility was the final stop. Also in Building 29, it provides controlled neutral buoyancy in water to simulate zero gravity. It aids in the design, testing and development of spacecraft and crew equipment, and provides the astronauts with preflight training.

Industry Tour

Thirty participants of the Third National Space Grant Conference visited McDonnell Douglas at the Clear Lake Development Center in Houston, and Space Industries International, Inc., in League City, Texas.

McDonnell Douglas

The McDonnell Douglas Clear Lake Development facilities include the Avionics Development facility, where software development and testing is conducted; the Mobil Remote Manipulator facility, where astronauts will be trained, and which currently is in the Phase II stage of development; the Space Station *Freedom* Mission Build facility; the Hardware Flow facility, with responsibility for development, manufacture and testing of components; and the Flight Manufacturing facility, where development work was in progress.

Space Industries International, Inc.

Space Industries International, Inc., 10 years in operation, is a commercial space systems design, development and manufacturing company that produces low-cost products by utilizing simple, off-the-shelf materials where possible. At the same time, Space Industries International promotes a great deal of university interaction. The company conducts experiments in conjunction with the University of Alabama, University of Colorado, Pennsylvania State University, University of Michigan, Texas A&M University and Florida Atlantic University.

Commercial Experiment Transporter Facility

Conference attendees visited the Commercial Experiment Transporter facility, where experiment containers were being built. Containers for biological cell studies (plants and animals), protein crystal growth, and microgravity experiments were being constructed using off-the-shelf hardware. A commercial experiment transporter for plants and mice also was under construction.

Intelligence Systems Area

Software technology used to access, interpret and manipulate information is developed in this area, and has as its primary focus cost reduction and enhancement of space flight performance.

Currently, Space Industries International is looking at transportation options for the future, and life survival technology — extending the capability of the firefighting air pack, for example — and is currently developing an air pack with up to two hours of body cooling capability. This product has implications for chemical warfare, astronauts and firefighters.

Wake Shield Facility

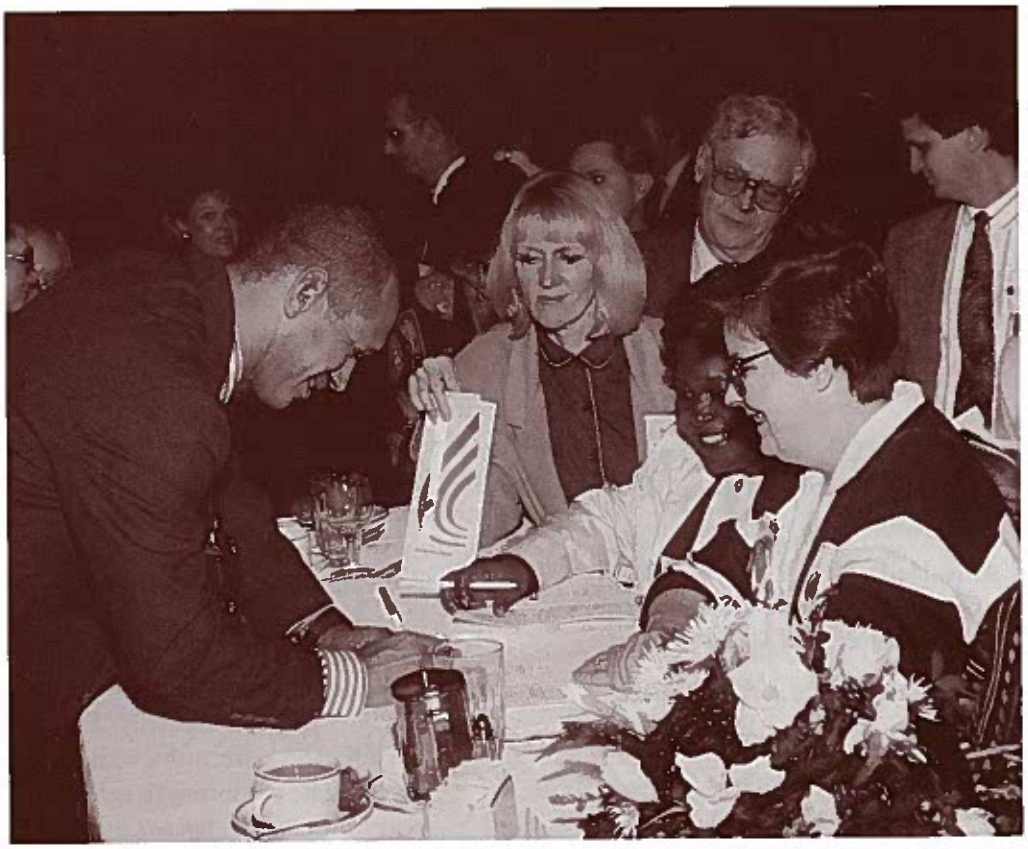
The free-flying Wake Shield Facility is a 12-foot diameter stainless steel disk. It will be the United States' first free-flying orbital experimental platform. Molecular beam epitaxy processing equipment is mounted on the ultra clean wake side, which opposes the orbital velocity vector during operation. It is designed to withstand at least six missions of up to three months duration and has been approved through NASA's Office of Commercial Programs* for flights in 1995 and 1996. Its inaugural flight is scheduled for autumn 1993. A Russian astronaut will be aboard.

*Now Office of Advanced Concepts and Technology

Keynote Banquet: "The Course of Human Spaceflight"

Colonel Charles F. Bolden, Jr., United States Marine Corps, is an astronaut at NASA Johnson Space Center (JSC) where he is training to fly in November 1993 as commander of STS-60 aboard the Space Shuttle *Discovery.*

Dr. Stanley Goldstein, Director, University Programs, JSC, introduced Bolden, after recognizing a host of Center personnel who were banquet guests. Bolden's talk, "The Course of Human Spaceflight," was illustrated with slides and video footage from his STS-45 *Atlantis* flight. The main scientific experiments deployed were part of the Atmospheric Emissions and Photographic Imaging satellite system, an early initiative in NASA's Mission to Planet Earth. Video and still photographs of Earth, featuring such landmarks as the Aral Sea, the Florida Keys and Mt. Pinatubo, were screened and discussed. Bolden concluded his presentation with an extended question and answer session.



Colonel Charles F. Bolden, Jr., United States Marine Corps

Aeronautics and Aviation Topical Group Organizational Meeting

Also on Tuesday, a group of state consortium representatives with an interest in aviation and aeronautics met. The intent of this meeting was to determine if interest in aviation and aeronautics was sufficient to warrant the formation of a topical group in these areas. In attendance were:

Dr. Anne Pierce, Connecticut Space Grant Consortium, University of Hartford

Dr. Ken Sivier, Aerospace Illinois Space Grant Consortium, University of Illinois

Dr. Wallace Sanders, Iowa Space Grant Consortium, Iowa State University

Ms. Leverne Seversike, Iowa Space Grant Consortium, Iowa State University

Dr. David Downing, Kansas Space Grant Consortium, University of Kansas

Dr. James Lookadoo, Kansas Space Grant Consortium, Pittsburgh State University

Ms. Helen Unruh, Kansas Space Grant Consortium, Kansas Cosmosphere and Space Center

Dr. John Wefel, Louisiana Space Grant Consortium, Louisiana State University

Dr. Joe Eisley, Michigan Space Grant Consortium, University of Michigan

Mr. Rich Heuermann, Missouri Space Grant Consortium, Washington University

Dr. Bill Hiscock, Montana Space Grant Consortium, Montana State University

Dr. Elaine McCoy, Nebraska Space Grant Consortium, University of Nebraska, Omaha

Dr. Alan Kelly, Oklahoma Space Grant Consortium, Oklahoma State University

Ms. Thelma Wallace, Oklahoma Space Grant Consortium, Langston University

Dr. LaDell Swiden, South Dakota Space Grant Consortium, South Dakota State University

Ms. Mary Sandy, Virginia Space Grant Consortium Office

Dr. Bob Ash, Virginia Space Grant Consortium, Old Dominion University

After discussion, participants concluded that sufficient interest exists to form an Aviation and Aeronautics Topical Group. It was further decided the Aviation and Aeronautics Topical Group had two immediate purposes:

1) To alert Space Grant program managers that there are significant interests and activities related to aviation and aeronautics within several state consortia. (It is hoped that future NASA Space Grant publications and presentations explicitly mention the interest in aviation and aeronautics. In summary, this topical group wants

to ensure that the first "A" in National Aeronautics and Space Administration be recognized as an integral part of the NASA Space Grant College and Fellowship Program); and,

2) To establish an organization that will aid in the coordination of activities and the exchange of information among state consortia having an interest in aviation and aeronautics.

It was proposed that an Aviation and Aeronautics Topical Group be formed. David R. Downing and Jim Lookadoo, from the Kansas Space Grant Consortium, agreed to serve as president and secretary, respectively. The Kansas Space Grant Consortium was charged with the following action items:

1) Prepare and distribute to the attendees a set of minutes of the January 12 meeting;
2) Notify NASA Headquarters program managers and the Directors' Council about the formation and plans of the Aviation and Aeronautics Topical Group;
3) Develop and distribute to all consortium directors a questionnaire to identify the aviation and aeronautics interests, activities and strengths of their consortium;
4) Compile and distribute the results of the above questionnaire no later than the next directors' meeting;
5) Establish an e-mail network for the Aviation and Aeronautics Topical Group;
6) Contact existing topical groups to determine the methods and procedures used; and,
7) Hold a meeting at the Directors' Council meeting to discuss organizational issues and plans for future activities.

The Journey: The Journey focuses the knowledge and fervor of the world toward a single, positive goal: the exploration and settlement of the solar system. Starting in Earth orbit from a space station, an international base camp in the foothills of space, the mission continues on to the Moon, where we learn to live on another celestial body. Finally, the Journey reaches Mars, where life might once have been or may still exist.

Capability Enhancement Breakfast

Twenty participants representing institutions in 13 states, NASA Marshall Space Flight Center and Headquarters took part in the breakfast meeting of representatives from NASA Capability Enhancement States.

Facilitator:

Dr. John Wefel, Director, Louisiana Space Grant Consortium

Report

At the first Capability Enhancement workshop at NASA Marshall Space Flight Center (MSFC), October 19-20, 1992, it was agreed that a "Capability Enhancement Group" should be established, since the states had considerable common interests and concerns. The meeting in Houston provided an opportunity to discuss common items and establish an initial agenda. There was discussion of: 1) the forthcoming NASA Experimental Program to Stimulate Competitive Research (EPSCoR) with a request from Ms. Elaine T. Schwartz, Chief, Higher Education, for the Capability Enhancement states to talk to her about their ideas or to send her written comments and suggestions; 2) commonality in programs; and, 3) the possibility for developing interstate collaborations in research areas. South Dakota presented a plan for a remote sensing thrust that would involve the EROS Data Center in Sioux Falls. Other states expressed interest in the remote sensing area. The results of the previous day's meeting to form an Aeronautics Group were mentioned since many of the Capability Enhancement states also have interests in this area. Aeronautics research and development may well be the "growth" area within NASA for 1993-94.

There was a realization that the Capability Enhancement states will be in competition with each other for whatever NASA EPSCoR-like research and development program is announced. Nevertheless, the participants felt that the states could still help each other. One strategy discussed was to identify "strong" and "developing" aerospace research and development programs in each state. Then, by forming some type of collaboration between a "strong" and one or more "developing" programs, the "developing" programs may be helped, while the "strong" program obtains new ideas and access to additional effort. (In a sense, this is like the National Science Foundation "clusters" approach to developing capabilities and personnel.) For this to work: 1) each state must take an "inventory" of its current capabilities and the interests of its researchers; 2) the information must be collated and formed into a database and all of the states must have access; and, 3) the states (or their researchers individually) will have to contact potential collaborators to see if there is common ground, or the group of Capability Enhancement directors could suggest "mergers" or "collaborations."

Some states have already completed the first task (Arkansas, for example, had such a report available at the meeting) while others are in the process. Louisiana Space Grant Consortium volunteered for the second part, to collate the information and look into establishing a database. The third aspect remains somewhat unfocused, but, in any event, must await the completion of the first two.

A Department of Energy EPSCoR request for proposals has been released and many of the states will respond. The NASA EPSCoR plan should emerge in the

near future. Coordination of the EPSCoR opportunities at the state level will be required in most states, and the Space Grant groups will need to become a part of, or work with, their state EPSCoR committee. However, the first two activities proposed are ones that need to be accomplished prior to a NASA EPSCoR proposal, so the effort will not be wasted.

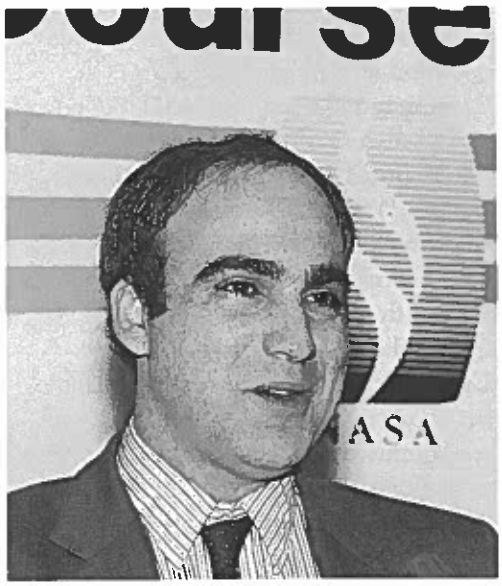
It also was agreed that meetings like the one at MSFC are very valuable and should be continued at other NASA Centers. (The next Directors' Council meeting is scheduled at NASA Lewis Research Center for September 10-11, 1993.)

Space Station Freedom: Research Opportunities

Mr. Barry Epstein, Program Manager for User Development, in NASA's Space Flight, Spacelab/Space Station Utilization User Integration Division, presented an illustrated talk on the Space Station program and how Space Grant universities might participate. He defined those who will be affected by Space Station activities as users, educators and the general public. Space Station personnel currently work and interact with personnel from the National Science Teachers Association, professional societies and educators in general.

Epstein's presentation was entitled "How to Get on Board Space Station *Freedom.*" He gave specific examples of many possible activities, especially those in the life sciences, advanced science and technical experiments, communications, and the acquisition of data for commercial use. He pointed out that many of NASA's 17 Centers for the Commercial Development of Space were engaged in preparation for Space Station activities and experiments.

Epstein's presentation concluded with an extended question and answer period.



Mr. Barry Epstein, Program Manager for User Development, in NASA's Space Flight, Spacelab/ Space Station Utilization User Integration Division

STS-40/SLS-1

Colonel Sidney Gutierrez, United States Air Force, told attendees that during 30 years of space flight, no studies of how the human body adapts to the space environment and to re-entry had been conducted by any country. STS-40, launched on June 5, 1991, and on which he was a pilot, was the first mission devoted solely to the study of the human body in space.

SLS-1 (Spacelab Life Sciences) was the culmination of 10 years preparation. During the mission, studies were performed on, among other things, the crew's cardiovascular, pulmonary, endocrine and neurovestibular systems. Researchers found that changes in the human heart occur in space, and that astronauts suffer muscle deterioration, and extreme loss of calcium. Calcium loss, Gutierrez noted, can cause space adaptation syndrome, manifested by malaise and a decrease in mental function.

Participants enjoyed a film of the mission, which was devoted to the human side of flying in space. As a result of SLS-1, many beliefs on how the human body adapts to space flight were found to be wrong, Gutierrez said. He called the crew, composed of medical doctors, scientists and pilots, one of the most educated NASA has ever flown in space.

After concluding his presentation, Gutierrez responded to a number of questions from the audience on topics such as how the crew trained to function as a team, difficulties that might be encountered on repair missions, and the dangers of radiation during space travel.

Art, Technology and the Space Frontier

Mr. Pat Rawlings of Science Applications International Corp. (SAIC), is one of the leading space artists in the United States. His paintings have been reproduced in hundreds of magazines and books, and been shown on television in both the United States and abroad. Rawlings addressed conference attendees with a spectacular slide show of select artwork he had created for NASA. Rawlings showed numerous slides of his depictions of a moon station, the Space Station, and exploration of Mars, among others.

Scientific and technical accuracy play an important role in his compositions. By contacting astronauts and experts in spacecraft design, mission design, mission operations, planetary geology, meteorology, and other related fields, Rawlings gives the viewer the sense of "being there." Rawlings likened himself to artists of the American frontier, saying images help people get beyond mere rationalization, motivating them toward exploration.

Rawlings designed the poster for the Third National Conference (page ii), which was given out to participants and which he signed. Depictions of his work can be found throughout this report.

Special Problems Involving the Recruitment and Retention of Hispanic Students in Science and Engineering

Dr. Diana Natalicio, President, University of Texas at El Paso, gave a personal and moving presentation during the final conference luncheon on the difficulties faced by Hispanic students in science and engineering. Throughout her talk, Natalicio stressed the theme that everyone has things they wish to do, but for which they are given no opportunity. She described her childhood desire to become a professional baseball player, and her countless encounters with the sentiment "but girls don't play baseball."

"At some point in the progression of life," she said, "there are road blocks to persons who are talented and motivated. These barriers are both direct and indirect, intentional and unintentional." Most are the result of cultural indoctrination.

Moreover, there is a very strong societal misconception, Natalico said, that the students who fail are the problem. She stressed that everyone loses when society "squanders" valuable resources, such as women and minority students. Such resources are lost, she asserted, through poor academic counseling, lower expectation levels on the part of administrators, misjudgments concerning academic limitations, dependence by school administrators on standardized score distributions, poor precollegiate counseling and the poor availability of resources. "The solution is to create conditions for success," she stressed.

Furthermore, she noted, "We should be celebrating academic accomplishments, not the speed with which they are attained." Nor should society be concerned with how people "measure up" to the standardized predictors of success.

Natalicio concluded her talk by emphasizing the economic benefits of investing in education. "In essence," she said, "this country spends more annual dollars on building prisons for an increasing number of inmates than for education. We should be investing in education, not paying for failure."

Underrepresented Groups: Special Focus on Hispanic Students

Facilitators:

Dr. Eugene H. Levy, Director, Arizona Space Grant Consortium; and, Dr. Juan Gonzalez, Director, Puerto Rico Space Grant Consortium

This discussion group was convened to focus on the challenge of recruiting, retaining and fostering the educational and career progression of students from underrepresented groups, with the emphasis on students from Hispanic backgrounds.

Panelist:

Ms. Sarita Brown, Assistant Dean and Director, Office of Graduate Studies, University of Texas at Austin

Participants were provided the following handout to facilitate discussion:

Proposition:

Hispanic students are among the most underrepresented of minority groups in undergraduate and graduate science and technology programs in the United States. It is clear that increasing the numbers of Hispanic students who see promise and opportunity for themselves in science and engineering — and who are academically prepared to pursue studies and careers in these directions — will require systematic and comprehensive strengthening of the educational enterprise that these students experience at all levels. It also may require efforts in other ways to expand the horizons of possibility and aspiration where Hispanic students contemplate and plan their futures.

This is a large challenge — one the Space Grant program, per se, given its currently severe limitations of resources and personnel, can only hope to influence in limited ways and for relatively small numbers of students on a national scale.

What specific ways can the Space Grant program — either individual consortia, regional associations, or the program overall — make positive contributions to the recruitment and academic success, as well as to the ultimate progression toward scientific and engineering careers, of Hispanic students? Are there specific contrasts among Hispanic cultural subgroups — for example, those from Puerto Rican, Cuban or Southwestern heritages — that might define significant differences in the most effective approaches to combat this problem?

Workshop Report

The proceedings began with introductory statements by Gonzalez and Brown.

Gonzalez focused on the experience at the University of Puerto Rico, which, having a student body where students from Hispanic backgrounds constitute a majority (98 percent), confronts its primary challenges in the areas of retention and career development. Gonzalez drew analogies between the relatively nascent Space Grant program and the much longer existing Sea Grant program at Puerto Rico. In Gonzalez's experience, the intensive focus on the ocean, which the Sea Grant program fostered, has had a large and salutary effect on the education and careers of

Dr. Diana Natalicio, President of the University of Texas at El Paso

University of Puerto Rico students — although it encountered early opposition from the Puerto Rico Department of Education.

Gonzalez described these efforts at the University of Puerto Rico as snowballing. Professionals, spurred by the marine sciences emphasis in the educational program, have emerged with Ph.D.s to become educators themselves. Many leave the island to work for NASA and other companies and institutions in the United States.

Puerto Rico also has put efforts into revitalizing the curriculum and to accelerating the progress toward obtaining Ph.D.s. Gonzalez showed charts illustrating the flow of talented precollege students (taught by teachers who had been trained in presenting the new curriculum) who moved into undergraduate work, participated in research, etc., (again taught under the new system curriculum), moving into graduate studies and then into professional roles. Gonzalez emphasized the important contribution that programs such as EPSCoR (Experimental Program to Stimulate Competitive Research), PRAMP (Faculty Enhancement at Undergraduate Institutions) and others, have made to vastly improve the education received by Puerto Rican students.

Gonzalez suggested that space, and the Space Grant program, can play a similar salutary role in the education of students from Hispanic backgrounds.

Brown related her experiences at the University of Texas where many Hispanic students are the first generation of college students in their families and come from financially and economically underprivileged circumstances. She pointed out that the term "Hispanic" codes for many different groups of people, and suggested that one must look at each university's regional demographics to determine just what the "Hispanic constituency" is. Many community colleges and small universities, for example, tend to have higher Hispanic enrollment and involvement. Brown urged Space Grant program personnel to seek out these institutions and provide support. She also pointed to campus offices of minority affairs, etc., as sources of help and expertise in shaping minority-directed programs. Brown emphasized the possible role of the Alliance for Minority Participation as a resource organization in helping with the development of recruitment strategies and to help build interinstitutional relationships in this area.

Brown also related a specific positive experience in the Texas mathematics department with the Emerging Scholar's Program, which allows students who show interest and exceptional ability in high school mathematics to enroll in an honors math class at the university level to ensure they continue to be challenged and interested in math at the college level. She suggested that many freshman-level math classes could result in instant "brain death."

Brown gave an amusing example of how lack of cultural sensitivity and under-

standing by a scientist can (unexpectedly) negatively influence Hispanic students: In a talk before a group of Hispanic students, one scholar bragged about the glamour of his career and how wonderful it was to be a successful scientist. He "strutted his stuff" about being important, and about the amount of international travel he did, and about how much time he spent away from home doing interesting things. He was surprised that the students were neither impressed nor interested in pursuing his line of work. They were more interested in, and committed to, remaining in their communities. So his attempt to excite them had exactly the opposite effect.

Finally, Brown emphasized the importance of developing the "pipeline" between community colleges and four-year universities. She described a program at the University of Texas, Austin, where university faculty are matched with community college faculty to help encourage students through two-year programs and into universities and, ultimately, graduate schools.

Points made in the open discussion

- The important benefits available by working with existing minority programs, program offices and staffs, such as Dean of Minority Student Affairs, etc.
- The "Mother-Daughter" project has been a useful approach to advancing education and career aspirations and school retention of young Hispanic women at the University of Texas. (In this project, young women are advised, mentored, and provided support services and skill training in a program that closely involves their mothers. Program includes monthly workshops, guest speakers, field trips, and training sessions for daughters and their mothers.)
- The impact of life-style issues on student aspirations, retention and success, for example, the quandary that some — especially female — students find themselves in when confronted with the opposition of significant others, spouses, or families, who may be resentful or jealous of their success and aspirations to break free from accepted female role patterns.
- The importance of role models and mentoring by "likes" with whom a student can identify.
- The importance of finding ways to support minority students outside the boundaries of "minority-oriented" programs, which may tend to stigmatize students and relegate them to a perception of being less inherently capable.
- The value of using Space Grant Graduate Fellows as mentors, recruiters, role models, and outreach participants, targeted to minority populations.
- The importance of recognizing that many of the problems minority and women students confront are emotionally challenging, and may deprive them of support from family and friends.
- The importance of establishing supportive one-on-one relationships.
- The importance of providing role-models: One participant related the impact of carrying her infant to work as a physics professor, and the value of such practices in expanding students' perceptions of what is possible and/or acceptable.
- The importance of overcoming a "group" mentality and recognizing students as individuals.

- Recommended reading: "Factors contributing to high attrition rates among science, mathematics, and engineering undergraduate majors: Report to the Alfred P. Sloan Foundation," Nancy M. Hewitt and Elaine Seymour, 1991. Published by: Ethnography and Assessment Research, Bureau of Sociological Research, University of Colorado, Boulder.

Undergraduate Training

Facilitator:
Dr. G. Jeffrey Taylor, Associate Director, Hawaii Space Grant Consortium

This workshop stimulated more than 50 attendees to focus on the role Space Grant programs can play in upgrading undergraduate curricula.

Workshop Report

Undergraduate training is a broad topic because it involves courses for science and engineering majors, research experiences (such as undergraduate fellowship programs), courses for future K-12 teachers (all fields, not just science), and courses for the general student body to promote science literacy.

Workshop participants agreed on the need for efficient information exchange. Some Space Grant programs are developing innovative courses and even whole curricula, and a mechanism is needed for sharing the ideas that work, including information on how the ideas were implemented. In short, what's needed is a clearinghouse of good ideas.

One way of establishing a clearinghouse is to use an electronic bulletin board. Another is to arrange for one of the Space Grant programs to take on the task of compiling the information. There need not be just one clearinghouse; rather, one with an engineering focus, another for planetary science and astronomy, and a third for teacher training, for example, could be developed. (No doubt others also are possible.) The clearinghouse would assemble the ideas into coherent packages and distribute them to all Space Grant programs and to NASA Headquarters. The advantage of this approach, when compared to electronic bulletin boards, for example, is that redundancies can be eliminated, producing more coherent reports. (They are not mutually exclusive, however.)

Two good ideas reported at the workshop illustrate the value of being able to share information. Treasure Brasher of West Texas State University reported that her university has instituted a science curriculum for nonscience majors. The program requires 12 credits of science courses. The other program is in place at Bemidji State University, a member of the Minnesota Space Grant Consortium. Its director, John Annexstad, described a minor in Space Studies.

The idea is to supplement a student's major field of study with an interdisciplinary minor that relates space-related fields to the student's major. The program consists of three required courses (12 quarter-hours): Planetology I and II, and Special

Problems, where students write a mini-thesis within the student's major field. Students also are required to take an additional 16 hours of electives chosen from a menu of courses in geography, geology, public policy, psychology, astronomy, meteorology and sociology. At least one of the electives must be in a nonscience or math course.

Those with experience in introducing curricular changes like these emphasized the importance of planning ahead and building a consensus among affected departments before announcing a new idea. By building coalitions first, most common turf battles and interdisciplinary rivalry can be avoided — or at least blunted. Annexstad pointed out that it is easier to establish a minor than a whole new major.

Industry participants noted that students need to be flexible to meet a rapidly changing job environment. Many engineers work on a certain type of project for a few years and then are assigned to something completely different. Thus, undergraduate training must provide a solid background in basic science, engineering and math. Along the same lines, Jim Jordan of Lamar University, a member of the Texas Space Grant Consortium, remarked that undergraduate programs do not include opportunities for students to be trained as technicians in industry, university or other research laboratories. At present, most students learn how to be technicians by working in a laboratory and building up expertise over the years. If their jobs change, however, they may not be prepared for the new challenges unless their undergraduate training was solid.

The workshop only briefly touched on the topic of courses for nonscience majors. E. Julius Dasch, NASA Space Grant Program Manager, and creator of "Rocks and Stars," a popular course at Oregon State University, noted that students think that science is beyond their grasp. While some science undoubtedly is, the whole subject can nevertheless be livened up with humor and scintillating guest speakers.

"Rocks and Stars" is a model for how teachers can reach numerous undergraduates and seize their attention. The course enrolled 748 students each time it was taught. (The enrollment was limited to 748 because that was the size of the largest classroom at Oregon State. Usually 1200-1500 students tried to take the course.) "Rocks and Stars" was popular because it was entertaining, fascinating and even "mind-blowing" to some students. It was promoted vigorously through the use of posters, displays and media attention.

"Rocks and Stars" was peppered with guest speakers, most of whom Dasch calls "barn burners." Two big-name speakers were brought in each year, with funds raised from private donators, including a pizza house. The mood for the course was set before each class started by music from "The Cosmos" series and music by composers and artists, such as Michel Jarre, Kitaro, Philip Glass and Fresh Aire, while timed slides showed space art by painters such as Bill Hartmann, Pat Rawlings and Don Dixon. "Rocks and Stars" was an extravaganza, but not without substance. It was fun, but not easy. It touched students and sparked their imaginations. That's what space education is all about.

Community College Initiatives

Facilitator:

Dr. Michael R. Dingerson, Director, Mississippi Space Grant Consortium

A group of 22 enthusiastic conference participants met to exchange ideas and information on collaborations with community colleges. Fourteen consortia were represented: Alabama, Arkansas, Colorado, District of Columbia, Illinois, Indiana, Maryland, Mississippi, Nevada, North Carolina, South Dakota, Tennessee, Texas and Virginia.

Panelists:

Dr. Armond T. Joyce, University Affairs Officer, NASA Stennis Space Center

Dr. Ann Lopez, Director of Instructional Programs, Community and Technical College Division, Texas Higher Education Coordinating Board

Dr. Glen Friedman, Associate Vice President for Institutional Advancement, University of Houston, Clear Lake

Ms. L.C. (Camille) Surber, Engineer, OSC Training and Crew Operations, Rockwell Space Operations Company, Rockwell International Corporation

Mr. Thomas D. Damon, Instructor, Dept. of Mathematics, Science and Health, Pikes Peak Community College

Workshop Report

This session was intended as an opportunity for those few four-year institutions with community college relationships to talk about their experiences so others could learn how to reach out to form active relationships. There were four active presenters in addition to the facilitator and one "volunteer" who represented a community college that is part of a Space Grant Consortium.

Joyce began the presentations with a report of a study designed to gather the information needed as a basis for developing a strategic plan for two-year institutions. It included the states of Mississippi, Louisiana and Alabama. The first goal of the study was to prioritize eight activities identified earlier as being of importance. These activities, in order of their perceived importance, are: 1) conduct a summer intern program for students; 2) implement a faculty enhancement program; 3) provide scholarships to promising students; 4) sponsor "classroom" science and engineering projects; 5) provide data, models, etc., for classroom and science literacy use; 6) encourage the development and/or improvement of curriculum and courses that take into account NASA program needs; 7) conduct tours, workshops and symposia at NASA Centers; and, 8) provide technical assistance for the implementation of information networks. Joyce cautioned against generalizing about these data, and noted that there was substantial variation between the three states in the study in terms of their relative priorities. In summary, he concluded that it is most important to know community college needs and desires before launching into a program.

Dingerson reported briefly about the Mississippi Space Grant effort. It is one of the few programs that has an active outreach effort to both regional universities, as well as community colleges. Although it

has just begun, the plan is to link each four-year research institution in the consortium with one regional university and one community college. The regional colleges have been provided with $6,000 each and the community colleges with $4,000 each to support efforts of mutual benefit and/or concern for the first year. The annual meeting will be used as a forum to discuss ways of improving and extending this effort.

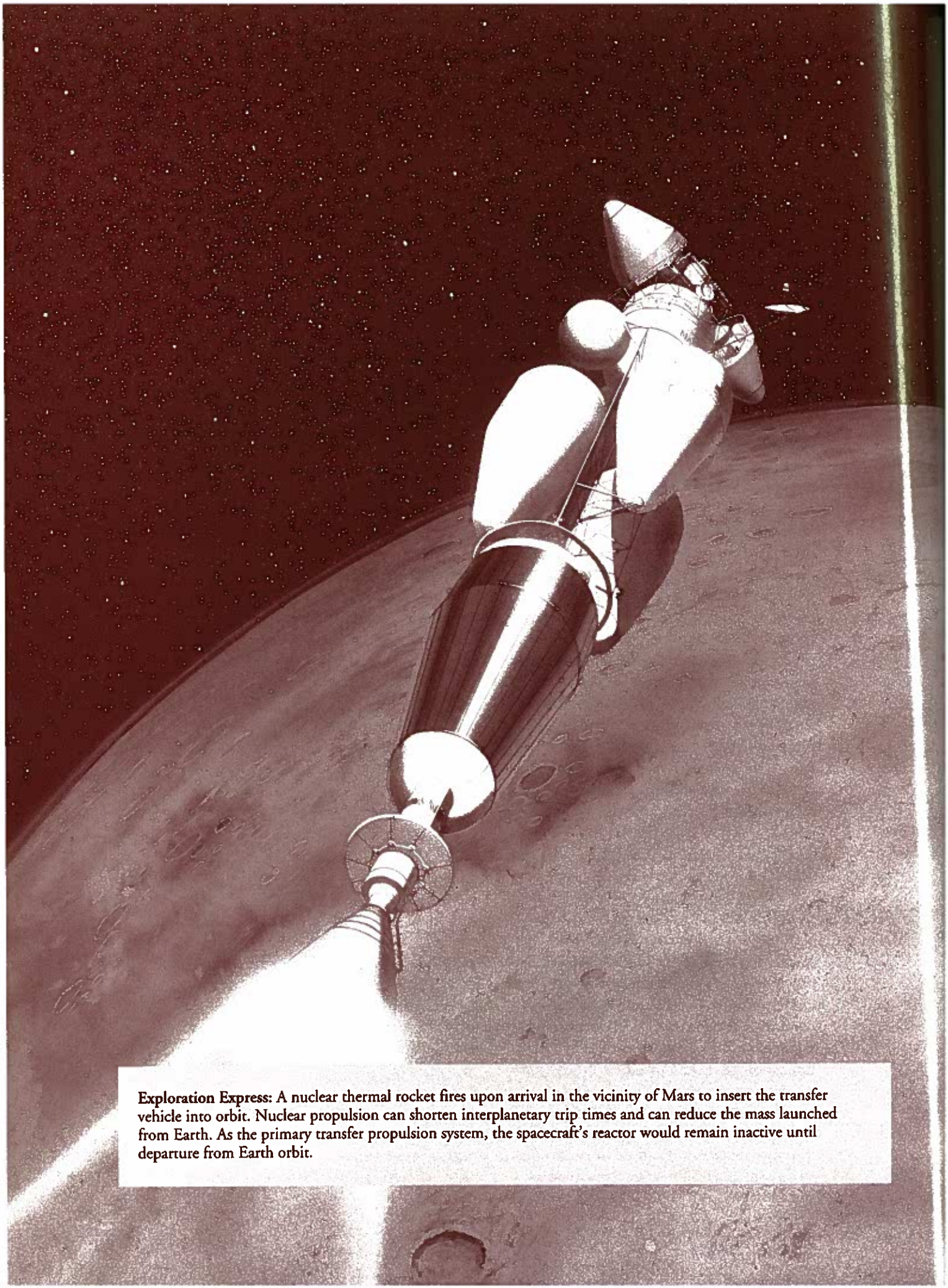
Lopez, Friedman and Surber have been recently working with a very active interchange that involves the Texas Board of Higher Education, the University of Houston at Clear Lake and Rockwell International as a NASA contractor. Their efforts are aimed at a broad range of aerospace technology programs and careers. Each has an obvious vested interest in the success of such an effort and each stressed the importance of communications to maintain a positive interaction. They also emphasized the importance of the associate degree graduate to the overall NASA program. Career areas such as flight design, data analysis, communications, electrical systems, data management and many others are critical to NASA's success.

The "volunteer" for this session was Damon from Pike's Peak Community College, a participant in the Colorado Space Grant Consortium. He reported on space education activities at Pike's Peak, particularly curriculum development efforts. He is the author of a 1989 work entitled *Introduction to Space: The Science of Space Flight*, published by Orbit Book Company, Inc., Post Office Box 9542, Melbourne, Florida, 32902-9542. This is a book manuscript of 320 pages "written as a textbook for an undergraduate liberal arts course, with or without mathematics."

It was clear from this session that community college efforts in the Space Grant Consortium context are few in number. However, there may be more aerospace education programs and courses being offered by community colleges than many in universities and colleges realize. A more concentrated outreach thrust from Space Grant Consortia and campuses, and continued discussions of these activities at Space Grant meetings, will likely benefit all involved communities.

Concluding Remarks

At the closing session, a number of workshop facilitators presented short summaries of their sessions, accompanied by comments from attendees. Discussion was followed by closing remarks from NASA Education Division Director Frank Owens, and Space Grant Program Manager E. Julius Dasch. Owens and Dasch thanked those present for their efforts in making the Third National Space Grant Conference a success.



Exploration Express: A nuclear thermal rocket fires upon arrival in the vicinity of Mars to insert the transfer vehicle into orbit. Nuclear propulsion can shorten interplanetary trip times and can reduce the mass launched from Earth. As the primary transfer propulsion system, the spacecraft's reactor would remain inactive until departure from Earth orbit.

LLOYD BENTSEN
TEXAS

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JOINT COMMITTEE ON TAXATION

United States Senate
WASHINGTON, DC 20510-4301

10 January 1993

Dr. Julius Dasch
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Ladies and Gentlemen:

Welcome to the third National Space Grant Conference. This conference and all of you have become important parts of a young and exciting program to improve America's science education and scientific literacy.

It's barely five years since Congress passed the Space Grant College and Fellowship Act that I crafted and introduced. But within this brief time more than 400 academic, industrial, and governmental institutions have joined in advancing the goals of that legislation. Last year, nearly 1,200 graduate and undergraduate scholarships were awarded, more than 40 percent of them to women and minorities, who deserve greater representation in halls of science education.

We've made a commendable beginning but only a beginning. Ahead lie generations of eager minds, an expanding spectrum of discovery, and yet-to-be-told benefits from the knowledge we acquire and apply. I hope the result of your conference is to renew your commitment to making that future possible.

Sincerely,

Lloyd Bentsen

Selected Biographies

Alan B. Shepard, Jr. (Rear Admiral, United States Navy, Retired)

Admiral Shepard received a Bachelor of Science degree from the United States Naval Academy in 1944, an Honorary Doctorate of Science from Miami University in Oxford, Ohio, and an Honorary Doctorate of Humanities from Franklin Pierce College. He began his naval career on the destroyer *Cogswell.* After serving in the Pacific during World War II, he entered flight training and received his wings in 1947. He subsequently served several tours aboard aircraft carriers in the Mediterranean.

In 1950, he attended the United States Navy Test Pilot School at Patuxent River, Maryland, and later participated in flight test work. He was assigned to Fighter Squadron 193 at Moffett Field, California, a night fighter unit flying *Banshee* jets. As operations officer of this squadron, he made two tours to the western Pacific on board the carrier *Oriskany.*

After returning to Patuxent, he served in numerous capacities, including test pilot and flight instructor. He has logged more than 8,000 hours flying time, 3,700 in jet aircraft.

Shepard was one of the *Mercury* astronauts and holds the distinction of being the first American to journey into space. In 1963, he became chief of the Astronaut Office with responsibility for monitoring the coordination, scheduling, and control of activities involving NASA astronauts.

Shepard made his second space flight as spacecraft commander on *Apollo* 14, the third lunar landing mission. He has logged just under 217 hours in space, of which nine were spent in lunar surface extravehicular activity.

He resumed his duties as chief of the Astronaut Office in June 1971 and served in this capacity until he retired from NASA and the Navy on August 1, 1974. He currently is in private business in Houston, Texas.

Charles F. Bolden, Jr. (Colonel, United States Marine Corps)

Colonel Bolden received a Bachelor of Science degree in electrical science from the United States Naval Academy in 1968, and a Master of Science in systems management from the University of Southern California in 1977. Upon graduating from the Naval Academy, Bolden accepted a commission as second lieutenant in the Marine Corps. He underwent flight training at Pensacola, Florida; Meridian, Mississippi; and Kingsville, Texas; before being designated a naval aviator in May 1970. He flew more than 100 sorties into North and South Vietnam, Laos, and Cambodia, in the A-6A *Intruder.* Upon returning to the United States, Bolden began a two-year tour as a Marine Corps officer, followed by three years in various assignments at the Marine Corps Air Station, El Toro, California. In June 1979, he graduated from the US Naval Test Pilot School at Patuxent River, Maryland, and was assigned to the Naval Air Test Center's Systems Engineering and Strike Aircraft Test Directorates. While there, he served as an ordnance test pilot and flew numerous test projects.

He became an astronaut in August 1981. His technical assignments include: Astronaut Safety Officer; Technical Assistant to the Director of Flight Crew Operations; Special Assistant to the Director of the Johnson Space Center; Astronaut Office Liaison to the Safety, Reliability and Quality Assurance Directorates of the Marshall Space Flight Center and the Kennedy Space Center; Chief of the Safety Division at Johnson Space Center; and lead astronaut for Vehicle Test and Checkout at Kennedy Space Center.

Colonel Bolden is a veteran of three space flights, most recently as commander of a crew of seven on STS-45, aboard the Space Shuttle *Atlantis.* Launched March 24, 1992, STS-45 was the first Spacelab mission dedicated to NASA's Mission to Planet Earth.

Colonel Bolden has logged more than 5,000 hours flying time, and over 481 hours in space.

His many honors include the NASA Exceptional Service Medal, the NASA Outstanding Leadership Medal and the Defense Superior Service Medal.

Sidney M. Gutierrez (Lieutenant Colonel, United States Air Force)

Colonel Gutierrez became an astronaut in 1985. He first served as commander for the Shuttle Avionics Integration Laboratory (SAIL), flying simulated missions to verify Shuttle flight software. He later served as an action officer for the Associate Administrator for Space Flight at NASA Headquarters. His duties included coordinating requests from the Presidential Commission and the Congress during the investigation of the *Challenger* accident. Gutierrez subsequently participated in the recertification of the Space Shuttle main engines, main propulsion system, and external tank. In 1988, he became the Astronaut Office lead for Shuttle software development, verification, and future requirements definition, and in 1990, supported five launches.

Most recently Gutierrez served as pilot on STS-40 Spacelab Life Sciences (SLS-1), a dedicated space and life sciences mission, which launched from the Kennedy Space Center on June 5, 1991. SLS-1 was a nine-day mission during which crew members performed experiments that explored how humans, animals, and cells respond to microgravity and re-adapt to Earth's gravity on return. Other payloads included experiments designed to investigate materials science, plant biology, and cosmic radiation. With the completion of this flight, Gutierrez logged over 218 hours in space.

Currently he serves as a spacecraft communicator for Shuttle flights, the voice link between the flight crew and Mission Control Center.

Gutierrez graduated from Valley High School, Albuquerque, New Mexico. After graduating from the Air Force Academy, where he received a bachelor of science degree in aeronautical engineering, Gutierrez completed undergraduate pilot training at Laughlin Air Force Base, Del Rio, Texas. He remained there as a T-38 instructor pilot from 1975 through 1977. He went on to attend Webster College, where he received a master of arts degree in management. In 1978, he was assigned to the 7th Tactical Fighter Squadron at Hollomon Air Force Base, Alamagordo, New Mexico, where he flew the F-15 *Eagle*. He attended the United States Air Force Test Pilot School in 1981 and was assigned to the F-16 *Falcon* Combined Test Force after graduation.

Gutierrez is a member of the Society of Experimental Test Pilots, the Air Force Association, and the United States Air Force Academy Association of Graduates, and has been accorded the following honors and awards: Distinguished Graduate of the United States Air Force Academy, Defense Superior Service Medal, Air Force Meritorious Service Medal, Air Force Commendation Medal with one Oak Leaf Cluster, two Air Force Outstanding Unit Awards, National Defense Service Medal, and Air Training Command Master Instructor.

He has logged approximately 4,000 hours flying time in approximately 30 different types of airplanes, sail planes, balloons, and rockets.

Diane Natalicio (President, University of Texas at El Paso)

Dr. Natalicio received a Bachelor of Science degree in Spanish from St. Louis University in 1961. She received a masters degree in Portuguese (1964) and a doctorate degree in linguistics (1969) from the University of Texas at Austin. After serving as a research assistant at the Center for Communication Research at the University of Texas at Austin, she joined the faculty of the University of Texas at El Paso in 1971. In addition to her teaching responsibilities in the Departments of Linguistics and Modern Languages, Natalicio has served as Chairman of Modern Languages, Associate Dean and Dean of Liberal Arts, Vice President for Academic Affairs, Interim President, and finally, President since 1988.

Natalicio has written numerous professional books, monographs, articles, and reviews in the field of applied linguistics. She has participated in many professional and civic activities, including the Society of International Business Fellows, Texas Business and Education Commission, American Council on Education's Commission on Women in Higher Education, the Hogg Foundation Commission on the Mental Health of Adolescents and Young Adults, and Leadership El Paso.

Natalicio has served as a member of the El Paso Branch of the Federal Reserve Board, Chair-Elect of Historically Black Colleges and Universities/Minority Institutions' Environmental Technology and Waste Management Consortium, as well as a Director of the National Physical Science Consortium, the Chihuahuan Desert Research Institute, KCOS public television, El Paso United Way, El Paso Chamber of Commerce, and a member of the National Science Foundation's Committee on Equal Opportunity in Science and Engineering.

Natalicio was named Alumna of the Year by Leadership El Paso and Woman of the Year by the El Paso Women's Political Caucus. She received the Torch of Liberty Award from the Anti-Defamation League of B'nai B'rith, the Conquistador Award from the City of El Paso for Outstanding Service to the Citizens of El Paso, the Humanitarian Award from the El Paso Chapter of the National Council of Christians and Jews, and, for outstanding contributions to the community, an award from the Mexican American Bar Association. She is a member of the Philosophical Society of Texas and the El Paso Women's Hall of Fame, and was recently nominated to the Texas Women's Hall of Fame. Most recently she was appointed to the Advisory Commission on Educational Excellence for Hispanic Americans by former President George Bush.

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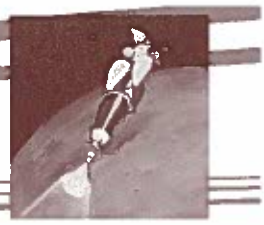

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