THE EVENT

The event, Partnership Award for the Integration of Research into Undergraduate Education (PAIR) Summit, was held on November 3, 5 and 6, 2002 in Leesburg, Virginia. This event brought together approximately 200 students and faculty from across the country and was sponsored by the NASA Office of Equal Opportunity Program, Minority University Research and Education Division (OEOP MURED). This is the first annual PAIR Summit and was hosted by the following PAIR Institutions:

- California State University Northridge
- City University of New York City College
- Clark Atlanta University
- Hampton University
- Norfolk State University
- North Carolina A&T State, University
- South Carolina State University
- Tuskegee University
- University of New Mexico
- University of Puerto Rico at Mayaguez

The event was facilitated by the University of Puerto Rico at Mayaguez and its purpose was to integrate cutting-edge NASA-related research into the undergraduate educational experience, to strengthen teaching and research strategies across academic programs and to enhance collaboration among Mathematics, Science, Engineering, and Technology (MSET) academic departments, thereby strengthening the MSET baccalaureate degree-producing capacity of a number of the nation's HBCU's and OMU's which include Hispanic Serving Institutions (HIS's) and Tribal Colleges and Universities (TCU's). The PAIR program provides an opportunity for these institutions to build upon their NASA-sponsored and NASA-related research across academic disciplines by creating innovative
approaches to the inter-disciplinary study of math, science, engineering, and technology (MSET).

This summit provided NASA PAIR Institutions the opportunity to:

- Share best practices in advancing minority students into MSET careers.
- Expose Students to NASA Enterprises and varied workforce opportunities (Internship, Co-op, and Full-time employment).
- Expose MSET Faculty to collaborative/funding opportunities within NASA Enterprises.
- Facilitate collaborative activities between NASA Enterprises and Minority Institutions.
- Provide diverse options to the NASA workforce team.
- Expose participating students and NASA representatives to Graduate Studies in MSET areas at MI's.

In addition to PAIR Institutions, other minority institutions participated and played an important role in NASA PAIR Summit. Those institutions are part of The Curriculum Improvement Partnership Award (CIPA) Program, which provides a unique opportunity for NASA to interact and collaborate with institutions that serve highly talented student communities. Their mission is to increase the quality of NASA-related mathematics, science, engineering and technology curricula, increase the number of minority students at the pre-collegiate and collegiate levels involved in this curriculum, and increase the number of minority students that choose careers in NASA-related fields. CIPA awards are made to institutions that have received limited funding from NASA and to date 28 grants to minority institutions has been awarded. The CIPA institutions that participated were:

- **Albuquerque Technical Vocational Institute** *Albuquerque, NM*
- **Allen University** *Columbia, SC*
- **Arizona Western College** *Yuma, AZ*
- **Bay Mills Community College** *Brimley, MI*
- **Cheyney University** *West Chester, PA*
- **Essex County College** *Newark, NJ*
- **Ft. Valley State University** *Ft. Valley, GA*
- **Harold Washington College** *Chicago, IL*
- **Hartnell College** *Salinas, CA*
- **John Jay College/CUNY** *New York, NY*
- **Keweenaw Bay Ojibwa Community College** *Baraga, MI*
- **Miles College** *Fairfield, AL*
• New York City Technical College/CUNY New York, NY
• North Carolina Central University Durham, NC
• Northeastern Illinois University Chicago, IL
• Paine College Augusta, GA
• Paul Quinn College Dallas, TX
• Rust College Holly Springs, MS
• San Jacinto College North Houston, TX
• Sinte Gleska Rosebud, SD
• Southeastern University Washington, DC
• St. Philip's College San Antonio, TX
• Stone Child College Box Elder, MT
• Universidad Interamericana de Puerto Rico Barranquitas, PR
• Universidad Metropolitana San Juan, PR
• Universidad Politécnica San Juan, PR
• Wiley College Marshall, TX

This PAIR Summit had an agenda full of different activities from presentations, keynote addresses, exhibits, presentations, workshops, cultural activities, seminars, student poster presentations where each of the ten PAIR Institutions exhibited two posters that were judged by a team of NASA Enterprise representatives under the chairmanship of General Spence M. Armstrong, Senior Advisor to the NASA Administrator. Several posters were awarded.

Students participating in all PAIR Programs have a great opportunity to enhance their future due to the benefits offered through those programs educating students on new technologies and encouraging research.

INTEGRATING RESEARCH INTO THE CURRICULUM

This Summit also held several sessions that included roundtable discussions with NASA Enterprises and best practices sessions that intended to identify and evaluate existing problems, give information to institutions, make presentations of the development and implementation of PAIR Program’s strategic plans, and offer suggestions to institutions to improve their NASA-related programs. The NASA Enterprises that were involved in these discussions were: Aerospace Technology, Biological and Physical Research, Earth Science, Human Exploration and Development of Space, and Space Science;

According to Mariana Triviso, from MURED, the accreditation of PAIR curriculum is a major concern for minority institutions with NASA-related programs. According to participants, NASA can play an influential role in the accreditation process of establishing the PAIR curriculum as a minor or a
certificate. The faculty that collaborate and educate the students participating in these programs restated the importance of PAIR courses. These courses as credential courses are tools to encourage student’s interest and participation through the accomplishment of a minor or certificate. In order to accomplish this goal, is necessary that colleagues use best practices by integrating PAIR modules across curriculum.

Education to other universities is also needed regarding the modules. These modules can be shared in order to inspire professors to use teaching approaches used in PAIR course work to motivate students to become excited about using hands on research so they will continue study in SMET course work.
In pursuing its goal, the Center for LIDAR and Atmospheric Science Students (CLASS), take some initiatives to encourage research through U.S. students who are underrepresented in NASA–related technology. One of these mechanisms is the recruitment through the Introductory Physics course where the best students are educated in these technologies and get interest in specific areas. They are offered the opportunity to do research and get deep on a specific theme. In that process, an intensive one-on-one interaction between students and scientists is provided.

CLASS has some mechanisms to pursue its goal:

- Educating students in atmospheric science, physics, & lidar-related technologies by integrating modules into existing courses and developing new courses
- Providing professional interaction with scientists and engineers from government and industry
- Forming a core student team receiving in-depth training in atmospheric science and lidar
- Training the team to design, build, test and maintain a portable, scanning, eyesafe lidar
- Training team members to propose, and perform experiments with that instrument
- Training team members to analyze, interpret, and report the experimental results
- Integrating the results of the lidar team’s project into the modified curriculum
- Conducting outreach to K-12 through demonstrations, joint experiments, web-based learning exercises and participation in the activities of the student lidar team
- Providing faculty development workshops to assist faculty in integrating NASA-related technology into their courses and/or developing entirely new courses.

The University has an eight week summer program on LIDAR, as well as other research programs and seminars. Students are provided with equipment, like notebooks, to do their research reading, scientific papers and to prepare their presentations at conferences and for demonstrations to K-12 students.
The BEST Lab (Bringing Education & Science Together) is Norfolk State University's Center of Excellence in Science Education. BEST Lab faculty and students are drawn from academic departments across the Schools of Science & Technology and Education. The mission of the lab is to enhance the teaching and learning of science through innovative technology and research based pedagogy. **MiLEN²UM (Mission Leveraged Education):** NSU/NASA is an effort to create an innovative approach to train students in NASA-related fields.

The BEST Lab goals are:

♦ To enhance student success in undergraduate mathematics and science courses through research into student learning.

♦ To assist in the preparation of future teachers for inquiry-based teaching of science in a technology-infused curriculum.

♦ To provide campus leadership in the evaluation and implementation of instructional technologies.

♦ To investigate the use of scientific visualization techniques for research and learning.

To attain these goals, the following objectives have been identified for BEST Lab projects:

♦ Maintain a state of the art facility for instructional technology and science education research.

♦ Provide specialized training opportunities for faculty, staff and students in the latest pedagogical and technological innovations.

♦ Involve faculty in the testing and development of multimedia courseware.

♦ Improve the attitudes towards science of non-science majors.
At the University of New Mexico, the PURSUE Program (Preparation for University Research of Students in Undergraduate Education), has been established in conjunction with two universities, the University of New Mexico and New Mexico Highlands University; two 2-year community colleges, Southwestern Indian Polytechnic Institute and Albuquerque Technical Vocational Institute; and two K-12 institutions, Bernalillo High School and Montezuma Vista School.

PURSUE includes all five School of Engineering Departments and its grant allows undergraduate students to work with state-of-the-art NASA-related technology, thus preparing them for careers in NASA-related fields. PURSUE has led to a great number of improvements in the MSET curricula at UNM through hands-on research in a peer-and-mentor supported environment for undergraduates. Undergraduate students receive the opportunity to work directly with industry and NASA researchers on projects that incorporate NASA-related research. The program stresses a professional approach to the student research project by requiring the following: student submitted proposals; the use of project management skills; written reports; publications; and presentations.

A Student Studies the Optical Properties of Semiconductors and Superlattices
The University of Puerto Rico at Mayagüez (UPRM) has established the **Partnership for Spatial and Computational Research (PaSCoR)**. The main goal of this 5-year project is to strengthen academic programs and integrate research at the undergraduate level in various science, math and engineering/technology (SMET) disciplines, following the strategy of the Learning Factory model implemented by the NSF Manufacturing Engineering Education Partnership. PaSCoR program is outcomes-based and student centered, focused on hands-on learning activities provided throughout the student’s academic career. The program’s outcomes are a SMET graduate that is knowledgeable of the technology and applications of remote sensing (RS), geographical information systems (GIS), their applications and, possesses the necessary skills either to enter graduate school or becomes a professional in these areas with success. The program also aims at developing values such as diversity, teamwork, global awareness and communication. PaSCoR goals are achieved through five tasks, namely: 1) curriculum development, 2) undergraduate research & student mentoring, 3) industry collaboration, 4) outreach, and, 5) assessment.

Students from various SMET colleges and departments at UPRM (Agricultural Sciences, Biology, Geology, Electrical & Computer Engineering, Civil Engineering, and Mathematics) earn a certificate in RS/GIS upon completion of 12 credit-hours in course work and 6 credit-hours in undergraduate research.

Currently, there are ten faculty members involved in student mentoring and course innovation/development, more than 38 students engaged in undergraduate research, and around 968 students taking RS/GIS-related courses. PaSCoR students have spent summers learning about RS-GIS and developing leadership skills in sites such as USGS, NASA, US Army, University of Illinois, IBM, Boeing, EPA, Puerto Rico Planning Board, National Security Agency, ATNET, and Howard University. More than 73 papers and presentations have helped disseminate this curriculum model in local, national and international forums.
At Clark Atlanta University, the Education in the Area of Earth System Science (ESS,) was created to guide and manage the challenges of today’s technology through student’s education. To pursue this goal, the students interested participate in interviews with PAIR scientists, administrators and former students, and then a group of students is selected. Once hired, these students are treated as colleagues and as “professionals-in-training”. Students are trained in research skills, technical writing, making presentations to their peers and participate on field trips.

Six objectives guide their efforts to provide undergraduate students with the knowledge and skill base needed to actively participate in research that incorporates NASA data and remotely sensed measurements of the atmosphere:

1. To teach instructors how to design, organize and deliver the content of earth systems science using experiential teaching;

2. To modify existing physics, mathematics, statistics, computer science, chemistry, and earth system science courses to include case and field studies that employ remotely sensed measurements of Earth's components;

3. To develop six new ESS courses;

4. To use technology as a mechanism to complement, reinforce, and extend students' understanding of earth systems science concepts;

5. To demonstrate and document the enhanced motivation and academic success of students; and

6. To replicate the PAIR framework at institutions with similar missions.

Research assistants start out with literature searches and then are involved in team investigations where they have individual responsibilities. To guide research and encourage individual thinking, the research assistants are provided with measurable objectives and deadlines to submit progress reports of their investigations. During the entire process, the program fosters relationships with scientists, industry, research centers and other institutions. Also, the element of K-12 outreach is advocated through Olympiads, science fairs and high school seminars.
The PAIR program established at North Carolina Agricultural and Technical State University looks for the improvement of the undergraduate education in the areas of science, technology, engineering and mathematics. The program recruit on average forty (40) students per semester and the research training for them is conducted through four different programs:

- Apprentice Program
- Developer Service Award
- Sophomore Shadow
- Independent researcher

The program’s objectives are to:

1. Enhance core-courses in the MSET curriculum though the development of portable learning modules, inspired by NASA-sponsored research;

2. Upgrade core-engineering laboratories to complement upgraded MSET curriculum and its appropriate teaching modules, and develop new undergraduate laboratory for multidisciplinary dynamic systems and instrumentation; and

3. Conduct research training for undergraduate in MSET disciplines through a sophomore shadow program with interaction among teaching and research faculty and through Research Experience for Undergraduate (REU) programs.

The University also has a Summer Undergraduate Research (SURE) program of eight weeks that allow students to get involve with research projects and a visit to NASA Research Center. These projects are divided according to NASA enterprises.

This PAIR program results on students researchers pursuing graduate studies and writing research papers.
The NASA Partnership Award links City, Medgar Evers, Hunter Colleges, and LaGuardia Community College of the City University of New York (CUNY) with the Goddard Institute for Space Studies (GISS) with a Program in Remote Sensing and Environmental/Climate Studies that offers undergraduate students a multidisciplinary core program combining mathematics, science, engineering and technology courses and research training. It was funded under the NASA/CUNY Partnership Agreement for the Integration of Research.

The Program focuses on the development of skills and knowledge in Remote Sensing and Environmental/Climate Studies. Research topics include atmospheric remote sensing, climate research, environmental chemistry, land use/land cover impacts, scientific computing, image processing, and spatial analysis.
NASA is supporting the PAIR Program *California State University, Northridge (CSUN)*, in partnership with the *Jet Propulsion Laboratory (JPL)* and *Huntington Medical Research Institute (HMRI)*, guided by Dr. Carol Shubin and Dr. Edward Carroll. Their purpose is to attract, retain and expand research experiences for underrepresented students in MSET disciplines.

The Program’s mission is:

1. Attract and retain minority students in SMET disciplines.
2. Improve SMET students’ analytical and computer skills.
3. Give SMET students an experience working with NASA data sets.
4. Increase the number of minority students interested in pursuing graduate careers in science and mathematics.
5. Publish a workbook of projects appropriate for undergraduates on the topics covered in our four new data analysis courses and seminars.

Participating students are able to:

- Perform manipulations requisite for statistical analysis on complex data,
- Build deterministic and stochastic models,
- Gain experience with software packages such as Matlab, Mathematica, and Excel, and
- Clean dirty or noisy data.

Participating in CSUN/JPL PAIR Program, students are provided with many opportunities including the preparation for graduate school.
The mission of the Tuskegee University NASA/PAIR project is to increase the production of competitively trained minority graduates with superior competence in NASA-related environmental science, engineering, and technology disciplines through research-enhanced curriculum delivery.

The project is currently being executed through five major project activity areas: (1) strengthen the institutional engineering and science infrastructure for the integration of research into undergraduate training in NASA-related science and engineering fields, (2) increase the quality and competitiveness of minority graduates in MSET, (3) nurture undergraduate students from their freshman year in order to develop in them analytical, independent study, and critical thinking skills, (4) produce MSET graduates who are better prepared for advanced studies and careers in MSET and NASA related fields, and (5) enhance the recruitment and retention of minorities in science, engineering and technology fields of relevance to NASA activities.

At Tuskegee University, the new courses developed for the program have been adopted as an integral part of the Chemical/Environmental engineering program, and the courses are offered and taught regularly. On-going research and experiments associated with the courses enable them to be updated. Equipment acquired with PAIR funds ensure that research experiments are carried out at a state of the art level.
The SCSU PAIR project links three academic departments: Physical Sciences, Industrial and Electrical Engineering Technology, and Mathematics and Computer Science. These departments have implemented inter-disciplinary student research projects that introduce current methods and recent discoveries in science and technology into the curriculum through the application of space science concepts data. Each research team work together for and entire year on a space science project, developing skills for graduate school or employment through opportunities that are not available under the existing curriculum.

Faculty members supported under PAIR are using unique and innovative approaches to curriculum development. They have created new, inquiry-based laboratory exercises for non-science majors. They have also introduced the metacognitive tool known as the Concept Map into science courses for teachers as well as upper level courses in physics.

Numerous student and faculty presentations have been made at state, regional and national conferences.
Throughout the PAIR Summit, there were several addresses made to the attendees. Here are a few biographies of key speakers.

**Frederick D. Gregory**  
*NASA Deputy Administrator*

Frederick D. Gregory was sworn in as NASA’s Deputy Administrator on August 12, 2002. He serves as the chief operating officer for the agency and reports directly to Administrator Sean O’Keefe. He is responsible for directing and managing many of the programs as well as the day-to-day operations and activities at NASA.

He had previously served as Associate Administrator for the Office of Space Flight. He began serving in this position, in an acting capacity, in December 2001. He was selected permanently in February 2002. He was responsible for overseeing the management of the International Space Station; Space Shuttle operations; Space Access using Expendable Launch Vehicles for commercial launch services; Space Communications; and Advanced Programs.

From June 1992 to December 2001, Mr. Gregory held the position of Associate Administrator, Office of Safety and Mission Assurance, at NASA Headquarters. As Associate Administrator, he was responsible for assuring the safety, reliability, quality, and mission assurance of all NASA programs.

Mr. Gregory has extensive experience as an astronaut, test pilot, and manager of flight safety programs and launch support operations. As a NASA astronaut, he logged 455 hours in space: as pilot for the Orbiter Challenger (STS-51B) in 1985, as spacecraft commander aboard Discovery (STS-33) in 1989, and as spacecraft commander aboard Atlantis (STS-44) in 1991. Mr. Gregory served in several key positions as an astronaut, including Astronaut Office Representative at the Kennedy Space Center, for the first Space Shuttle flights (STS-1 and STS-2); lead Capsule Communicator (CAPCOM); Chief, Operational Safety at NASA Headquarters; and Chief, Astronaut Training. He also served on the Orbiter Configuration Control Board and Space Shuttle Program Control Board.
Bernard Harris, M.D.
Former NASA Astronaut

Dr. Harris began his formal education by earning a Bachelor of Science in Biology from the University of Houston. He obtained his Doctorate of Medicine from Texas Tech University School of Medicine in 1982, and completed a Residency in Internal Medicine at the Mayo Clinic in 1985. In addition, Dr. Harris completed a National Research Council Fellowship in Endocrinology at the NASA Ames Research Center in 1987, and trained as a Flight Surgeon at the Aerospace School of Medicine, Brook Air Force Base in San Antonio, Texas in 1988. In 1996, he received a Master of Medical Science from the University of Texas Medical Branch at Galveston and received an Honorary Doctorate of Science from Morehouse School of Medicine. Dr. Harris earned a Master of Business Administration (MBA) from the University of Houston in 1999.

While working on his fellowship at the Ames Research Center in 1986, Dr. Harris conducted research in the field of musculoskeletal physiology and disuse osteoporosis. Later, as Project Manager of the Exercise Counter measure Project, he conducted clinical investigations of space adaptation and developed countermeasures for extended duration space flight at the Johnson Space Center.

Selected by NASA in January 1990, Dr. Harris became an astronaut in July 1991. He was a Mission Specialist on the Space Shuttle Columbia STS-55/Spacelab D-2, (April 26 to May 6, 1993), marking the Shuttle's one year of total flight time. As Payload Commander on the Space Shuttle Discovery STS-63 (February 2-11, 1995), the first flight of the joint Russian-American Space Program, Dr. Harris accomplished his childhood dream by completing his first walk in space. A veteran of space for over nine years, he has logged more than 438 hours in space and traveled over 7.2 million miles.

Dr. Harris has served as Vice President, SPACEHAB, Inc., where he was involved in business development and marketing of the company's space-based products and services. He also was Vice President of Business Development for Space Media, Inc., establishing an international space education program for students. In addition, he is a member of the board of some of the leading technology companies in the world.
Participants from the University of Puerto Rico at Mayagüez and the Chancellor.

Summit conference at The National Conference Center on Leesburg, Virginia.
Students preparing their posters for the competition

Students had the opportunity to take home a photo of themselves as NASA astronauts.
Students exhibiting their posters at the competition

Students worked hard on their investigations and here are the results of their effort.
Also, students had the chance to interact with scholars, scientists and an astronaut. They shared their research experiences and interests.
Student **Miguel Román** from the University of Puerto Rico at Mayagüez won the first place at the poster competition. He represented the **PaSCoR Program**.

**Luis J. Olivieri-P1, Dr. Ramón Vásquez-CoPI, and Dr. Jorge I. Vélez Arocho-Chancellor of the University of Puerto Rico at Mayagüez** with the group of students who competed for the **PaSCoR Program**.
Here are snapshots of the first NASA PAIR Summit 2002

To see more photos, please find the folder attached to this compact disc.