NASA/CP—1999–209204

Materials Presented at the MU-SPIN Eighth Annual Users' Conference

Sponsored by NASA's Office of Equal Opportunity Programs
Minority University Research and Education Division

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Proceedings of a Conference Held at
Southwestern Indian Polytechnic Institute
and the DoubleTree Hotel
Albuquerque, New Mexico
October 20–23, 1998

"Strengthening Partnerships Between Tribal and Non-Indian Institutions"

National Aeronautics and
Space Administration

Goddard Space Flight Center
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April 1999

Available from:

NASA Center for AeroSpace Information
7121 Standard Drive
Hanover, MD 21076-1320
Price Code: A17

National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
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Conference Summary

James Harrington
Project Manager

The goal of NASA's many outreach programs is to promote to the general public an understanding of how NASA makes significant contributions to American education systems and to institutions dedicated to improving science literacy. This newsletter provides one vehicle for reporting how applications and hardware used for space science and other NASA research and development can be adapted for use by teachers and their students and by non-NASA organizations.

Report on MU-SPIN's Eighth Annual Conference

James Harrington, Jr., and Valerie L. Thomas, Minority University - Space Interdisciplinary Network, Goddard Space Flight Center

For the 8th consecutive year, the Minority University - Space Interdisciplinary Network (MU-SPIN) held its annual Users Conference. This year's conference, hosted by the Southwestern Indian Polytechnic Institute (SIPI) in Albuquerque, New Mexico, focused on the theme "Strengthening Partnerships Between Tribal and Non-Indian Institutions." A NASA educational outreach program, MU-SPIN has sucessfully developed a strong infrastructure of hardware, software, and human resources and offers training and, as of recently, applications. The program has made some impressive impacts during its 8 years.

Development phases

MU-SPIN evolved through four major phases: conceptualization; infrastructure (hardware, software, and human resources); training; and applications. The success experienced in each of the phases was enhanced by the recognition of the importance of collaboration at all levels of the project.

During the conceptualization phase, collaboration was demonstrated with the idea for the project emanating from NASA Headquarters and the formulation and structuring of the project being done at the Goddard Space Flight Center (GSFC). The infrastructure development involved collaborations with GSFC, the National Science Foundation (NSF), and the Association of Computer and Information Science/Engineering Departments at Minority Institutions (ADMI). While GSFC managed the project, NSF provided infrastructure grants to some of the MU-SPIN institutions for Internet connectivity and support for the MU-SPIN Users' Conferences and ADMI provided access to the deans of the engineering schools and heads of the computer science departments at minority institutions (and other institutions with large minority enrollments.)

With the establishment of the MU-SPIN Network Resources & Training Site (NRTS), MU-SPIN collaborations took off at an explosive rate. Collaborations include: NASA; seven NRTS institutions and other higher education institutions, Kindergarten Through Grade 12 (K-12) schools in their regions; other government agencies; and other organizations. This allowed the NRTS to train a large number of students, faculty, and staff through their education and research outreach initiatives as part of the applications phase.

During the current phase of the MU-SPIN development, partnerships are being established which will bring them into the mainstream with an awareness of and experience with the cutting edge science and technology research.

Partnership With Tribal Institutions

This year's MU-SPIN Users' Conference was a unique experience for its attendees because it was hosted by a Tribal College.

Understanding how NASA research and education resources can be implemented in Tribal Institutions is a critical goal for NASA.

During the conference, the welcome address was given by Carolyn Elgin, SIPI President. The keynote address was presented by Dave Warren, Professor Emeritus, Institute of American Indian Art & the

Smithsonian National Museum of the American Indian. Remarks or presentations were given by Karen Buller, President, National Indian Telecommunications Institute (NITI); Jose C'de Bacca, American Indian Science & Technology Education Consortium (AISTEC); Maureen Smith, Wabanaki Science and Math Project; Michelle Bekaye and Alvino Sam, American Indian Network Information Center (AINIC); and Phillip Sakimoto, NASA Headquarters Tribal Colleges Program Manager.

In addition to the conference speakers mentioned above, Georgia Johnson, University of Idaho, gave a very interesting presentation on how the Space Grant Math and Science curriculum will work for Native American students if "the frame of reference and teaching strategies include the tribal world views and experiences of the Indian students." Johnston proposes that the theory of "Ethnoscience" helps to better understand the differences in world views between European thinkers and Native thinkers and will help frame instruction. Ethnoscience includes the methods, thought processes, mind sets values, concepts, and experiences by which Native American groups understand, reflect, and obtain empirical knowledge about the natural world (Cajete, G.,1986).

Adopting an Ethnoscience framework will aide the educator in adopting a broader view of knowledge systems. Successfully teaching Indian students requires a shift in thinking - western, scientific thought and knowledge is not THE TRUTH, it is ONE way of understanding the world. The following chart is an overview of world view differences between European and Indian knowledge systems. The chart is a guide to aide the teacher as she/he plans inclusive lessons.

ETHNOSCIENCE

AMERICAN INDIAN EUROPEAN

Cyclical Time Linear Time
Harmony and Balance Hierarchies
Matrifocal (Mother Earth) Patrifocal (Laws)
Oral Knowledge Base Written Texts Group Identity
Individualism Shared Resources Accumulation
Observing Talking Respect for Elders Challenge the status quo Creation Creation
Thinking Making

1. Thought Woman 1. Deity 2. Rituals 2. Rewards/Punishes
3. Sacred Places 3. Churches - man made
4. Relatedness 4. Separateness

There are several visible results of these conference activities. In addition to everyone receiving a thorough education about tribal culture and education, some new tribal and non-tribal collaborations were initiated. California State University - Los Angeles established a new initiative to work with tribes in northern California on remote sensing and geographic information systems (GIS) concepts for managing tribal lands and resources. NASA is working with NITI to conduct a study of telecommunications capabilities for tribal colleges. Prairie View A&M University is planning to upgrade distance learning technology at Dine College.

NRTS Technology Expertise

Another major highlight of the conference was the opportunity to see the overall impact of the MU-SPIN project on the minority community in the MSET areas. This opportunity was available through the NRTS Principal Investigators and Consultants Poster Session, held on the first day, and the presentations and Student and Faculty Poster Session, held on subsequent days.

NRTS showcased their technology expertise in areas such as videoconferencing and distance education, multimedia, high performance computing, and cache servers. Videoconferencing and distance education topics such as the best set-up for the NRTS, curriculum-based distance learning opportunities, and a portal to emerging technologies were presented. Topics covered in the multimedia area were streaming content and courseware development, hypermedia and the textbook, design tools for developing web pages, object oriented programming, and graphical programming in the study of digital arithmetic. Hardware and software technology presentation topics included: a summer institute for faculty and student high performance computing technological and scientific investigations, and cache servers. To help strengthen the MU-SPIN institutions' ability to write winning proposals and their understanding of NASA research opportunities, Mildred Boyd gave a presentation on Proposal Writing and Dillard Menchan gave a presentation on Research Opportunities

Education and Research Outreach

Education and research outreach activities were addressed in the presentations and poster sessions. NRTS showcased the impact of their programs mainly during the NRTS and the Student and Faculty Poster Session, presenting, in addition to topics previously mentioned, information on astronomy, astrophysics, robotics, CCNY Weather Network, material sciences, environmental science, the Internet and the science classroom, teaching multimedia in Kindergarten Through Grade 12, and creating and using Thread with Java. Additionally, there were presentations by others on students sharing their weather while learning math, Global Observations for a Better Environment (GLOBE), the Sun Earth Connection, Earth Science, ECHO the Bat (remote sensing/visualization curriculum), Project VISION, Mars Orbiting Laser Altimeter (MOLA), digital libraries, and using algebraic software and graphical calculators. Because of the large number of conference activities, all of the presentations and posters have not been explicitly mentioned in this article; however, an attempt has been made to cover all of the main topic areas.

This conference opened the doors for new collaborations. They include NRTS and NASA science and education collaborations as well as tribal and non-tribal collaborations. The collaborations with the Tribal Colleges has strengthened MU-SPIN's ability to impact all of its constituent groups.

MU-SPIN Eighth Annual Users Conference
Southwestern Indian Polytechnic Institute
and the
DoubleTree Hotel - Albuquerque
on
October 20-23, 1998

Tuesday, October 20, 1998

5:00 — 8:00 p.m.	Registration *DoubleTree Hotel, Lobby Level*
5:00 — 8:00 p.m.	Welcome Reception *DoubleTree Hotel, Salons I & II*
5:00 — 8:00 p.m.	Principal Investigators & Consultants Poster Session *DoubleTree Hotel, Salons I & II*

Wednesday, October 21, 1998

7:00 — 8:00 a.m.	Breakfast *DoubleTree Hotel, Salon III*
8:00 a.m.	Buses leave for SIPI *DoubleTree Hotel (parking lot) & La Posada de Albuquerque (2nd Street exit)*
9:00 — 9:15 a.m.	Welcome *Dr. Carolyn Elgin, SIPI President*
9:15 — 9:45 a.m.	Opening Remarks *Ms. Karen Buller, National Indian Telecommunications Institute (NITI)*
9:45 — 10:15 a.m.	Keynote Address *Dr. Dave Warren, Professor Emeritus, Institute of American Indian Art and the Smithsonian National Museum of the American Indian*
10:15 — 10:30 a.m.	Minority University Research & Education Division *Ms. Bettie White, NASA HQ*
10:30 — 10:45 a.m.	Tribal Colleges & Universities Initiatives *Dr. Philip Sakimoto, NASA HQ*
10:30 — 11:30 a.m.	MU-SPIN Update *Mr. James Harrington, MU-SPIN Project Manager*
11:30 a.m. — 1:30 p.m.	Lunch & Walking Tour of SIPI

1:30–3:00 p.m.	Science & Communications Forum
	Sun Earth Connection Forum Presentation for Education and Outreach *Dr. James R. Thieman, NASA Goddard Space Flight Center, National Space Science Data Center & World Data Center*
	The Function of National Weather Service and NOAA and their Outreach to Minorities *Mr. Charly Wells, National Weather Service*
	21st Century Space & Science Careers *Mr. Dillard Menchan, NASA Goddard Space Flight Center, Office of Equal Opportunity Programs*
	Local Research & Education Resources from the University of New Mexico *Dr. Art St. George, University of New Mexico*
	Earth Remote Sensing: What is it Really? – What to Do with It? *Dr. Blanche Meeson, NASA Goddard Space Flight Center, Earth Sciences Research & Education*
3:00–3:15 p.m.	Wrap-up
3:15 p.m.	Buses leave for the DoubleTree Hotel & La Posada de Albuquerque
5:00–7:00 p.m.	Student & Faculty Poster Session & Reception *DoubleTree Hotel, Salons II & III*
	Collaborative Research at the University of Houston-Downtown *Dr. Richard Alo', University of Houston - Downtown*
	Center for Network Resources and Training Internship Program, *Ms. Alice Baker & Ms. Helen Stillinger South Carolina State University*
	Teaching Multimedia in K-12 *Ms. Stephanie Drotos, South Carolina State University*
	Spatial Temperature Variations in the Lagoon Nebula (M8) *Ms. Ely N. Duenas, City College of New York*
	Effects of Ag and Au Doping on High Temperature Superconducting Materials *Mr. Ly John Fridie, South Carolina State University*
	Houston PREP *Ms. Sangeeta Gad, University of Houston – Downtown*
	NYC NEW TEAM - Real Science in the Bronx: An Urban Middle School Initiative *Ms. Ellen Goldstein, Mr. Kenneth Harris, Mr. Wilford Hemans, Ms. Leslie Jones, and Mr. Tirso Valenzeula, City College of New York, NASA RERC*
	Image Segmentation: Enhancement of the Region Labeling Tool using Khoros Software System *Ms. JoAnna P. Graham, Bowie State University*

5:00 – 7:00 p.m.	Student & Faculty Poster Session & Reception - continued
	Creating and Using Thread with Java *Mr. Regg Hatcher Jr., Morgan State University*
	Digital Libraries: Impact on Science Medicine and Libraries *Ms. Ruth Hodges, South Carolina State University*
	Network Management Developed Using Java *Ms. Denee Lake, City College of New York*
	Technology and Libraries: Bringing Together Information Literacy and Diversity *Ms. Elaina Norlin & Ms. Patricia Morris, University of Arizona Libraries*
	Processing of High Temperature Superconducting BSCCO Compounds *Ms. Kelry Robinson, South Carolina State University*
	Strengthening Partnerships through Research Experiences in Earth System Science *Dr. Waldo Rodriguez, Norfolk State University*
	Animations of Series Approximations and Polar Functions Using Algebraic Software and Graphing Calculators *Ms. Jamilah M. Seifullah, Alliance for Minority Partnership in Science (AMPS)*
	Developing a LabVIEW Based Ultrasonic Test and Evaluation Unit for Materials Testing *Dr. Nikunja K. Swain and Ms. Gwendolyn Tobin, South Carolina State University*
	Object Oriented Programming (Visual Basic) and Graphical Programming (LabVIEW) in study of Digital Arithmetic *Ms. Gwendolyn Tobin and Dr. Nikunja K. Swain, South Carolina State University*
	CCD Image Processing in Astrophysical Research *Mr. Taran Tulsee, Queensborough Community College*
	Ground and Space Based Observations of the Bubble Nebula *Dr. Donald Walter, South Carolina State University;*
	Implications Derived from a Case Study of Teachers' Understanding and Use of the Internet as It Relates to Curriculum Changes in a Middle School *Dr. Diane Westfall, Moultrie Middle School*
7:00 – 9:00 p.m.	Awards Dinner *DoubleTree Hotel, Salons II & III*

Thursday, October 22, 1998

7:00 – 8:00 a.m.	Breakfast *DoubleTree Hotel, Salon III*
8:00 a.m.	Buses leave for SIPI *DoubleTree Hotel (parking lot) & La Posada de Albuquerque (2nd Street exit)*

Thursday, October 22, 1998 - continued

9:00–9:15 a.m.	Welcome *Mr. Reggie Eason, Deputy Project Manager*
9:15–10:15 a.m.	Call for Participation Papers Instructional Technology *Mr. Mike Scott, University of Maine* City College of New York Weather Network *Dr. Shermane Austin, City College of New York* High Performance Computing Summer Institute: Foundation of Faculty/Student Technological and Scientific Investigations *Ms. Dorothy Russell, Morgan State University*
10:15–10:30 a.m.	Break
10:30 a.m.–12:00 p.m.	Call for Participation Papers - continued Wabanaki Science & Math Project: A Model Program for Integrating Culture into the Curriculum *Ms. Maureen Smith, University of Maine, Wabanaki Center* Cache Servers *Dr. Linda Hayden, Elizabeth City State University* Creating Culturally Inclusive Curriculum and Classrooms *Ms. Georgia Johnson, University of Idaho* American Indian Science & Technology Education Consortium (AISTEC) *Mr. Jose C'de Baca, New Mexico Highlands University*
12:00–1:00 p.m.	Lunch
1:00–2:15 p.m.	Pre-College MSET Break-out Session I MOLA: Meaningful Learning Contexts *Dr. Marino Alvarez, Tennessee State University:* ECHO the Bat *Ms. Virginia Butcher* GLOBE Science Research *Ms. Stephanie Stockman, NASA Goddard Space Flight Center*
1:00–2:15 p.m.	Networking Break-out Session I American Indian Network Information Center *Ms. Michelle Bekaye and Mr. Alvino Sam, American Indian Network Information Center*
1:00–2:15 p.m.	Distance Learning Break-out Session Distance Learning at Prairie View A&M University *Dr. John Williams, Prairie View A&M University*

Thursday, October 22, 1998 - continued

1:00–2:15 p.m.	Distance Learning Break-out Session – continued
	Exploiting Distant Learning - A Portal (Among Minority Institutions) to Emerging Technologies *Dr. Moses Gwan, Grambling State University*
	Distance Learning on the Internet *Dr. Ashok Satpathy, South Carolina State University*
1:00–2:15 p.m.	Internet Break-out Session
	Design Tools for Developing Web Pages *Mr. James Holloway and Mr. Charlie Wrenn, Tennessee State University*
2:15–2:30 p.m.	Break
2:30–3:45 p.m.	Pre-College MSET Break-out Session II
	Integrating the Internet into the Science Classroom/Curriculum, *Dr. Sheila Gersh, City College of New York*
	Students Sharing Their Weather while Learning Mathematics *Dr. Beverly Lynds, University Corporation for Atmospheric Research (UCAR);*
	Project VISION: Using Technology to Enhance the Science and Math Curriculum in the Middle Schools *Dr. Gustavo Roig and Mr. Jorge Nosti, Florida International University*
2:30–3:45 p.m.	Networking Break-out Session II
	Information Technology Reference Documentation *Mr. Mark Irish, ADNET Systems Inc.*
	Video Conferencing: Closing the Distance - Improving the Learning *Mr. Samir Maniar, South Carolina University and Mr. Carl Taylor, Prairie View A&M University*
2:30–3:45 p.m.	Multimedia Break-out Session
	Streaming Content and Courseware Development: A Multimedia Multi-Mode Approach to Distance Learning *Mr. Harry Schulte, University of Texas at El Paso*
	Hypermedia and the Textbook - Teaching C++ *Mr. Curtis Sollohub, New Mexico Highlands University*
2:30–3:45 p.m.	Proposal Writing & Research Opportunities Break-out Session *Dr. Mildred Boyd, EduTech & Mr. Dillard Menchan, NASA Goddard Space Flight Center, Office of Equal Opportunity Programs*
3:45–4:00 p.m.	Wrap-up
4:00 p.m.	Buses leave for the DoubleTree Hotel & La Posada de Albuquerque

Thursday, October 22, 1998 - continued

6:00 p.m.	Buses leave for the Indian Pueblo Cultural Center *DoubleTree Hotel (parking lot) & La Posada de Albuquerque (2nd Street exit)*
6:15 p.m.	Dinner & Tour *Indian Pueblo Cultural Center*

Friday, October 23, 1998

7:00 – 8:00 a.m.	Breakfast *DoubleTree Hotel, Salon III*
8:00 a.m.	Buses leave for SIPI *DoubleTree Hotel (parking lot) & La Posada de Albuquerque (2nd Street exit)*
9:00 – 10:15 a.m.	Conference Wrap-up *Mr. James Harrington, MU-SPIN Project Manager*
10:15 – 10:30 a.m.	Break
10:30 a.m. – 12 p.m.	Giveaway *(Winners must be present!)*
12 p.m.	Buses leave for the DoubleTree Hotel & La Posada de Albuquerque
2:00 – 9:30 p.m.	Group Activity I: *Downtown Albuquerque & Sandia Peak ($37)* *DoubleTree Hotel (parking lot) & La Posada de Albuquerque (2nd Street exit)*

Saturday, October 24, 1998

10:00 a.m. – 4:00 p.m.	Group Activity II: *Acoma Pueblo & Casino ($15)* *DoubleTree Hotel (parking lot) & La Posada de Albuquerque (2nd Street exit)*

MU-SPIN Eighth Annual Users' Conference
Albuquerque, NM
October 20-23, 1998

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MURED Update

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MU-SPIN

ANNUAL USERS CONFERENCE

October 21, 1998
Southwest Indian Polytechnic Institute

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MUREP Overview

- Generate and Communicate Knowledge
- Budget is Guidelines
- Budget is Divided Along Research/Education Line
- Focus is on Institution, not Individuals
- Focus is on Competitive/Peer Reviewed Awards

MURED Approach

TWO PROGRAMS:

- HBCUs
- OMUs
  - Hispanic-Serving
  - Tribal Colleges
  - Other Universities Institutions

SEVEN COMPETITIVE OPPORTUNITIES:

- Research
  - URC
  - IRA
  - Individual PI: FAR
- Education
  - Partnership
  - PAIR
  - Pre-college Outreach: PACE
  - Teacher Enhancement: MASTAP

Strategic Direction

- **Outlook:**
  - ...achieve the full participation of Minority Institutions (MI's) in NASA-sponsored research and education...
- **Mission:**
  - ...synergism between NASA's mission and the Federal mandates for MI's...
  - ...equal opportunity in all NASA-sponsored research and education programs...
  - ...strengthen the capacity of mathematics, science, engineering, and technology (MSET) at MI's...
- **Goals:**
  - ...foster research and development activities...
  - ...systemic and sustainable change through partnerships and programs...
  - ...prepare faculty and students for competitive research and education process...
  - ...increase the number of students prepared to enter college in MSET fields...

OFFICE OF EQUAL OPPORTUNITY PROGRAMS
MINORITY UNIVERSITY RESEARCH AND EDUCATION PROGRAMS

Objectives

URC - Achieve a broad-based, competitive aerospace research capability among the Nation's HBCUs and OMUs.

IRA - Strengthen the research capacity of minority institutions to provide a quality learning and research environment.

FAR - Enhance cultural diversity in the NASA-sponsored research community.

Partnership - Establish partnership between minority institutions and NASA.

PAIR - Build upon NASA research to enhance the quality of MSET undergraduate education.

PACE - Increase the awareness and student participation in MSET.

MASTAP - Enhance the teaching skills of middle and high school MSET teachers.

Expected Outcomes

- Outcome metrics for research and education
- Minority participation in MSET areas.
- Minority institution and minority community benefit from and support of NASA activities.

Funding Priorities

- Honor NASA commitments made through competitive review processes
- Build NASA-related institutional infrastructure at HBCUs and OMUs
- Outcome Metrics (faculty and students at MI's who are socially and economically disadvantaged and/or disabled)

Commitments

- FAR, MASTAP and PACE
- IRA (NRTS) - 2001
- MU -SPIN
- URC - 2001/2002
- IRA (Research) - 2000

Mured Homepage

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Tribal Colleges Update

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NASA TRIBAL COLLEGES AND UNIVERSITIES INITIATIVES

MU-SPIN Conference

Albuquerque, New Mexico
October 21, 1998

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OFFICE OF EQUAL OPPORTUNITY PROGRAMS
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Tribal Colleges and Universities
Milestones

- October 19, 1996 - Executive Order 13021, Tribal Colleges and Universities, signed.
- 1997-98 - Site Visits to 8 TCU campuses.
- February 2, 1998 - American Indian Higher Education Consortium (AIHEC) meeting with OEOP.
- February 13, 1998 -
  - Carrie L. Billy, AIHEC Federal Relations Coordinator, sworn in as director of the newly established White House Initiative on Tribal Colleges and Universities.
  - George E. Reese designated as NASA's primary liaison to the White House Initiative on Tribal Colleges and Universities, with Bettie White and Philip Sakimoto as alternates.
- April 15, 1998 - Inter-Departmental Committee on Tribal Colleges & Universities, first meeting, Washington, DC.

Proposed NASA Approach for Tribal Colleges

February 2, 1998

- Pre-college outreach and teacher training
  - Use existing programs (e.g., PACE, MASTAP) modified as necessary to accommodate tribal college projects.
- Transfer pipelines to 4-year colleges
  - AISTEC revised this year to take lead.
- New solicitation for Institutional Development

OFFICE OF EQUAL OPPORTUNITY PROGRAMS
MINORITY UNIVERSITY RESEARCH AND EDUCATION DIVISION

Tribal College Participation in Precollege Awards for Excellence in Mathematics, Science, Engineering, and Technology (PACE/MSET)

1 st Year	Instal l	Institution	Project Title
1995	HQ	Fort Belknap College	Preserving the Past and the Future
1996	HQ	Northwest Indian College	Seaquest Phase II
1996	JSC	Southwest Indian Polytechnic Institute	SIPI PACE/MSET Project
1998	GSFC	Oglala Lakota College	OLC PACE/MSET

- **1998 PACE:**
  - Improved accessibility for TCU's by adding TCU's explicitly to list of eligible institutions and removing tenure-track requirement on P.I.
  - Received 4 TCU proposals of which 1 was selected.
- **1999 PACE**
  - Received LOI from 1 TCU.

Tribal College Participation
in
Mathematics Science Teacher and Curriculum Enhancement Awards Program (MASTAP)

- **1994-1998 MASTAP:**
  - Eligibility limited to colleges that offered an undergraduate degree in education.
  - No Tribal College Participation.
- **1999 MASTAP:**
  - Improved accessibility for TCU's by adding TCU's explicitly to list of eligible institutions and allowing community colleges to propose as lead institution if they have a partnership with another institution that offers an undergraduate degree in education.
  - Received 2 TCU proposals.

Tribal College Participation in Partnership Awards

1st Year	Install	Institution	Project Title
1997	ARC	Diné College	American Indian Network Information Center (AINIC)
1997	JSC	Diné College	Science Enrichment Activities
1997	JSC	Oglala Lakota College	Project SMASH--Student Math & Health Sciences Initiative
1997	DFRC	Salish Kootenai College	NASA Aeronautical Ambassador Program for American Indians

- **1997 Partnership:**
  - 4 TCU projects selected.
- **1998 PAIR:**
  - Eligibility limited to institutions offering 4-year SEM degrees and holding current NASA research grant.
  - No TCU projects selected.

American Indian Science Technology Education Consortium (AISTEC)

- **Consortium members:**
  - 4-year and graduate institutions: New Mexico Highlands (lead), Arizona State, Oklahoma State, South Dakota School of Mines and Technology, University of New Mexico, University of Washington
  - Tribal Colleges and Universities: Dine (Navajo) Community College, D-Q University, Haskell Indian Nations University, Salish Kootenai College
- **1998 Improvements:**
  - Revised goals to emphasize tribal college development
  - Revised objectives to provide measurable metrics
  - Revised financial reporting system to control costing
- **1999 Improvements:**
  - Increase TCU and Native American community ownership by:
    - » Establishing external advisory committee
    - » Establishing new and continuing project proposal review board to be led by Salish Kootenai College
  - Develop additional sources of funds (e.g., private sector grants; technology transfer projects)

OFFICE OF EQUAL OPPORTUNITY PROGRAMS
MINORITY UNIVERSITY RESEARCH AND EDUCATION DIVISION

Opportunities

- Existing precollege outreach and teacher training solicitations: PACE & MASTAP
- New process for AISTEC projects
  - call for proposals anticipated early 1999
- Tribal College workshops at NASA Installations
  - now in early planning stages
  - anticipate first workshop ~March 1999
- New solicitation for curriculum development
  - currently being revised

KEEP INFORMED

- Visit the NASA MUREP website at

http://www.hq.nasa.gov/office/codee/mured.html

- Send me your e-mail address to get on my distribution list for Tribal Colleges opportunities.

phil.sakimoto@hq.nasa.gov

MU-SPIN Update

James Harrington
Project Manager

MU-SPIN Presentation

8th Annual User's Conference
Southwestern Polytechnic Institute

Albequerque, NM

October 20, 1998

James L. Harrington, Jr./933 MU-SPIN Project Manager

Reginald Eason/933 MU-SPIN Deputy Project Manager

August 13, 1998

MU-SPIN DESCRIPTION

The Minority University Space Interdisciplinary (MU-SPIN) Network project is a comprehensive outreach and education initiative that focuses on the transfer of advanced computer networking technologies and relevant science to Historically Black Colleges and Universities (HBCU's) and Other Minority Universities (OMU's) for supporting multi-disciplinary research.

Historical Highlights

- 1989 Yvonne Freeman, former MURED program director requested GSFC to design a network that connect HBCUs and OMUs to scientific and technical programs at NASA.
- Dr. Feeman, Dillard Menchan, Valerie Thomas, Nagi Wakim implemented the concept of MU-SPIN.
- 10 initial MUs were surveyed for their current electronic networking capabilities and to find out if MUs would be interested in participating with the project.
- 1991 at GSFC, a pre-conference planning attended by interested MUs and representatives of NASA/GSFC and NASA/HQs recommended that NSF be contacted to add support to the networking efforts.
- The formulation of a MU-SPIN coordination team was soon developed to formulate a strategic plan for transferring network technology to Minority Universities.

Historical Highlights con't

First MU-SPIN Coordination Team (FY91-FY92)

- Valerie Thomas, Program Manager
- Jerome Bennett, Deputy Program Manager
- Nagi Wakim, (IPA) Program Coordinator
- Phil Sakimoto, GSFC University Affairs Officer
- Dillard Menchan, EOPO GSFC
- Mildred Wyatt, Edutech
- Gerald Engel, NSF
- David Staudt, NSF
- Dan VanBellinghem, NSF

Initial MU-SPIN Outreach

- Serial Operation (One group at a time)
- Primarily Lectural (Not many hands-on labs)
- Primarily Technical (Most important at the time)
  - Network Starter Kit (Howard U. and Fisk U. built first LANs with the kit)
    - Step by Step instructions for installing network hardware and software
  - Applications and Utilities
    - Setting up Gopher and Archie Client and Server applications
      - Initial text based information dissemination server and Internet ftp search engine
    - Configuring e-mail servers
    - Dial-up access (dedicated connectivity resources were scarce)
    - Network Management (SNMP, Netstate, Traceroute, Ping)
- Relied heavily on U.S. Mail
  - Conference announcments
  - MU-SPINews
  - MU-SPIN Library (Starter Kit, Apps & Utils, Reference Guide)
  - Workshop collaboration

Pre-NRTS Summary

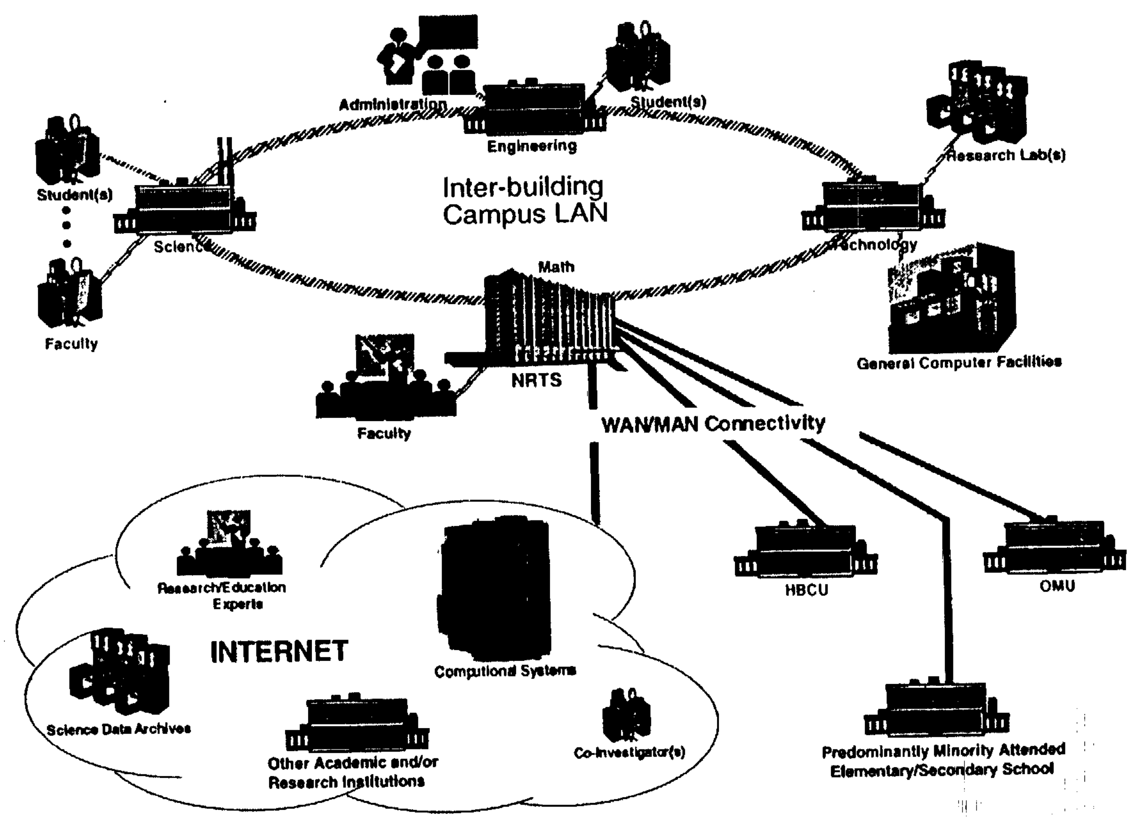
- 1989-1991 Developed preliminary program plan.
- April 1991 Obtained first RTOP funding (Code S) Joe Bredakemp
- FY92 to FY93 established contractor based technical team which supported:
  - Annual Users Conferences
  - On-Campus Training Sessions
  - Assistance with NSF network proposals
  - Disseminate NASA Research Opps
  - Developed On-Line Resource Center
  - MU-SPINews
  - Established Supercomputing facility at MSU
  - Establised a Library
    - Network Starter Kit
    - Reference Guide
    - Network Applications & Utilities Guide

Network Resources and Training Sites

Background

- Established seven NRTS in FY96.
- Each site serves as a partnership of colleges/ universities and pre-college institutions
- Transfer and support of networking technology and other infrastructure for math, science and engineering research and education.

Comprehensive Overview of the NRTS's Responsibilities



NRTS Impact Year 1

- Number of States Impacted
  - Before NRTS - 9
  - After Year 1- 17
- Number of Schools Impacted
  - Before NRTS - 29
  - After Year 1- ~68
- Number of Internet Connections
  - Before NRTS- ~17
  - After Year 1- ~58
- Number of Faculty, Student & Staff Trained
  - Before NRTS - ~700
  - After Year 1- ~4,000

NRTS Impact Year 2

- Number of States Impacted
  - After Year 1- 17
  - After Year 2- 24
- Number of Schools Impacted
  - After Year 1- ~68
  - After Year 2- ~179
- Number of Internet Connections
  - After Year 1- ~58
  - After Year 2- ~110
- Number of Faculty, Student & Staff Trained
  - After Year 1- ~4,000
  - After Year 2- ~13,000 (4,000 Year 1/9,000 Year2)

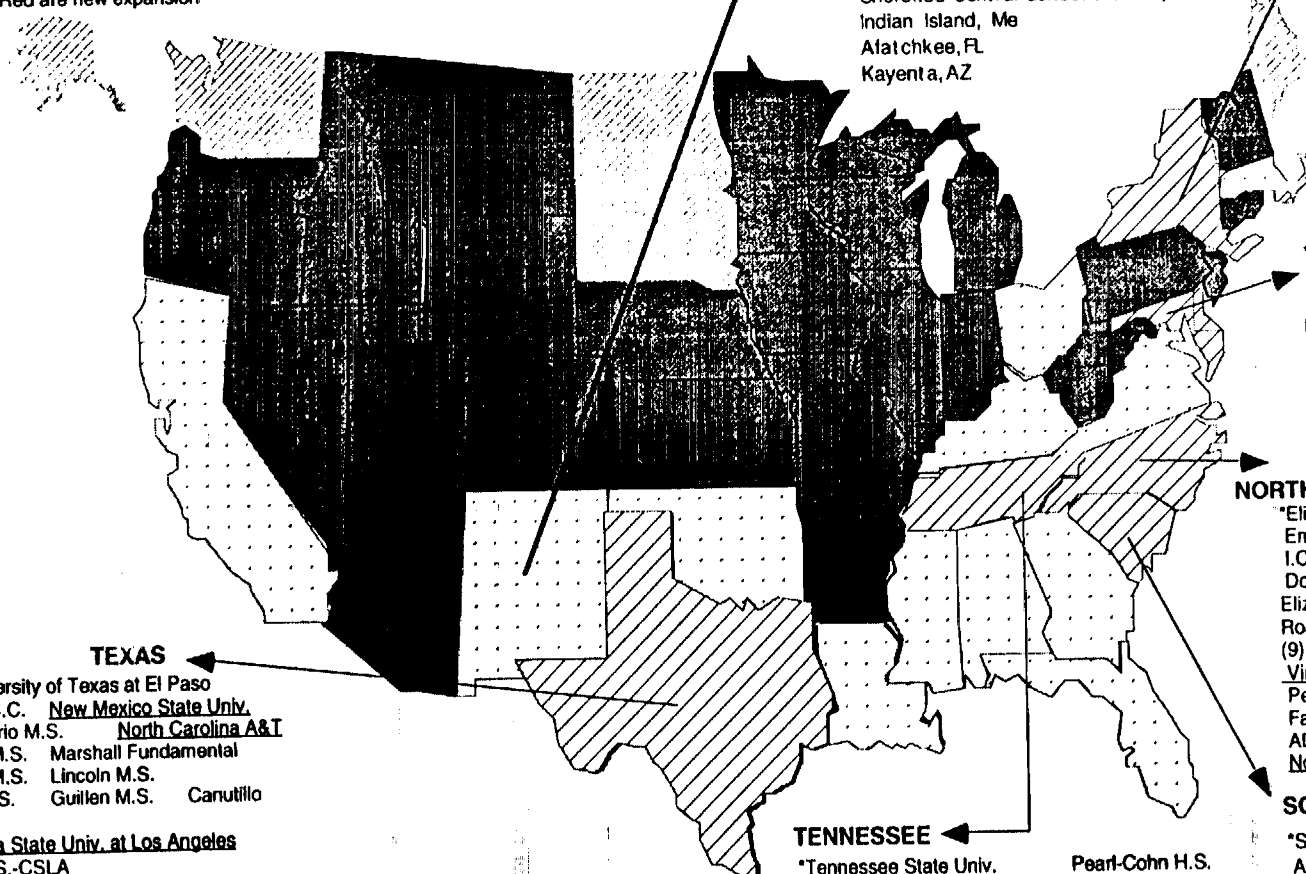
NRTS Impact Year 3

- Number of States Impacted
  - After Year 2- 24
  - After Year 3- 24
- Number of Schools Impacted
  - After Year 2- ~179
  - After Year 3- ~220
- Number of Internet Connections
  - After Year 2- ~110
  - After Year 3- ~116
- Number of Faculty, Student & Staff Trained
  - After Year 2- ~13,000
  - After Year 2- ~23,000 (4,000 Year 1/9,000 Year2/10,000 Year 3)

NETWORK RESOURCES AND TRAINING SITES WITH TEAM MEMBERS FOR FY98

Legend: M.S. - Middle School
H.S. - High School
E.S. - Elementary School
S.D. - School District
C.C. - Community College
* Lead institution
\+ Institutions that were not part of the orginal team but incorporated into the lead NRTS's region to broader the availability of Internet resources

Note: Underlined institutions are located in neighboring states. Schools in Red are new expansion patners.



National Indian Telecommunications Institute
University of Alaska Southeast
Lower Kuskokwim School District, Alaska
Lummi, Washington
Turtle Mountain, ND
Pine Ridge Indian Res, SD
Cherokee Central School District, NC
Indian Island, Me
Afatchkee, FL
Kayenta, AZ

NEW YORK

*City College of N.Y.
Bronx H. S.
LaGuardia C.C.
Queensborough C.C.
NASA GISS
A. Phillip Randolph H.S.
CUNY Alliance for Minority Participation
National Indian Telecommunications Institute
Brandeis H.S. Samuel Gompers H.S.
(8) Level 1 Colleges (14) H.S. (9) M.S.
York College
George Washington H.S.
Medgar Evers College
Urban Systemic Initiative

MARYLAND

*Morgan State Univ.
Lemmel M.S.
U. M. Eastern Shore
Harlem Park M.S. Frederick Douglass H.S.
Southern H.S. Mathew Henson E. S.
Sinclair Lane E.S.
Sojourner Douglass College
Baltimore City C.C. +Bowie State Univ.
+Central State Univ. (Ohio)
Gwynn Falls E.S.
Douglass H.S.
Coppin State College

NORTH CAROLINA

*Elizabeth City State University
Emily Spong Earth & Space Technology E.S.
I.C. Norcom Aerospace Technology Magnet H.S.
Douglass Park Earth & Space E.S.
Elizabeth City M.S. Purnell Swett H.S.
Roanoke River Valley Consortium (7) M.S. (6) H.S.
(9) Level 1 M.S., H.S. Partners in VA & NC
Virginia State Univ.
Pembroke State Univ.
Fayetteville State Univ.
ADNET Systems, Inc.
Norfolk State Univ. (Virginia)
+Bennett College
Hampton Univ.
NASA/Langley

TEXAS

*The University of Texas at El Paso
El Paso C.C. New Mexico State Univ.
San Elizario M.S. North Carolina A&T
Dell City M.S. Marshall Fundamental
Charles M.S. Lincoln M.S.
Wiggs M.S. Guillen M.S. Canutillo M.S.
+California State Univ. at Los Angeles
Fulton M.S.-CSLA

*Prairie View A&M University
Navajo C.C. Central Consolidated S.D.
Waller Independent S.D.
Hempstead Independent S.D.
Wiley College Texas College
Huston-Tillotson College Xavier Univ. (LA)
Paul Quinn College Langston Univ.
Jarvis Christian College
+Texas A&M Corpus Christi
+Southern Univ. (Lousiana)
National Indian Telecommunications Institute

TENNESSEE

*Tennessee State Univ.
Kings Lane M.S.
Meharry Medical College
Lemoyne-Owen College
Martin Marietta Energy Sys.
+Alabama A&M Univ.
+Jackson State Univ. (Missisippi)
Pearl-Cohn H.S.
Knoxville College
Kentucky State Univ.
Fisk Univ.
Lane College

SOUTH CAROLINA

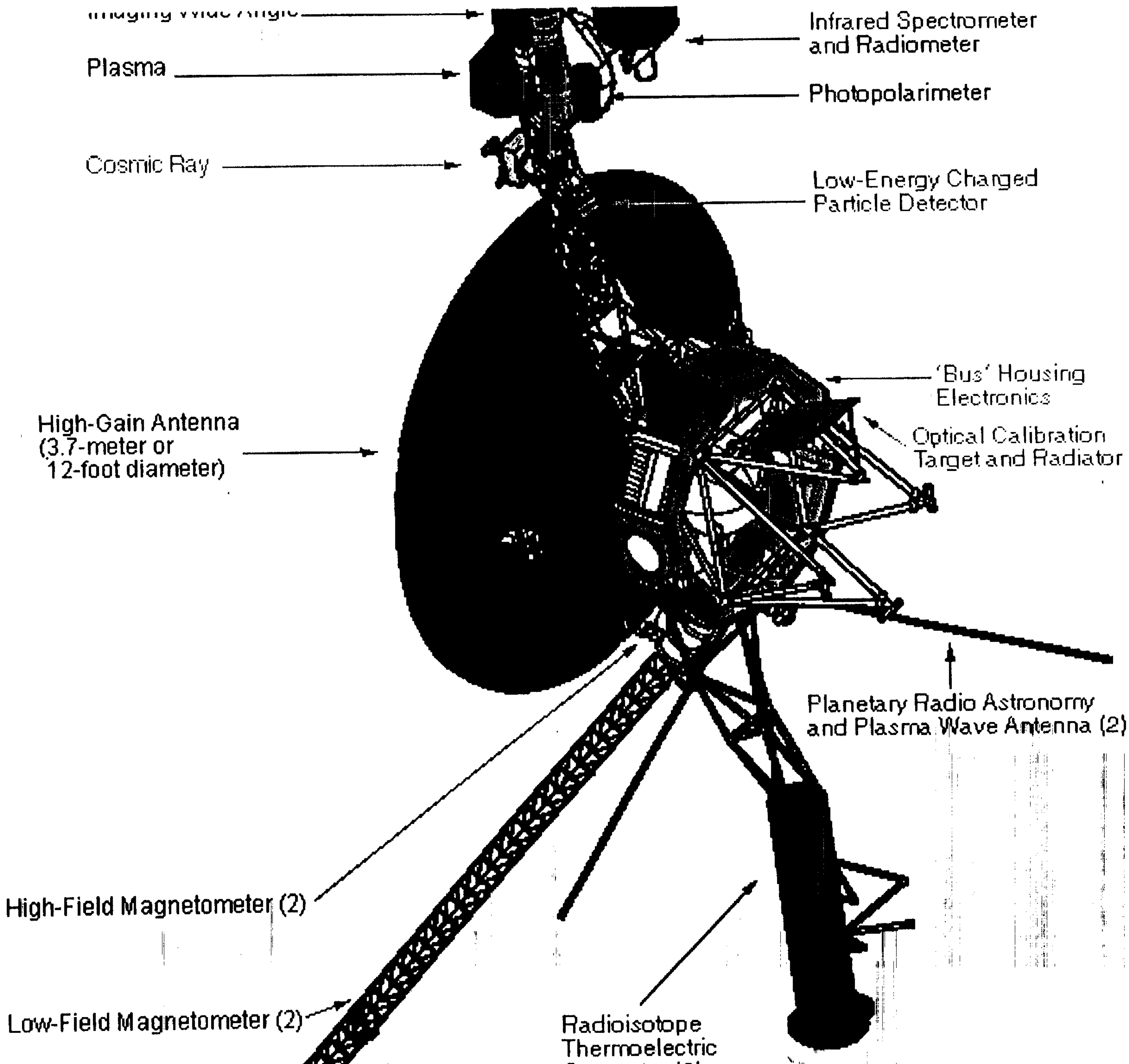
*South Carolina State Univ.
Allen Univ.
NASA/Langley
Clafin College
Voorhees College
Felton Laboratory School
Orangeburg-Wilkinson H.S.
+Benedict College
+Florida International Univ.
+Morris Brown College
NASA/GSFC
NASA/MSFC
Edward Waters Coll
Morris College
Bowman H.S.
Howard M.S.

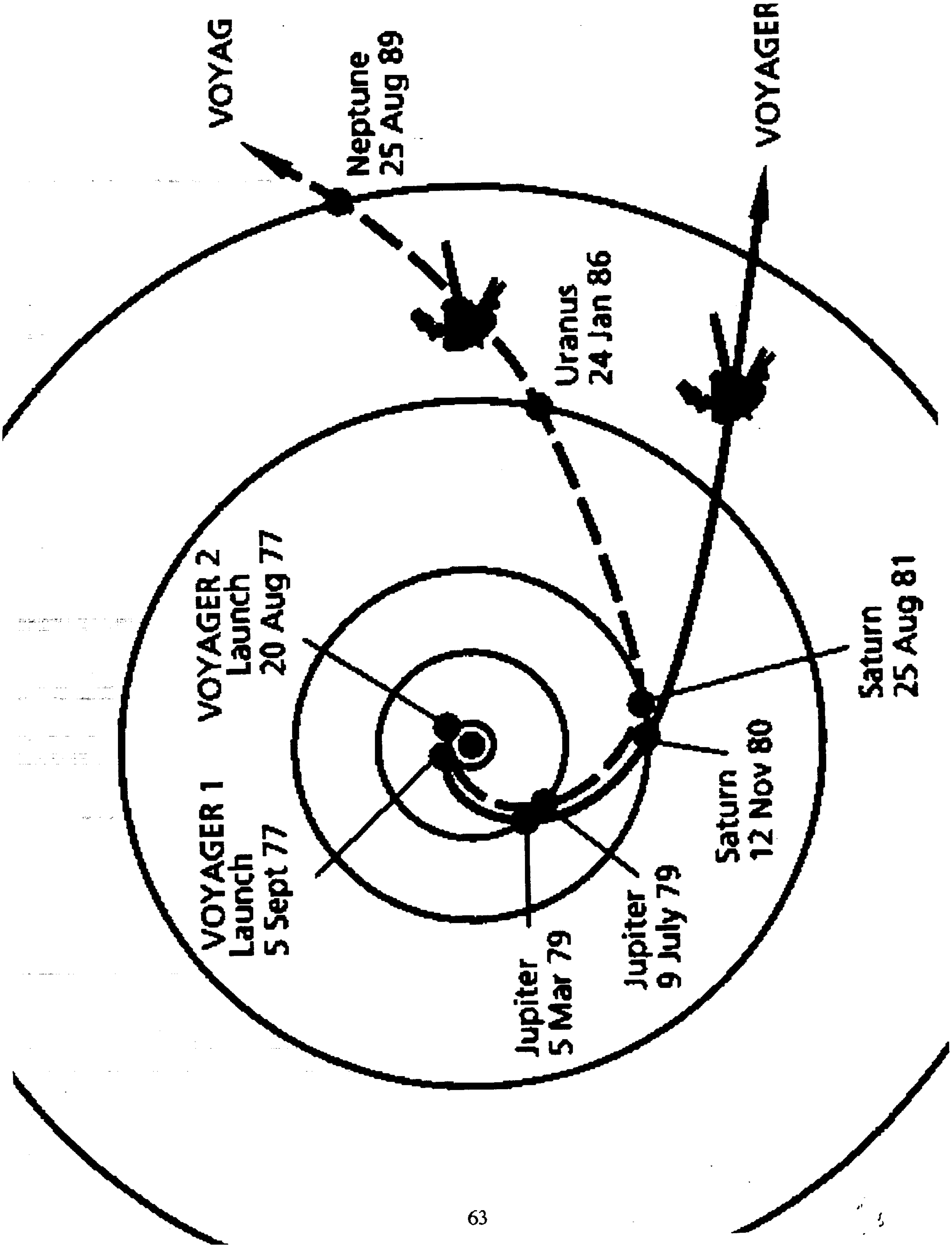
Initial phase of Program successfully implemented and developing new strategies for relevancy with HQs.

- Creation of "Expert Institutes" within our NRTSs, to capitalize on diverse capabilities that will attract research and other resources from NASA and other entities.
- Creation of multidisciplinary initiatives to support self-sustaining support through proposals, partnerships, and commercialization.
- Increase collaborations with NASA Centers (i.e. LaRC, ARC, JPL) building on expert institute concepts to compete for relevant enterprise missions.

Programmatic Impact

- "Expert Institute" concept has provided a strong foundation for facilitating the goals of the IRA program and the CAN to improve underrepresentation of minorities in NASA Science and Technology.
  - SCSU Hubble Space Telescope Access/Summer Research Program
  - CCNY/NOAA(NWS) Metro Weather Climate Network
- New Research and Curriculum significantly improves precollege and undergraduate teaching and learning
  - TSU/Lab for Terrestrial Physics for Mars Global Surveyor MOLA education
  - MSU/GSFC EarthKam Education
  - UTEP/UCAR Using Weather Concepts for Understanding Mathematics (SkyMath)
- Commercialization projects present tremendous opportunities for sustainability and competitiveness
  - ECSU/URLabs Proxy Cache Server Technology
  - MSU/TECCO Algebra Multimedia Software


Plasma
Cosmic Ray
High-Gain Antenna (3.7-meter or 12-foot diameter)
High-Field Magnetometer (2)
Low-Field Magnetometer (2)
Infrared Spectrometer and Radiometer
Photopolarimeter
Low-Energy Changed Particle Detector
'Bus' Housing Electronics
Optical Calibration Target and Radiator
Planetary Radio Astronomy and Plasma Wave Antenna (2)
Radioisotope Thermoelectric


VOYAG
Neptune
25 Aug 89
VOYAGER
Uranus
24 Jan 86
VOYAGER 2
Launch
20 Aug 77
Saturn
25 Aug 81
VOYAGER 1
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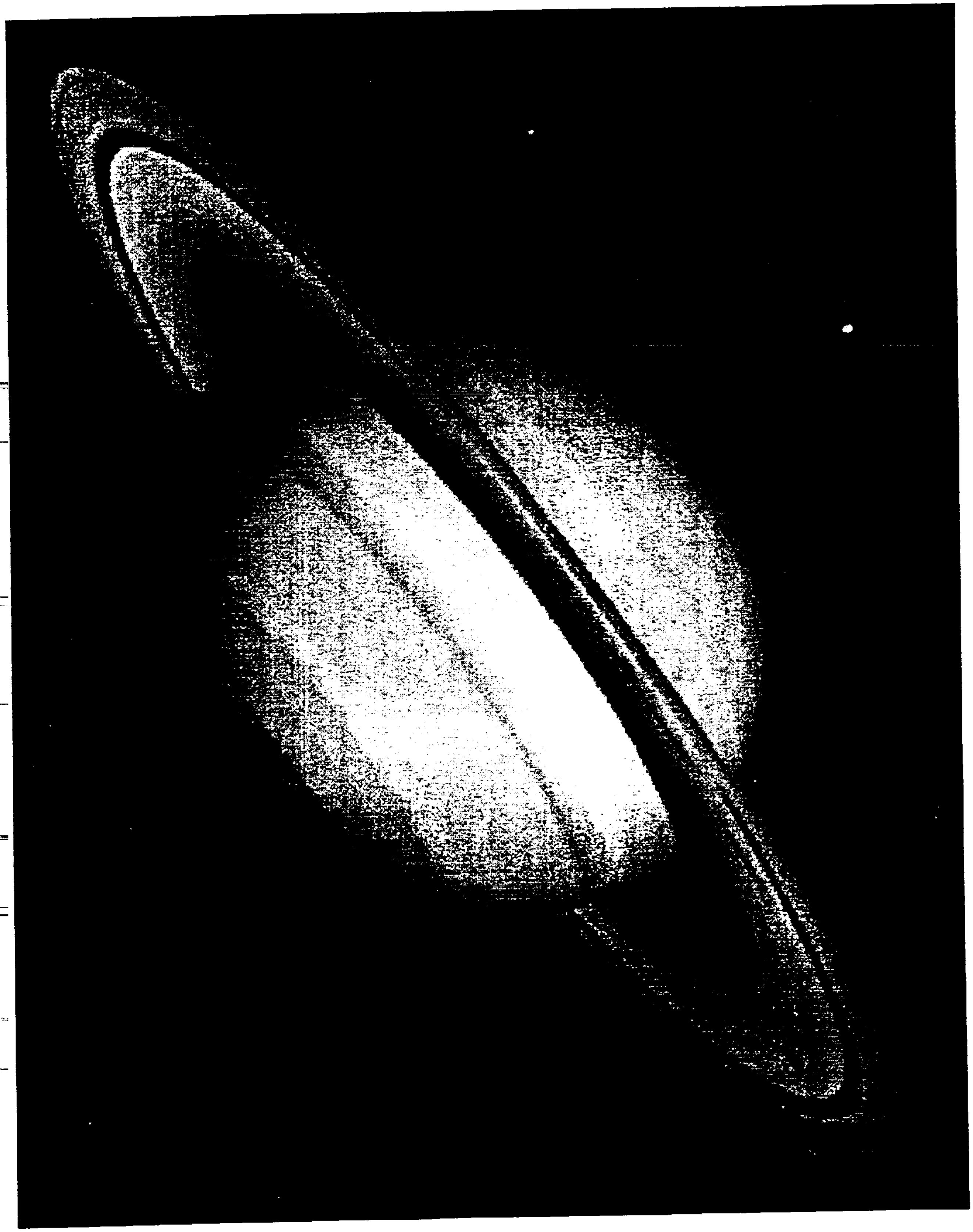
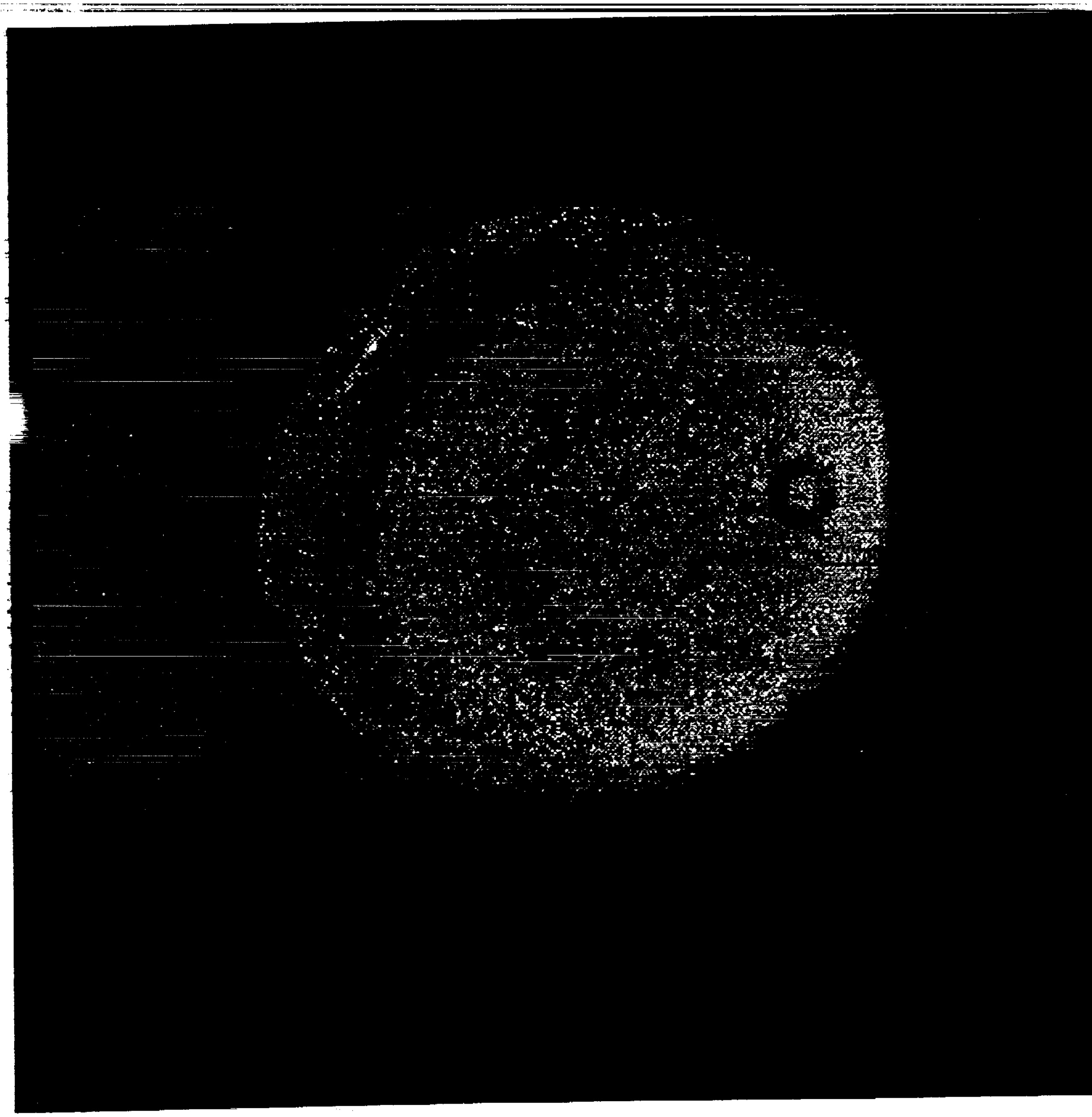
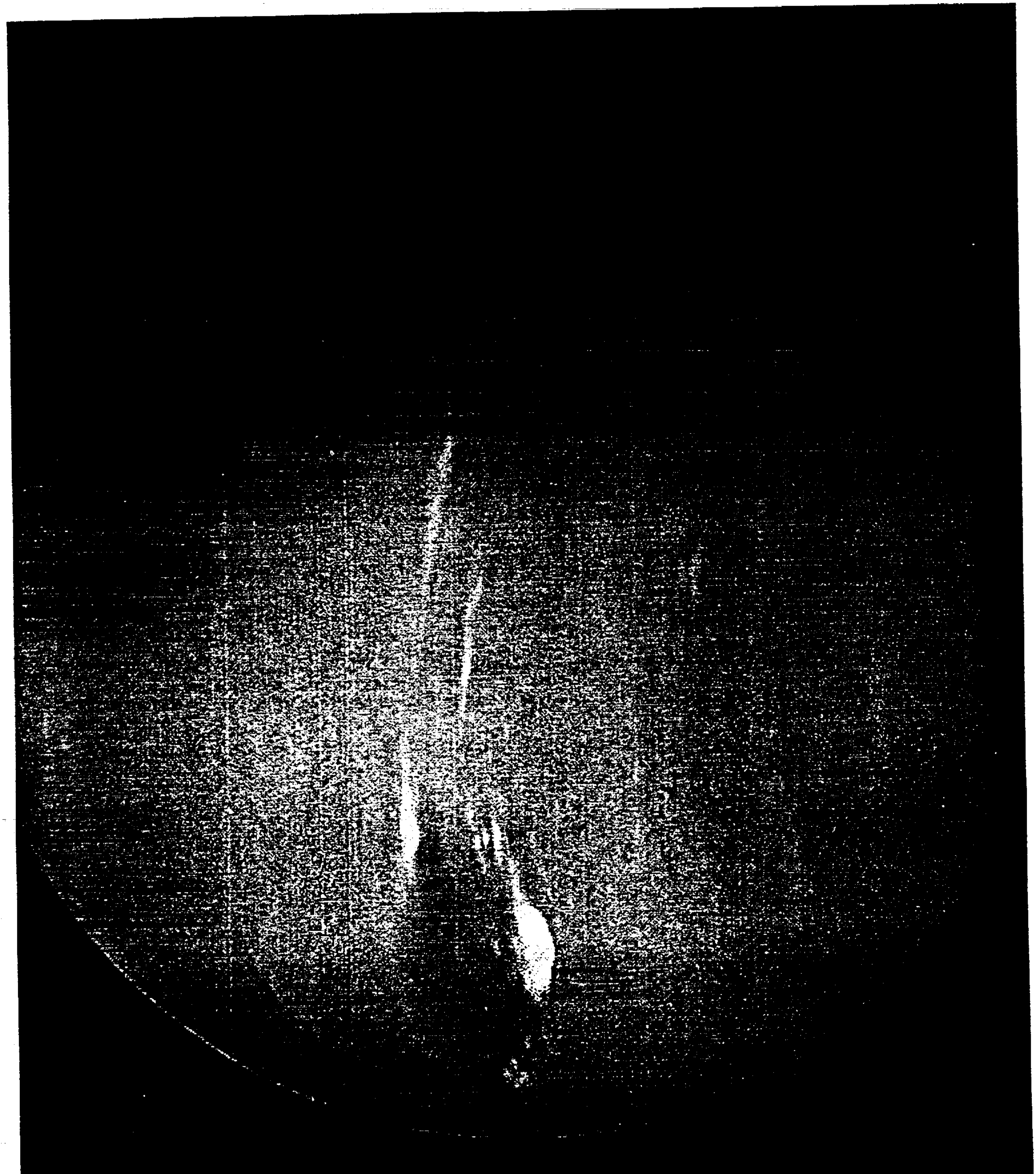
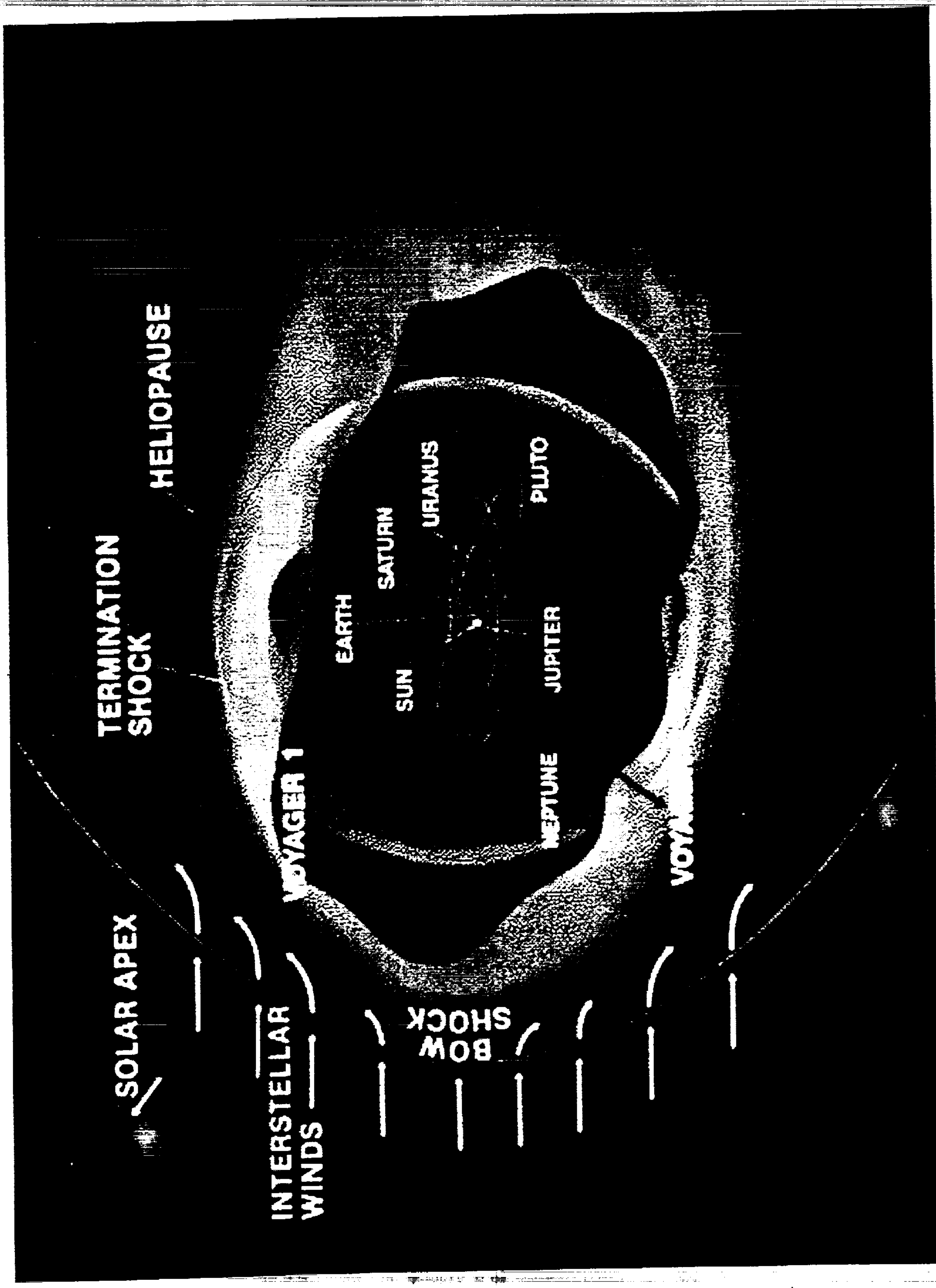
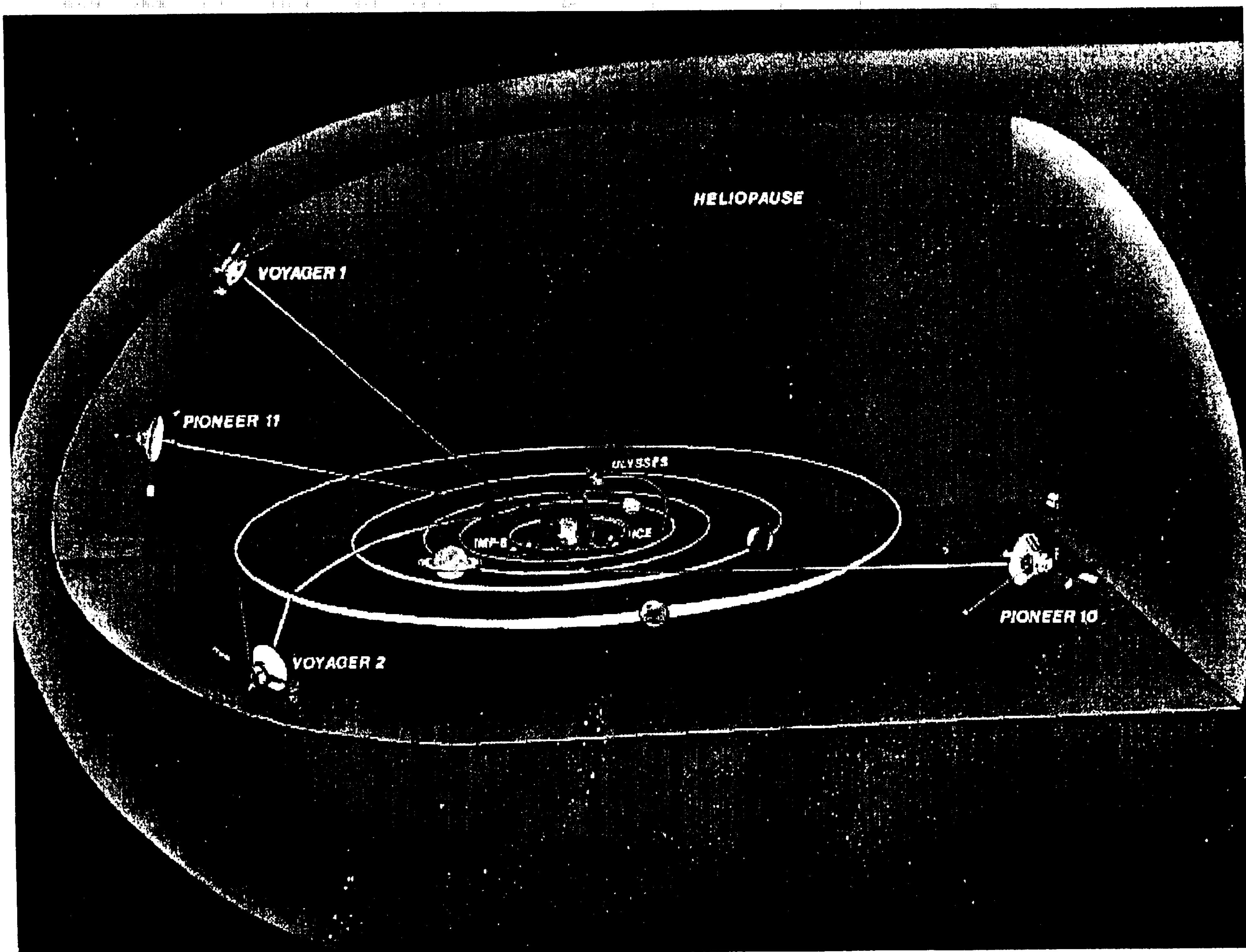
5 Sept 77
Saturn
12 Nov 80
Jupiter
5 Mar 79
Jupiter
9 July 79

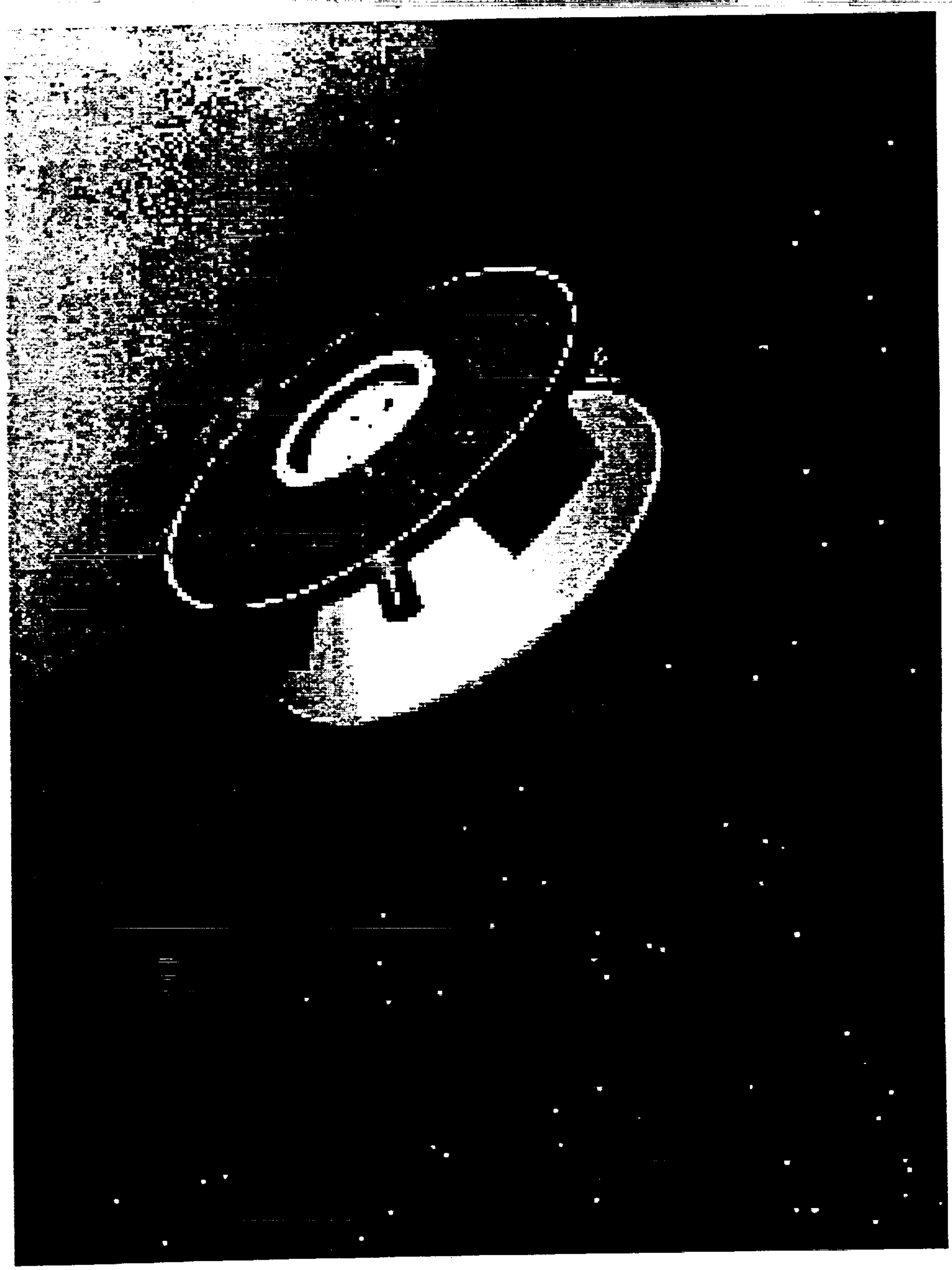


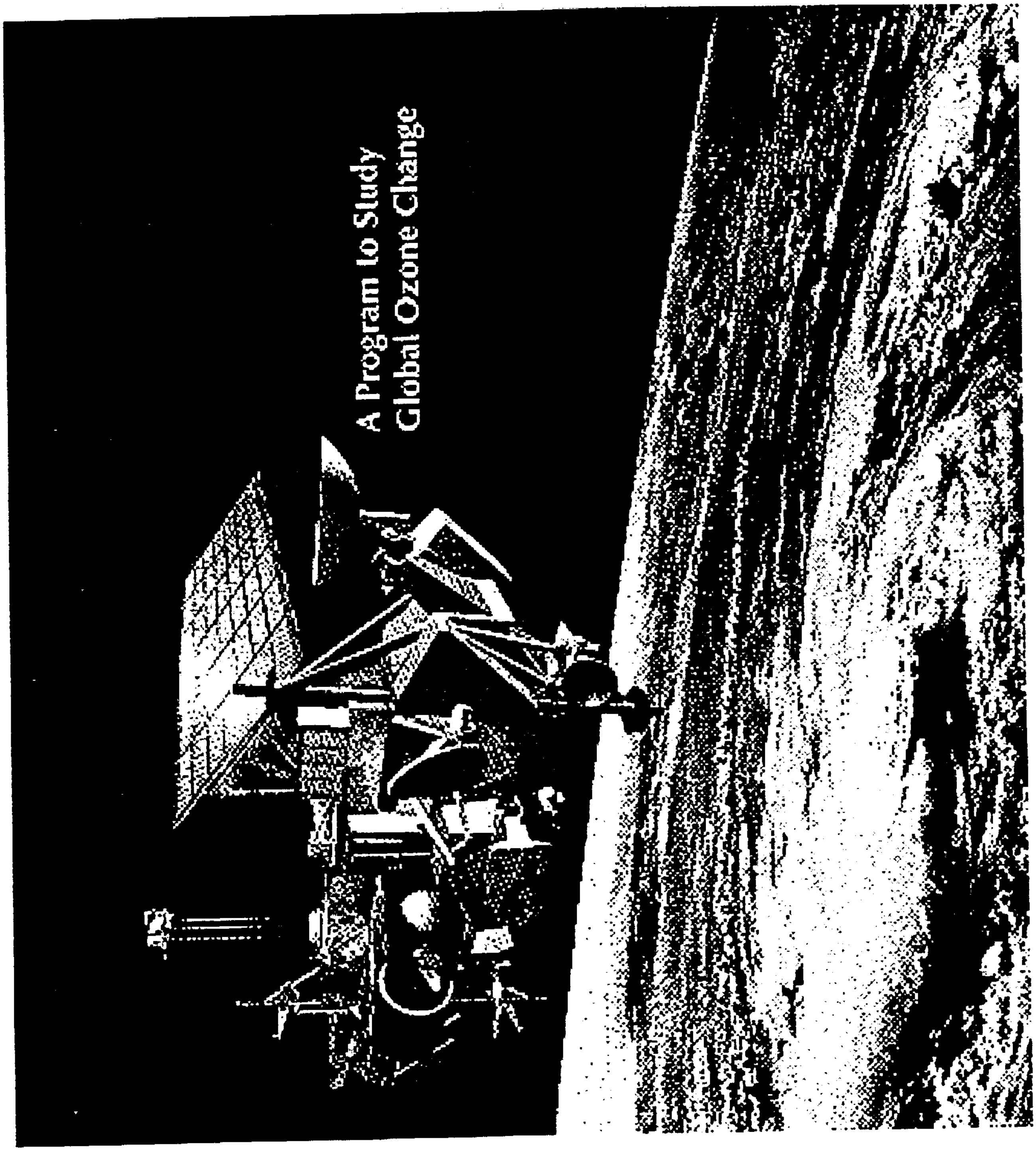


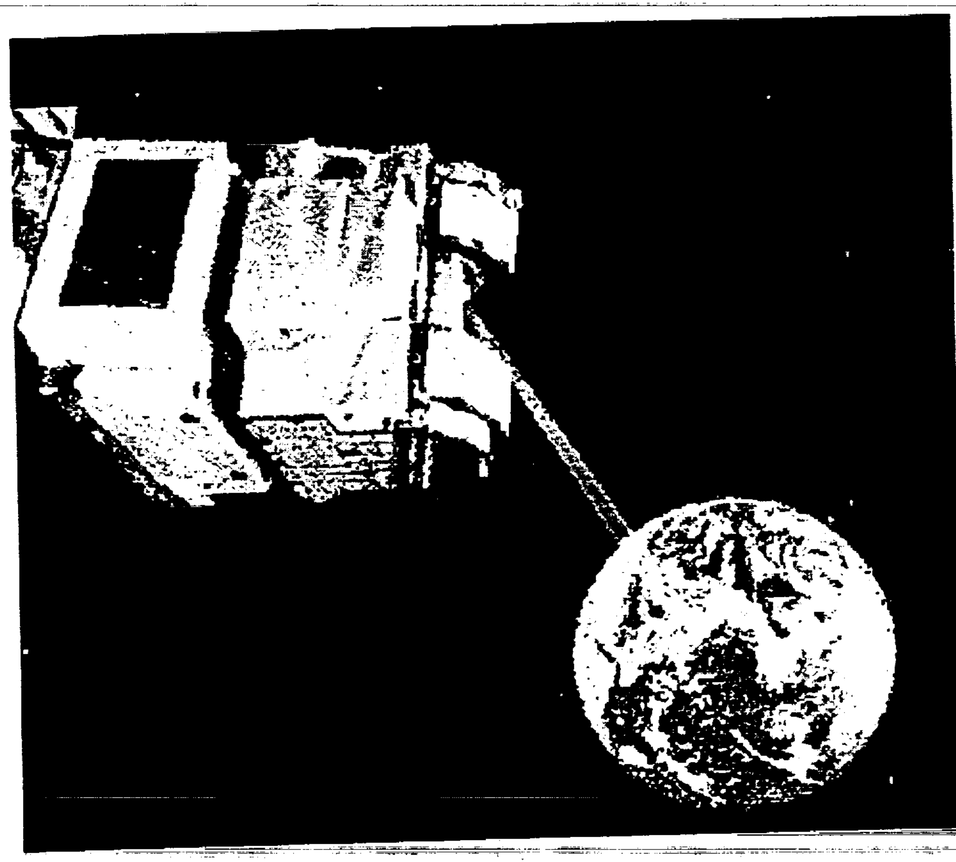



SOLAR APEX
INTERSTELLAR WINDS
BOW SHOCK
TERMINATION SHOCK
HELIOPAUSE
VOYAGER 1
NEPTUNE
SUN
EARTH
SATURN
URANUS
JUPITER
PLUTO

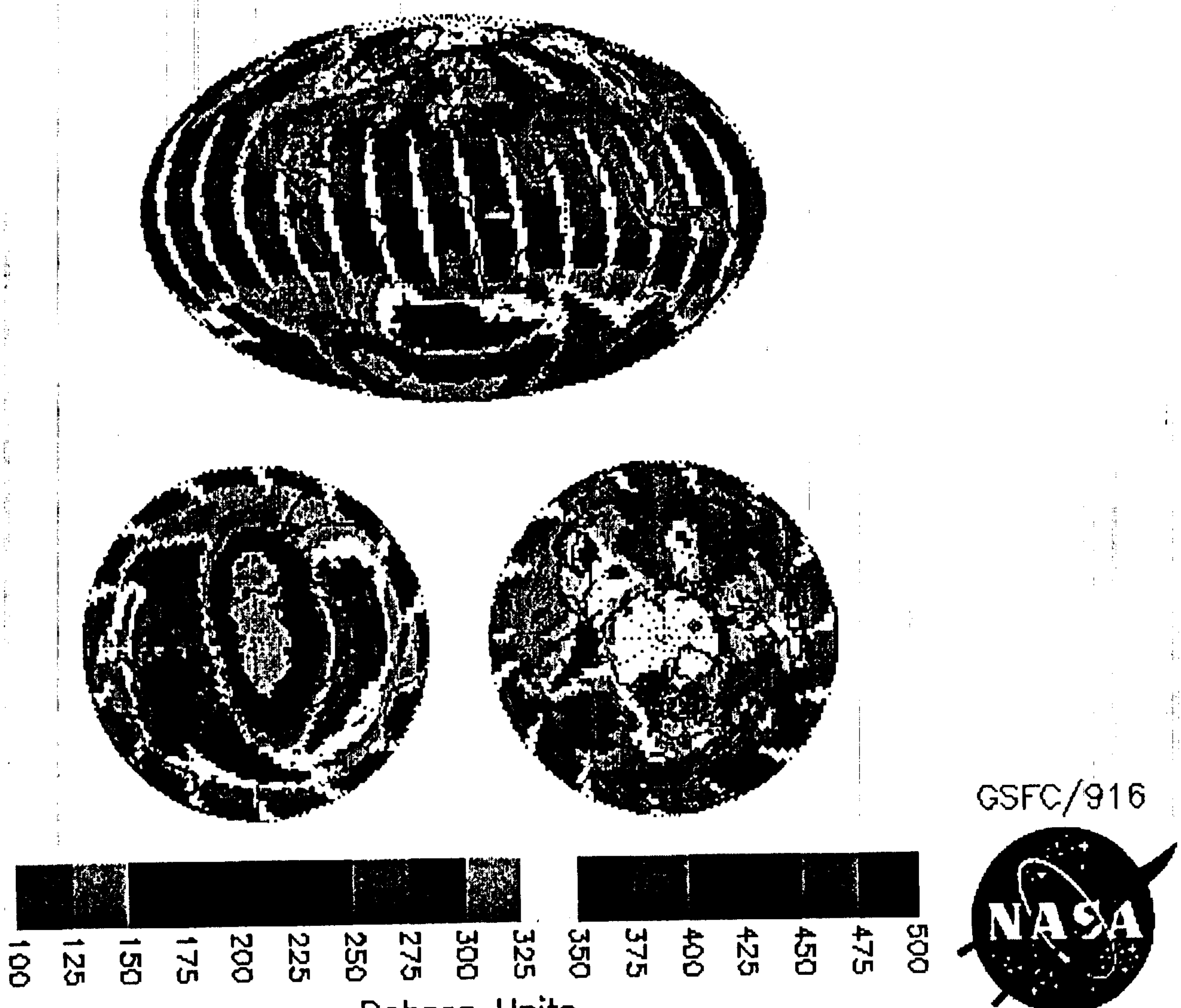

HELIOPAUSE
VOYAGER 1
PIONEER 11
ULYSSES
ICE
VOYAGER 2
PIONEER 10

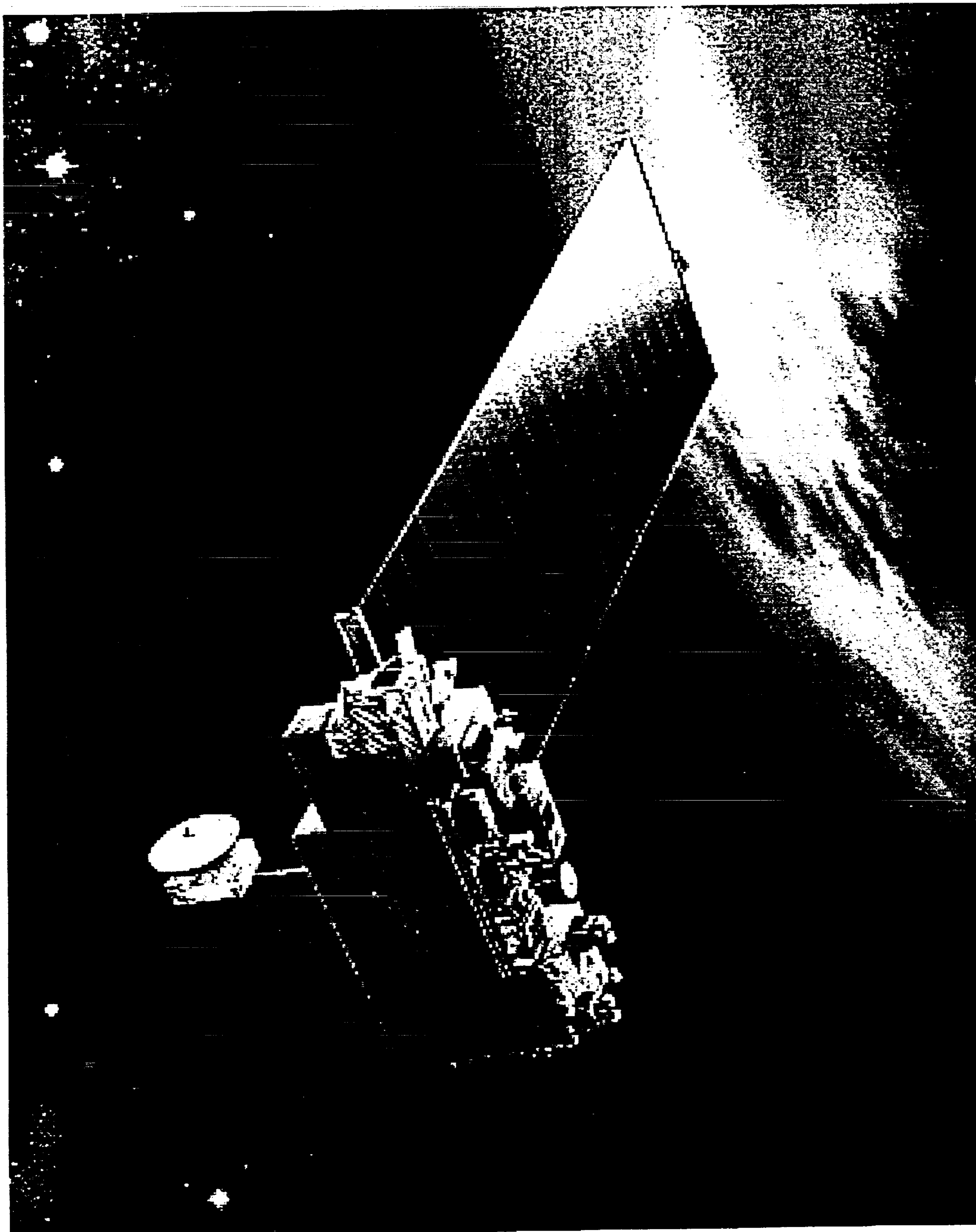



A Program to Study
Global Ozone Change



EP/TOMS NRT OZONE for Oct 19, 1998



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MOPITT
NASA-GSFC
MODIS
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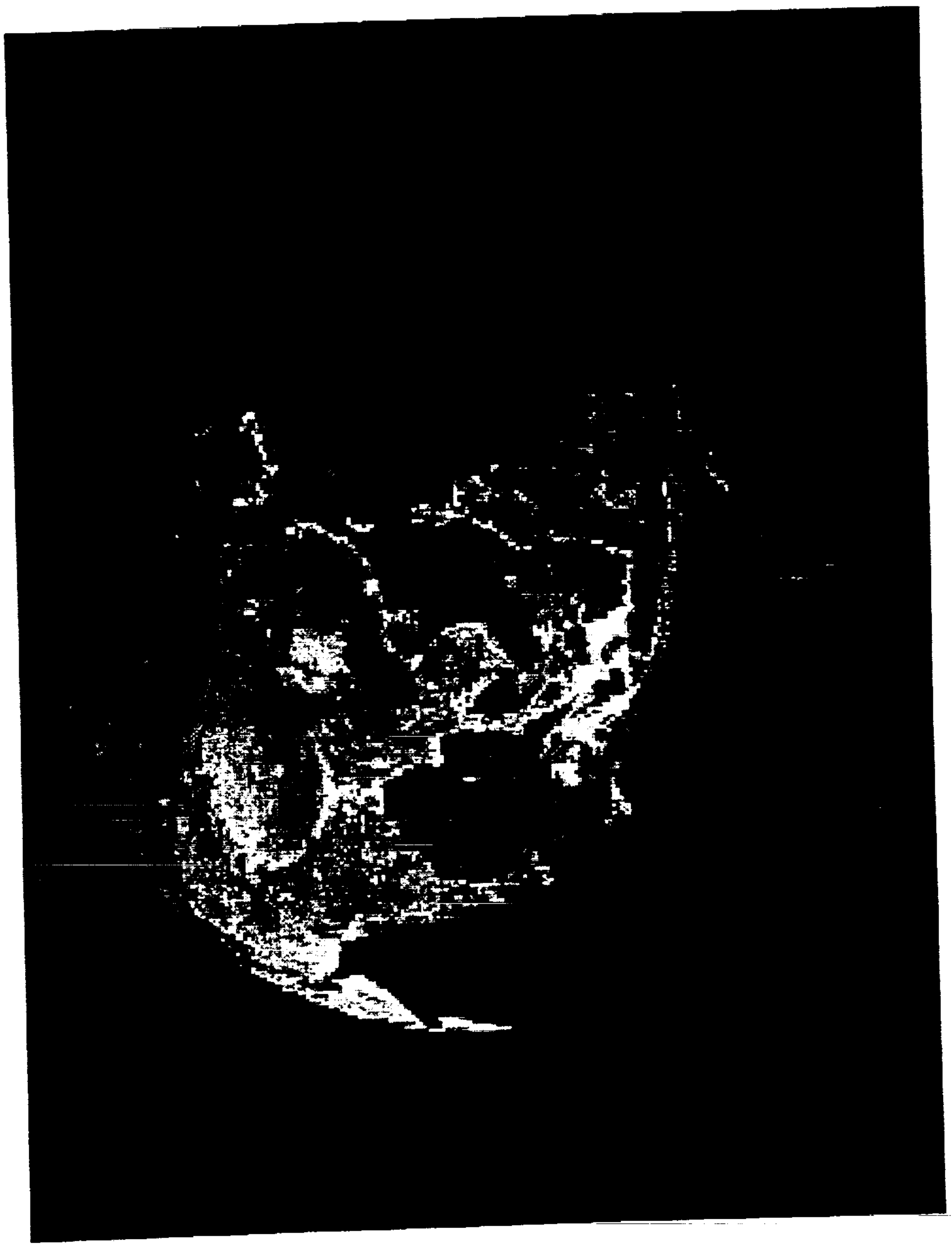
CERES



Science & Communications Forum

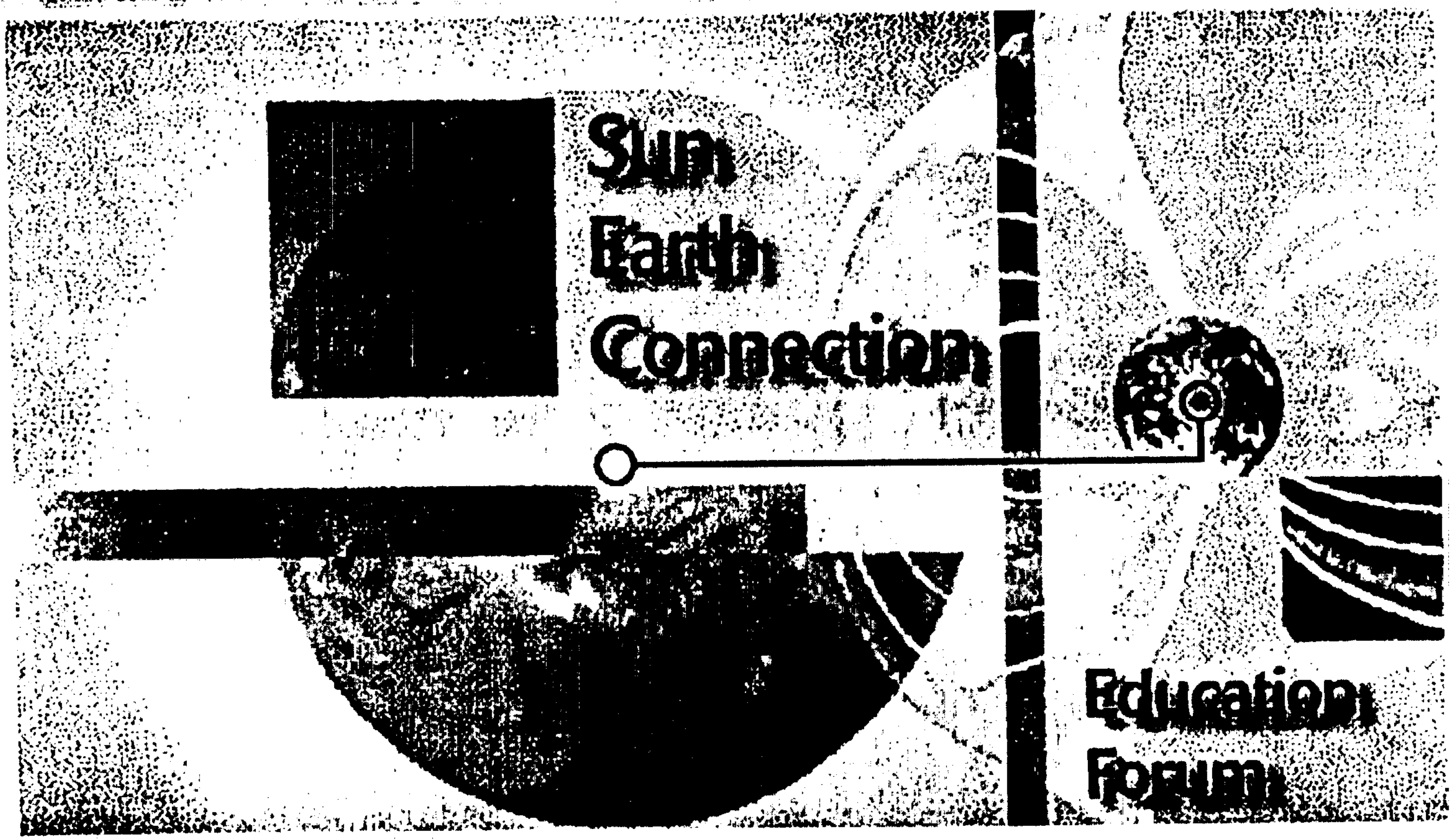
Dr. James R. Thieman
NASA Goddard Space Flight Center
National Space Science Data Center

Dr. Ray A. Williamson
NASA Goddard Space Flight Center
Office of Equal Opportunity Programs

Mr. Dillard Menchan
NASA Goddard Space Flight Center
Office of Equal Opportunity Programs

Mr. Ernie Herrera
University of New Mexico

OSS EDUCATION ECOSYSTEM FORUMS



MU-SPIN Presentation

Jim Thieman

Oct. 21, 1998

The Sun-Earth Connection Education Forum

KEY NATIONAL STATISTICS

Fortieth Anniversary Pioneering the Future

- Number of students: 48.9 million
- Number of teachers: 2.9 million
- Number of classrooms: 1.9 million
- Number of schools: 110,000
- Number of school districts: 15,200

Source: National Center for Education Statistics -- 1993

- Number of space scientists: ~10,000

High leverage is the key to having any impact

The Sun-Earth Connection Education Forum

OSS EDUCATION/OUTREACH PLAN

The Office of Space Science (OSS) Education/Public Outreach Strategy and Implementation Plan are directed towards:

- Embedding education and public outreach throughout all OSS missions and research programs
- Creating long-term partnerships between the space science and education communities
- Channeling individual efforts towards high leverage opportunities
- Building on and adding value to existing programs, institutions, and infrastructure
- **Providing meaningful opportunities for underserved/underutilized groups to participate in the space science program**
- Helping the space science community to become involved in education and outreach
- Ensuring that products and programs developed locally become national resources
- Making a significant, long-term contribution to education and public understanding of science in the United States

The Sun-Earth Connection Education Forum

WHAT IS AN EDUCATION FORUM?

An Education Forum is a major center for long-term support of space science education in one of the four science theme areas of the NASA Office of Space Science. Forums have been established at institutions where a critical mass of scientific and educational expertise exists for the theme.

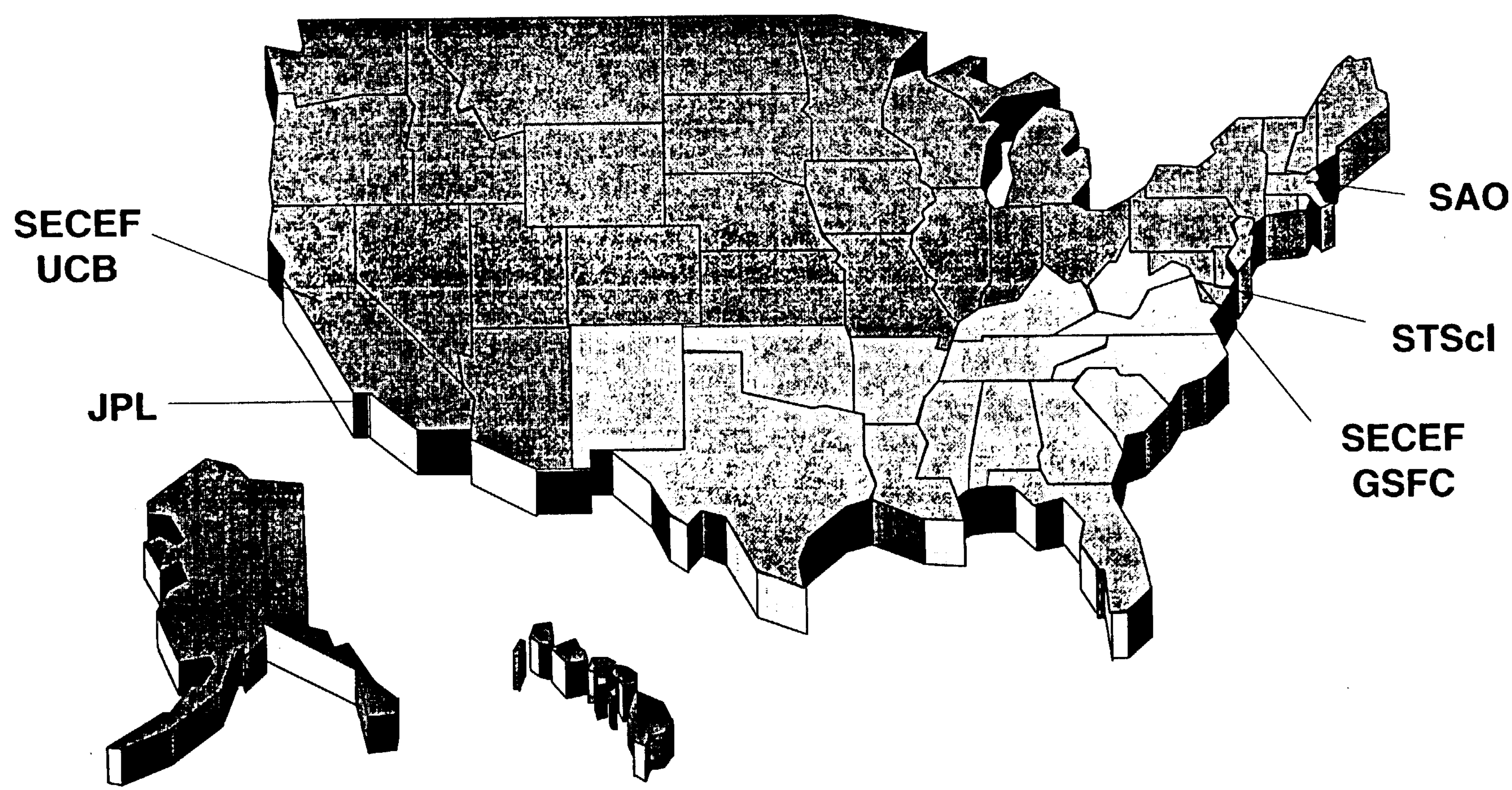
Education Forums

- Sun-Earth Connection
  - GSFC and University of California at Berkeley/ Rich Vondrak and Isabel Hawkins - Co-Directors
- Astronomical Search for Origins and Planetary Systems
  - Space Telescope Science Institute/ Carol Christian - Director
- Solar System Exploration
  - Jet Propulsion Laboratory/ Stephen Saunders - Director
- Structure and Evolution of the Universe
  - Smithsonian Astrophysical Observatory/ Roy Gould - Director

The Sun-Earth Connection Education Forum

Fortieth Anniversary
Pioneering the Future

EDUCATION FORUMS



The Sun-Earth Connection Education Forum

BROKER/FACILITATORS

Pioneering the Future

- DePaul University/Carolyn Narasimhan
- Lunar and Planetary Institute/David Black
- Ohio Aerospace Institute/Larry Cooper
- South Carolina Space Grant Consortium/Mitchell Colgan
- Space Science Institute/Cherilynn Morrow

The Broker/Facilitators will: identify and help establish alliances between educators and space scientists; identify and work with space scientists and educators to address outstanding local, state, and regional needs in the formal and informal education communities; facilitate the use of the archiving and dissemination infrastructure; generally help space scientists become more effective participants in education and outreach.

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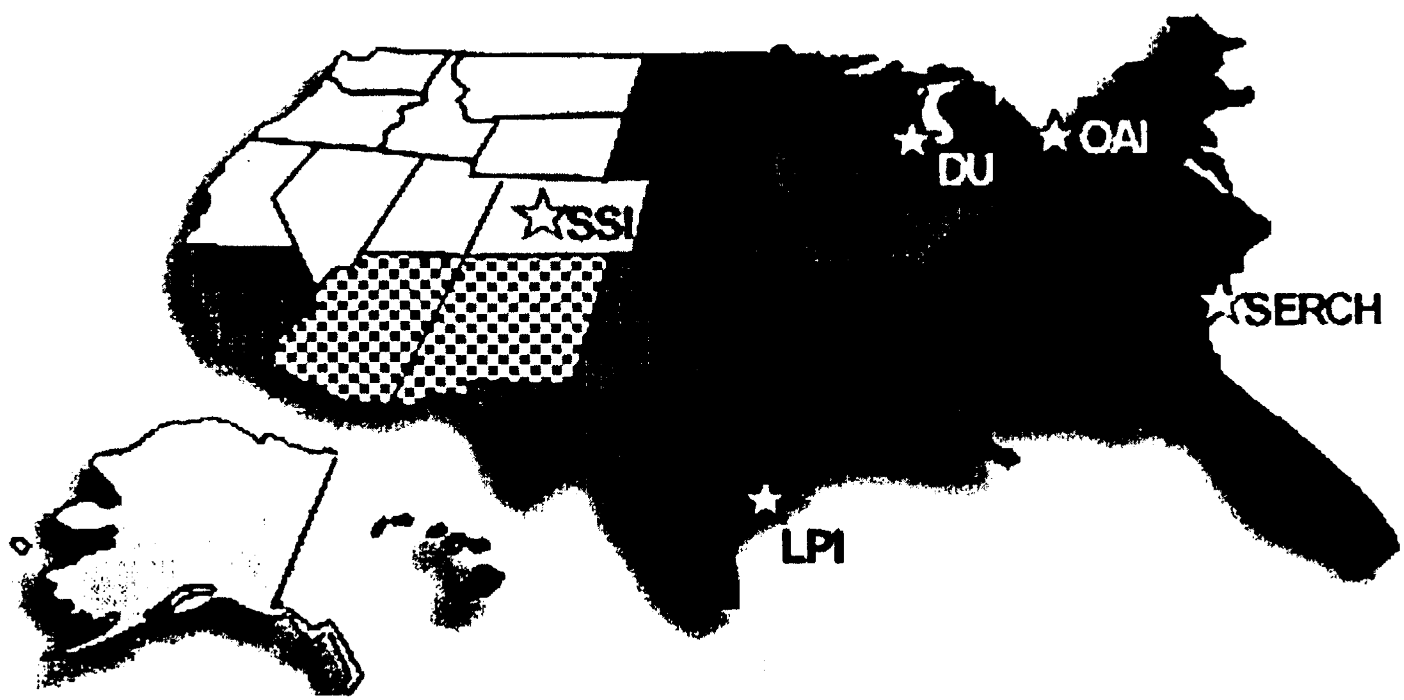
BROKER/FACILITATORS

Fortieth Anniversary
Pioneering the Future

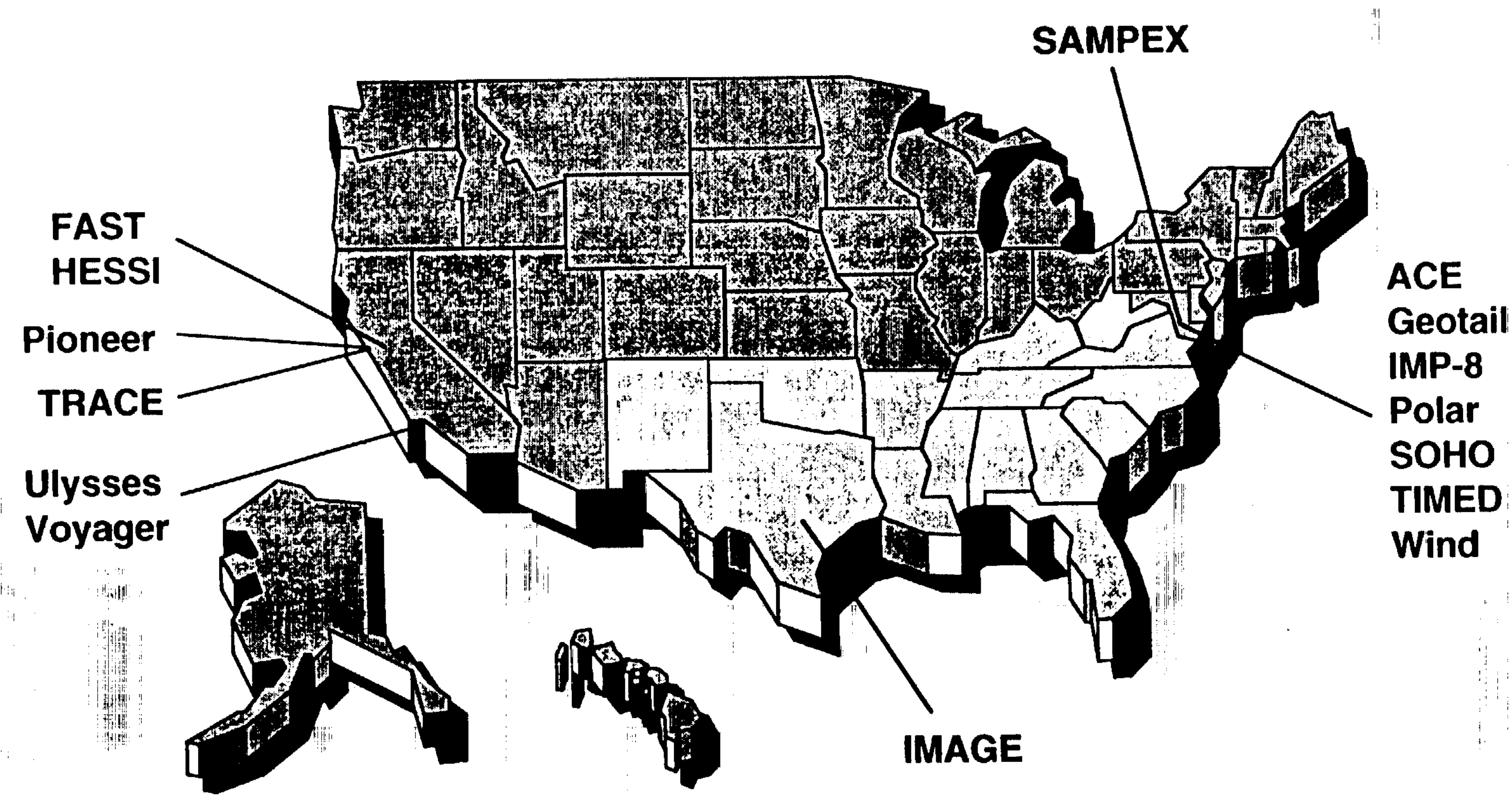


The Sun-Earth Connection Education Forum

WORKING WITH THE MISSIONS

Pioneering the Future

In support of Sun-Earth Connection Education and Outreach SECEF works together with existing SEC missions to enhance their impact and assure coordinated effort. SECEF also provides assistance for older or smaller missions which may not have an education/outreach program.



The Sun-Earth Connection Education Forum

NATIONAL IMPACT

Fortieth Anniversary
Pioneering the Future

The Forums seek to make an impact in their theme area on a national level. "High leverage" opportunities are of special interest.

For example,

- A science training module which could be used in many pre-service teacher training programs
- A booth at the National Science Teachers Association (NSTA) national conference with ~15,000 science teachers attending
- A new Great Explorations in Math and Science (GEMS) volume, a series used by approximately 7,000,000 students
- A "high visibility" public event which is of interest to a broad range of the public

The Sun-Earth Connection Education Forum

SEEKING ANSWERS

The Office of Space Science Education Ecosystem is seeking ways to provide meaningful opportunities for underserved/underutilized groups to participate in the space science program

How do we bring more space science to HBCU's, HSI's, and TCU's?

What can be done to increase the number of minority space scientists?

How can we get feedback on effective ways the institutions can have meaningful participation?

The Sun-Earth Connection Education Forum

Fortieth Anniversary Pioneering the Future

MU-SPIN QUESTIONS

- How well-connected are HBCU's, HSI's, and TCU's and can this be improved and exploited?
- Can network capabilities be used to more effectively promote space science?
- How familiar are the institutions with resources already available on the network?

The Sun-Earth Connection Education Forum

Education Forums

Structure and Evolution of the Universe

Smithsonian Astrophysical Observatory (SAO)
Point of Contact: Roy Gould
Phone Number: (617/496-7689
Email Address: rgould@cfa.harvard.edu

Astronomical Search for Origins and Planetary Systems

Space Telescope Science Institute (STScI)
Point of Contact: Carol Christian
Phone Number: (410)/338-4764
Email Address: carolc@stsci.edu

Solar System Exploration

Jet Propulsion Laboratory (JPL)
Point of Contact: Stephen Saunders
Phone Number: (818)/354-2867
Email Address: saunders@scn1.jpl.nasa.gov

Sun-Earth Connection

NASA Goddard Space Flight Center (GSFC)
Point of Contact: Richard Vondrak
Phone Number: (301)/286-8112
Email Address: vondrak@lepvax.gsfc.nasa.gov

University of California (Berkeley)
Point of Contact: Isabel Hawkins
Phone Number: (510)/643-5662
Email Address: isabelh@cea.berkeley.edu

The Sun-Earth Connection Education Forum

Fortieth Anniversary
Pioneering the Future

BROKER/FACILITATORS

Lunar and Planetary Institute (LPI)
Point of Contact: Pam Thompson
Phone Number: (281)/486-2175
Email Address: thompson@lpi.jsc.nasa.gov

Southeast Regional Clearing House (SERCH)
Point of Contact: Cassandra Coombs
Phone Number: (803)/953-8279
Email Address: cass@jove.cofc.edu

Ohio Aerospace Institute (OAI)
Point of Contact: Larry Cooper
Phone Number: (513)/245-9897
Email Address: larrycooper@oai.org

Space Science Institute (SSI)
Point of Contact: Cheri Morrow
Phone Number: (303)/492-7321
Email Address: camorrow@colorado.edu

Depaul University (DU)
Point of Contact: Lynn Narasimhan
Phone Number: (773)/325-1854
Email Address: cnarasim@condor.depaul.edu

Earth Observations Data and Technology in Support of Education and Outreach

Ray A. Williamson
Research Professor
The George Washington University
202-994-6451
fax: 202-994-1639
email: RWill555@aol.com

Native Peoples, Native Homelands Climate Change Workshop* Will Provide Insights On:

- Native Peoples' strategies for coping with climate change/variability, other environmental changes
- Effects of climate change/variability on Native resources (agriculture, timber, rangelands, water, etc.)
- Other stresses, challenges, opportunities on Native homelands
- The possible uses of new Earth observations data sources that will begin to come on line in 1999, as well as existing data resources

* Albuquerque, 28 Oct. - 1 Nov. Part of the National Assessment of the effects of climate change

The Opportunity:
To use the results of the NP-NH workshop as a starting point to:

- Sustain a continuing dialogue between scientists and Native Peoples about the effects of climate change/variability on Native homelands
- Assist in development of culturally sensitive environmental educational materials for K-12
- Expand training in geospatial technologies (remote sensing, geographic information systems (GIS) and positioning technologies) to support sustainable development of Native lands
  - Use indigenous knowledge and indigenous concerns about environmental change as the basis for choosing subject matter and focus of the training

Education/Outreach Activities

- In collaboration with tribal colleges, develop:
  - Culturally sensitive educational materials on the regional effects of climate change/climate variability for K-12 (esp. science and math); emphasis on Native lands, experience of Native communities
  - Teacher training modules
- Begin in Southwest as case study, then extend model beyond
- Work with tribal colleges, tribal organizations to build indigenous capacity (professional development) to use geospatial tools
- Improve connections among NASA centers as technical resources for Native communities in coping with climate change/variability
- Extend knowledge of how Native Peoples have coped with climate change/variability to other, non-Native populations

Educational Impacts

- Teaching the sciences of Earth and its peoples
  - Geology
  - Biology
  - Geography
- Teaching mathematics through applications of the data to real world problems:
  - Mapping
  - Land planning
  - Resource development and use
- Teaching history
  - Cultural history of land use and land use choices
  - Could feed into non-Native curricula
- Contributing to sustainable development
  - Within Native lands
  - Adjoining, non-Native lands

"MU-SPIN USERS CONFERENCE"

21st CENTURY CAREERS PERSONAL STRATEGIC PLANNING

DILLARD MENCHAN
CHIEF, EQUAL OPPORTUNITY
PROGRAMS OFFICE
NASA/GODDARD SPACE FLIGHT CENTER
GREENBELT, MARYLAND

21^{st} CENTURY TRENDS

I SHORTAGE OF COMPETENT WORKERS WITH SUFFICIENT COMPUTER LITERACY

II SERVICE INDUSTRIES WILL BE RESPONSIBLE FOR MOST JOB GROWTH

III UNEMPLOYMENT RATES WILL FLUCTUATE

IV AS LARGE COMPANIES CONTINUE TO CUT BACK OR CONSOLIDATE, MAJOR JOB GROWTH WILL TAKE PLACE AMONG SMALL COMPANIES (LESS THAN 50 EMPLOYEES)

V MORE BLACKS AND HISPANICS WILL ENTER THE JOB MARKET

VI MORE EQUALITY IN THE WORKPLACE

VII TELECOMMUTER BACKLASH

21st CENTURY TRENDS (Cont'd)

VIII TECHNOLOGY TO REINVENT WORKPLACE

IX LIFELONG LEARNING- NEW REALITY

X CONTINGENT WORKFORCE WILL GROW

XI OPPORTUNITIES FOR CAREER ADVANCEMENT WILL BE INCREASINGLY LIMITED WITHIN MOST LARGE ORGANIZATIONS

XII JOB SATISFACTION WILL BECOME A MAJOR PROBLEM

ENGINEERING FIELDS

21st CENTURY OUTLOOK

AEROSPACE ENGINEERS	↓	DECREASING DoD EXPENDITURES & SLOW REPLACEMENT OF CIVILIAN AIRCRAFT
CHEMICAL ENGINEERS	→	LIMITED GROWTH IN INDUSTRIAL CHEMICALS AND MATERIAL SCIENCE
CIVIL ENGINEERS	→	DEPENDS HEAVILY ON ECONOMY, GROWTH AREAS ARE TRANSPORTATION SYSTEMS, WATER SUPPLY AND POLLUTION CONTROL
ELECTRICAL AND ELECTRONICS ENGINEERS	↑	COMMUNICATIONS, ROBOTICS, AND ADVANCED COMPUTERS
INDUSTRIAL ENGINEERS	→	QUALITY AND AUTOMATION
MECHANICAL ENGINEERS	↑	INCREASED COMPLEXITY OF INDUSTRIAL MACHINERY AND PROCESSES
MATERIAL ENGINEERS	↑	RESEARCH AND TESTING SERVICES
NUCLEAR ENGINEERS	↓	NO NEW NUCLEAR POWER PLANTS
PETROLEUM ENGINEERS	↓	DEPENDS HEAVILY ON PRICE OF OIL

PHYSICAL SCIENTIST OCCUPATIONS

21st CENTURY OUTLOOK

CHEMISTS	→	PHARMACEUTICALS AND PERSONAL CARE PRODUCTS. IMPACTED BY REDUCTIONS IN RESEARCH AND DEVELOPMENT BUDGETS
GEOLOGIST AND GEOPHYSICISTS	→	UNCERTAINTY IN PETROLEUM INDUSTRY, BUT GROWTH IN ENVIRONMENTAL PROTECTION AREA
METEROLOGIST	→	NATIONAL WEATHER SERVICE IS IN THE FEDERAL GOVERNMENT. GRADUATE DEGREE ESSENTIAL
PHYSICISTS AND ASTRONOMERS	↓	REDUCTION IN DEFENSE-RELATED RESEARCH VERY LOW TURNOVER IN UNIVERSITIES PHD IS ESSENTIAL

COMPUTER AND MATHEMATICAL OCCUPATIONS

21st CENTURY OUTLOOK

COMPUTER SCIENTISTS AND SYSTEMS ANALYSTS	↑↑	EVER EXPANDING MARKET FOR NEW TECHNOLOGY IN A VARIETY OF DISCIPLINES
MATHEMATICIANS	↓	SHRINKING RESEARCH AND DEVELOPMENT RESOURCES. GRADUATE DEGREE ESSENTIAL
OPERATION RESEARCH ANALYSTS	↑	SCIENTIFIC TECHNIQUES TO IMPROVE MANAGEMENT. GRADUATE DEGREE IMPORTANT
STATISTICIANS	↓	DATA ANALYSTS IN ECONOMICS, BIOLOGICAL SCIENCE, AND PSYCHOLOGY
ACTUARIES	↑	NOT AS DEPENDANT ON GROWTH IN INSURANCE INDUSTRY

CAREER PLANNING SUGGESTIONS

- CHOOSE AN OCCUPATION THAT WILL USE THE ABILITIES YOU POSSESS
- DO NOT CONFUSE INTEREST AND ABILITY
- AVOID OCCUPATIONS THAT REQUIRE ABILITIES YOU DO NOT POSSE OR CANNOT ACQUIRE
- CHOOSE AN OCCUPATION BECAUSE YOU LIKE THE WORK, NOT SOLEY BECAUSE OF THE REWARDS IN MONEY AND PRESTIGE
- DO NOT EXPECT TO FIND A JOB IN WHICH YOU WILL NEVER HAVE TO DO ANYTHING YOU DISLIKE
- BEWARE OF BIASED INFORMATION FROM RECRUITERS
- TAKE ALL THE ADVISE THAT IS OFFERED, THEN ACT ON YOUR OWN JUDGMENT

THE CAREER PLAN

- DEFINE THE SIGNIFICANCE OF A CAREER FOR YOURSELF
- DON'T FEAR MAKING WRONG CAREER CHOICE DECISIONS
- DEVELOP A COURSE OF ACTION
- NETWORK WITH SUCCESSFUL AFRICAN AMERICANS IN YOUR CHOSEN CAREER FIELD
- LEARN GOOD PROJECT MANAGEMENT SKILLS
- SEARCH FOR ALTERNATIVE JOB OPPORTUNITIES

FEINGOLD AND MILLER

"EMERGING CAREERS"

EMERGING CAREERS FOR THE 21st CENTURY

ARTIFICIAL INTELLIGENCE TECHNICIAN

AQUACULTURIST

AUTOMOTIVE FUEL CELL BATTERY TECHNICIAN

BENEFITS ANALYST

BIONIC ELECTRON TECHNICIAN

COMPUTATIONAL LINGUIST

COMPUTER MICROPROCESSOR

CRYONICS TECHNICIAN

DIALYSIS TECHNOLOGIST

ELECTRONIC MAIL TECHNICIAN

FIBER OPTIC TECHNICIAN

FUSION ENGINEER

HAZARDOUS WASTE TECHNICIAN

HORTICULTURE THERAPY

IMAGE CONSULTANT

INFORMATION BROKER

INFORMATION CENTER MANGER

JOB DEVELOPER

LEISURE CONSULTANT

MATERIALS UTILIZATION SPECIALIST

MEDICAL DIAGNOSTIC IMAGING TECHNICIAN

MYOTHERAPIST

RELOCTION COUNSELOR

RETIREMENT COUNSELOR

ROBOT TECHNICIAN

SHYNESS CONSULTANT

SOFTWARE CLUB DIRECTOR

SPACE MECHANIC

UNDERWATER ARCHAEOLOGIST

WATER QUALITY SPECIALIST

NETWORKING FOR JOB LEADS

- 7 OUT OF 10 JOBS ARE FOUND THROUGH NETWORKING
- EMPLOYERS DO NOT WANT TO HIRE STRANGERS
- FOUR GROUPS OF PEOPLE FOR NETWORKING
  - WHO YOU KNOW
  - WHO YOUR PARENTS/MENTORS KNOW
  - WHO KNOWS YOU
  - WHO THEY KNOW
- SKILLS FOR EFFECTIVE NETWORKING
  - ASSERT YOURSELF POSITIVELY
  - ASK GOOD QUESTIONS
  - PRESENT YOURSELF ATTRACTIVELY
  - LISTEN

MINORITIES IN THE WORKFORCE

- MINORITIES COMPRISE 21% OF WORKFORCE
  - NO MORE THAN 13% MANAGERS IN ANY JOB SKILL INDUSTRY
  - LESS THAN 3% IN SENIOR – LEVEL POSITIONS
- AFRICAN AMERICAN UNEMPLOYMENT RATE IS DOUBLED THAT OF WHITES OVER THE LAST 3 DECADES
- OVER 30% OF HISPANICS BELOW POVERTY LEVEL
- IN 1997, ONLY 3% OF COLLEGE EDUCATED MINORITY MALES UMEMPLOYED

FOR MINORITIES ACHIEVERS ACTION PLAN

- HAVE OPTIONS FOR THEMSELVES EITHER INSIDE OR OUTSIDE THEIR COMPANY
- MAKE SURE THEIR WORK IS RECOGNIZED
- ASK FOR WHAT THEY WANT
- HAVE SUPPORT GROUP
- CONSTANTLY FOCUS ON THEIR PERSONAL AND PROFESSIONAL GOALS
- HAVE AN ATTITUDE

The University of New Mexico

High Performance Computing Education & Research Center

High Performance Computing and Communications Education, Research and Services at the University of New Mexico

- Ernie Herrera
  Associate Director

- High Performance Computing Education and Research Center

- October 21, 1998

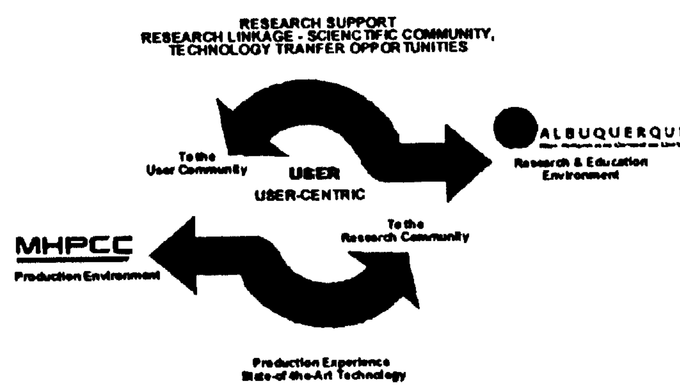
The University of New Mexico

High Performance Computing Education & Research Center

High Performance Computing Education and Research Center

Mission: "To Focus UNM initiatives in High Performance computing and communications"

- Largest University Center, serving all colleges and departments
- Conducts its mission through its two centers
  - **Maui High Performance Computing Center**
  - **Albuquerque High Performance Computing Center**
- Approach is to provide a full spectrum of education, research and development, and production activities



The University of New Mexico

High Performance Computing Education & Research Center

The AHPCC - MHPCC Spectrum

AHPCC Education and Research	MHPCC Development and Production
Primarily conducts education and research	A world-class supercomputer center with emphasis on development and high-end production
Supports faculty, staff and students	Supports government industries and academic organizations
Computer resources emphasizing research	High-end production facilities rank in Top 30 in the world
Highly interdisciplinary	Over 1400 users
About 550 users	

Summary

- UNM resources in high performance computing and communication are extensive
- Large university center with two sub-centers covering a spectrum from education to production
- Albuquerque High Performance Computing Center provides a unique environment for education and research activities

The University of New Mexico

High Performance Computing
Education & Research Center

AHPCC

Mission: "To provide focus for university research and education in advanced high performance computing and inter-disciplinary applications and state-of-the-art communications."

Resources

- Computing Systems
  - 128 node IBM SP2
  - 8 node SGI Origin 2000
  - 12 node Linux cluster
  - 8 node Alta cluster
  - Engineering workstations
  - Visualization Laboratory
- Staff
  - 12 Affiliated Faculty
  - 14 Research Scientists, Engineers, and Post Docs
  - 22 Graduate Research Assistants
  - 4 Technical Support
- Programs
  - 9 Research Groups
  - 20 funded research projects/programs

The University of New Mexico

High Performance Computing
Education & Research Center

Research at the AHPCC

- Conducted through 9 Research Groups

ALBUQUERQUE
High Performance Computing Center

Group Name	Group Leader
Computational Biology	Mary Anne Nelson
Computational Chemistry	Debi Evans & Andy Pineda
Computational Mechanics	Malcolm Panthaki
Computational Physics	Paul M. Alsing
Linux Clusters	John Greenfield
Multiphase Flows	Andrea Mammoli
Signal & Image Processing	Joseph Fogler
Systems & Networks	John S. Sobolewski
Visualization	Tom Caudell

- Research Groups consist of Faculty, Staff and Research Assistants

The University of New Mexico

High Performance Computing Education & Research Center

Education Outreach and Training

- AHPCC conducts HPCC training for regional academic, industry and government organizations
- AHPCC provides workshops & training for DOD centers and National Laboratories
- HPCERC is a partner in the National Computational Sciences Alliance to provide
  - **Training for Alliance Partners**
  - **Outreach and Training for Native Americans**
  - **Advanced Computing Services, Including User Support**

The University of New Mexico

High Performance Computing
Education & Research Center

Workshops

- Workshops are conducted at the AHPCC facilities
  - **Permanent Workshops 'cluster' for training and research**
  - **Staff and graduate student instructors**
  - **Materials being migrated to web-based instruction**
- Topics include
  - **Fall schedule emphasizes training first-time users**
  - **Spring and Summer focuses on advanced and special topics**

The University of New Mexico

High Performance Computing Education & Research Center

Workshops Continued

Date	Course	Instructor
September 10, 1998 (9:30-11:30) (3:00-5:00)	Introduction to AHPCC/MHPCC Systems	AHPCC Systems Staff
September 10, 1998 (9:30-11:30) (3:00-5:00)	High Performance Fortran	Brian Smith
September 10, 1998 (9:30-11:30) (3:00-5:00)	MPI I	Andy Pineda
September 10, 1998 (9:30-11:30) (3:00-5:00)	MPI II	Paul Alsing & Andy Pineda
September 10, 1998 (9:30-11:30) (3:00-5:00)	MPI III	Paul Alsing & Andy Pineda
September 10, 1998 (9:30-11:30) (3:00-5:00)	Parallel Libraries	Paul Bennett
September 10, 1998 (9:30-11:30) (3:00-5:00)	SP2 Related Topics Hardware Overview, Mass Storage, Batch Scheduling	Brian Baltz
September 10, 1998 (9:30-11:30) (3:00-5:00)	Scientific V isualization I via Data Explorer	Karen Haines
September 10, 1998 (9:30-11:30) (3:00-5:00)	Scientific Visualization II Multimedia Output via Data Explorer	Karen Haines
September 10, 1998 (9:30-11:30) (3:00-5:00)	Introduction to SMP Programming with Compiler Directives	Randy Evans

Scientific and Engineering Computational Certificate Program

- Unique program that certifies MS and PhD students in HPC application emphasis
  - **11 interdisciplinary university departments are represented**
  - **Core program curriculum with applications in 11 areas**
  - **Research emphasis in HPC applications**
- Post-graduate program for professionals

Student & Faculty Poster Session

Ms. Alice Baker & Ms. Helen Stillinger
South Carolina State University

Ms. Ely N. Duenas
City College of New York

Mr. Ly John Fridie
South Carolina State University

Ms. Sangeeta Gad
University of Houston - Downtown

Ms. Ruth Hodges
South Carolina State University

Ms. Elaina Norlin & Ms. Patricia Morris
University of Arizona Libraries

Ms. Kelry Robinson
South Carolina State University

Dr. Waldo Rodriguez
Norfolk State University

Dr. Nikunja Swain & Ms. Gwendolyn Tobin
South Carolina State University

Mr. Taran Tulsee
Queensborough Community College

Dr. Donald Walter
South Carolina State University

Center for Network Resources and Training Internship Program

Ms. Alice Baker and Ms. Helen Stillinger
South Carolina State University
Center for Network Resources and Trainin
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The Center for Network Resources and Training Internship Program is dedicated to giving South Carolina State University (SCSU) students the opportunity to participate in an active learning environment in such areas as UNIX operating system, networking, systems administration, multimedia, web design and teaching in a classroom, while gaining meaningful work experience. While technical in nature, the program is geared toward reinforcing skills with hands-on learning whereby students are able to utilize the expertise of SCSU faculty and staff as well as its various affiliates to ensure the accuracy of duties and projects.

Students are selected from the areas of biology, physics, chemistry, engineering, computer science, mathematics, and engineering technologies and are required to attend an orientation process and several training workshops throughout the semester to ensure the proficiency of the work in order to gain maximum knowledge in their respective jobs.

The program is composed of three levels:

1. Research Assistant - assists with the installation and maintenance of the Center for Network Resources and Training (CNRT) LAN systems for SCSU and CNRT partner schools; provides hardware and software support to CNRT server and clients; creates web pages using HyperText Markup Language (HTML).
2. User Support Trainee (UST) - monitors the CNRT computer lab and assists users with the computers, while developing personal skills with the computer software and hardware.
3. Office Assistant/User Support Trainee - Assists in administrative duties in the CNRT office as well as those defined in (2) above.

To date, more than 40 students have participated in the program. Some students had summer internships at General Motors and AT&T; others received scholarships and fellowships to attend graduate schools such as Wake Forest University, University of Georgia, and University of South Carolina, while others have gained permanent employment at Lucent Technologies, MCI, IBM, and Santee-Cooper.

Since April of 1997, the students have participated in the following projects:

PowerPoint Presentations	Poster Presentations
Internet/Technology Oral Presentations	GLOBE Training Workshop (student GLOBE certified)
Assistance with K-12 Internet Camp	Assistance in Design of CNRT Web Site
Mathematics Project	Undergraduate Research in Astronomy
Undergraduate Research in Material Science	Undergraduate Research in Computer Engineering
Web Pages: Funding Agencies & Proposal Writing	Guide to Graduate & Professional Fellowships for Minority Students Web Page
Developed a SCSU Faculty/Staff Search Directory	CNRT Webmaster
Student Personalized Web Page	Assisted Faculty in Putting Courses Online
Assisted Faculty - Developing Web-based Instruction for Courses	Assisted in Drawing of LAN Design
UTP Cable Installation	Win 95 and Win NT Systems Administration
Computer Hardware Repair	

The largest group, or 37%, of the students working within the CNRT Internship Program are biology majors. Computer Science majors are second, comprising 27%.

Students who participated in the Internship Program have gained permanent positions at IBM, Santee-Cooper, MCI, Lucent Technologies, Milliken, Inc., and College of Charleston. Some are in graduate school at Wake Forest University, University of Georgia, and University of South Carolina; and others obtained summer internships at Lucent Technologies, AT&T, General Motors, and SCSU. Damian Clarke, together with another CNRT student intern, Brian Lalla, participated in an exchange program with Oxford University in England during the month of July, 1998.

PERMANENT JOBS

Name	Major	Intern	Current
Sirbrittie Grant	Comp Science	Asst Web Publisher	IBM Programmer
Andre' Green	Mech Engineering	Asst Network Mgr	Santee-Cooper Networking
Charisma Pagan	Comp Science	Lab Monitor	MCI Programmer
Cedric Snell	Comp Science	Asst Web Publisher	Lucent Technologies
Regional Wells	Elect Eng Tech	Asst Network Mgr	Milliken, Inc. Process Engineer
Tracy Wigfall	Biology	Lab Monitor	College of Charleston Accounts Payable

GRADUATE SCHOOL

Name	Major	Intern	Current
Jermaine Hampton	Physics/Eng	Asst Web Publisher	Wake Forest University - Biomedical Eng
Antoinette Williams	Biology	Asst Web Publisher	University of South Carolina - Medical School
Jowi McMillan	Biology	Lab Monitor	University of Georgia - Biology

SUMMER INTERNSHIPS

Name	Major	CNRT	Intern
Nicole Baldwin	Chemistry	Asst Web Publisher	SCSU
Marcus Britt	Comp Science	Asst Sys Admin	Web Development Lucent Technologies
Damian Clarke	Comp Science	Asst Web Publisher	Exhange Program Oxford University General Motors - Programming
Sirbrittie Grant	Comp Science	Asst Web Publisher	AT&T - Web Development

In comparison to minimum wage earners on campus at South Carolina State University, the lowest salary of any CNRT intern is greater than the minimum wage.

Jermaine Hampton, a Physics/Engineering major, graduated from South Carolina State University in December 1996. While at SCSU, he worked with the CNRT as its webmaster until July 1997. He is currently a graduate student at Wake Forest University, majoring in Medical Engineering. He states:

From its inception at S. C. State, the Center for Network Resources and Training shaped my educational experience as a student by placing basic Internet utilities necessary within my reach and by providing the training that allowed effective use of these tools for research and career planning. During my tenure as CNRT Webmaster, my knowledge of computers, networking and the Internet continued to grow to develop into skills which impact my life as a graduate student even today.

Sirbrittie Grant, Computer Science major, worked as a CNRT Research Assistant in 1997, during which time she created and maintained the SCSU Ongoing Research Web Site while working in a UNIX environment, utilizing digital imaging techniques. It was her desire to pursue a career in Management Information Systems upon graduation in May 1998. She is currently employed by IBM as an IT Specialist-Application Development/Management, developing on a Windows NT platform, jointly using Oracle databases, PowerBuilder and Java tools. Sirbrittie had this to say about CNRT:

CNRT provided the practical technological experience every institution should possess. It introduced me to the dynamics of the World Wide Web and extended me the opportunity to plunge deep into the Internet's intricacies. CNRT's infrastructure and staff made learning enjoyable. CNRT has proven to be a well-grounded stepping-stone to my academic, technical and professional growth.

Andre' Murphy, a Computer Science major, is currently the CNRT Webmaster. He is also a member of the United States Coast Guard and upon graduation from South Carolina State University, he will become a commissioned officer. After a three-year tour of duty with the Coast Guard, Andre' plans to pursue a Master's Degree in Networking Administration. Of the program, he says:

The Center for Network Resources and Training vastly improves one's educational experience at South

Carolina State University through the exposure it provides to various integral facets of computer science. Some of these aspects include Web Publishing, Network Administration, and Research. The CNRT provides the accessibility to the Internet so that both students and faculty at SCSU can fully realize and appreciate its educational value and usefulness. The CNRT furnishes the valuable hands-on experience that is no available in the ordinary classroom environment but it is so necessary for one to acquire a job of their choice. The benefits of the Center for Network Resources and Training are both exponential and boundless.

Spatial Temperature Variations in the Lagoon Nebula (M8)

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Abstract

MUSPIN NRTS sites at South Carolina State University (SCSU) and City College of New York (CCNY) have collaborated to fund student astrophysical research during the summer of 1998. The results of one such student are presented.

The emission nebula M8 has being examined using ground based CCD imagery taken through narrowband interference filters at select wavelengths of diagnostic importance (e.g., temperature). The IRAF software package was used in the standard manner to calibrate the raw images. Further details of the data reduction can be found elsewhere in this conference (see Taran Tulsee's poster). The ultimate goal of this project is to produce a temperature map of the nebula using the doubly ionized oxygen atom, which emits at a wavelength of 4363 and 5007 angstroms. The ratio of images obtained at these two wavelengths will lead to the most detailed spatial temperature map of M8 to date. This map will be of importance to future researchers in determining chemical abundance variations among M8 and other galactic emission nebulae.

This research is being funded by MUSPIN NASA cooperative agreement NCC5-116, NASA-URC NCC5-228, and other NASA sources.

Summary

NRTS Summer Collaboration

In a collaborative effort to motivate undergraduate students to develop an interest in Astronomy and Space Science, the MUSPIN NRTS sites at SCSU and CCNY have participated in a research exchange program that involved students from each NRTS.

The presenter of this poster had the opportunity, for the first time, to have hands-on use of an 8" telescope during astronomical observing nights set up by the observing team. The observing team was composed by Taran Tulsee (Queensborough Community College—see his poster display), Anthony Williams (SCSU), Ely Duenas (Hunter College of CUNY), and was guided by Dr. Donald Walter (SCSU). Such observing experience was very rewarding for students who are considering a career in the Space Sciences. Additionally, the students gained computing/technical skills including web publishing, digital image processing, working in the UNIX environment, and the use of SUN workstations.

About the Lagoon Nebula, M8

Also called NGC 6523, the Lagoon Nebula is about 5200 light-years from the Sun and in the direction of the center of the galaxy, and it can be seen by the naked eye as a comet-like glow in the Sagittarius constellation. M8 contains dust and gas clouds where new stars form; it gets its energy from ultraviolet (UV) radiation that results from interacting with young hot stars in its midst, and it is seen as a glowing region of hydrogen gas called an "HII" region. In the nucleus of the nebula, a dumbbell-shaped feature—the Hourglass—is observed, which has a high surface brightness. Another interesting feature of the Lagoon nebula are the Bok globules, which are tiny, circular dark nebula against the brilliant nebular background, with diameters of 7,000 to 10,000 AU, produced by relatively dense clouds of dust. Globules are thought to be protostars or new stars in their earliest stages of formation.

Results from this Study

This poster will summarize the results of the data reduction and image processing performed on a set of ground-based images taken of the nebula through narrow-band interference filters. These images were examined using the IRAF software package to remove sources of noise and produce data which is scientifically useful. An example of this will be presented in the form of a temperature map of the nebula using the ratio of two images taken at different wavelengths of doubly ionized oxygen. After additional analysis, the results of this study will be published and made available for others interested in determining chemical abundances and modeling HII regions.

The Effects of Au and Ag Doping of Bismuth Compounds

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Abstract

A NASA funded undergraduate research student at South Carolina State University will present the results of a study of the effects of doping BiSCCO superconducting compounds with Ag and Au. Previously processed compounds (See Kelry Robinson this conference) are used to make quantitative measurements of pellets and whiskers. These measurements are used to determine the effect of doping on the transition temperature (temperature at which material superconducts). This study will look at doping ratios not previously studied. The results of this study will ultimately contribute to a better understanding of superconducting materials and commercial applications.

Introduction

BiSCCO is shorthand for bismuth strontium calcium copper oxide (Bi2Sr2Ca2Cu3O or Bi2Sr2Ca1Cu2O) compounds which are high transition temperature superconductors. One of the easiest measured parameters of superconductivity is the transition temperature T_c. There are theories of how T_c should be affected by substitution. Thus there are many studies of the effect of substitutions for Cu in the Cu-O planes which are thought to be the cause of high T_c superconducting compounds. The research group at South Carolina State University has found it to be relatively simple to grow substituted single crystals (whiskers) of the Bi-based superconductors with narrow transitions so that various substitutions may be studied. This work has concentrated on substituting the Cu in the BiSCCO series with either Au or Ag.

Experimental Procedures

The growth method for the single crystals was pioneered by Matsubara et al. Details of the method can be found in the presentation by K. Robinson. Briefly, the proper amounts of oxides and carbonates were mixed, melted at 1200^0 C, splat-cooled and annealed at just below the melting point for 100 hours. Quantitative compositional analysis of substituted samples was done by electron probe microanalysis using a Cameca SX50 four-wavelength spectrometer automated electron microprobe.

A standard four-probe DC technique with a supply current of 100 microamps was used to measure the a-axis electrical resistance which allowed for the determination of the sample resistance as a function of temperature. Electrical contacts were made by evaporating four silver pads on the sample, then annealing at

550^0 C for one minute in air. Typical contact resistance was less than one ohm when silver paint was applied after the evaporation.

The resistance-versus-temperature curves usually contained two drops in resistance from the normal state resistance. The first in the region of 110 K corresponds to the transition for the 2223 phase. The second near 80 K corresponds to the transition for the 2212 phase. It has been shown from other analysis techniques that the majority of the sample is 2212 with filaments of 2223 shunting the 2212 material. The data was taken for various substitution levels of silver in the starting compound $Bi_2Sr_{1.9}Ca_{2.2}Cu_{4-n}Ag_nO_{8+x}$ where n ranged from 0.1 to 2.0. As indicated above, the amount of substituted material in the whisker was determined from microprobe analysis.

Results

A systematic substitution of Ag for the Cu does not produce a systematic change in the material's T_c. Resistance measurements on the whiskers show that the transition temperature of the Ag-substituted BiSCCO materials appear to be unaffected by the substitution indicating that there is either no effect or the silver is not taken up by the whisker. This is supported by the electron microprobe analysis results which show the absence of Ag in the whiskers.

Acknowledgments

Funding for this project is provided by the U.S. Department of Energy, Grant # DE-FG02-97ER45630, MU-SPIN/NASA Cooperative Agreement NCC5-116 and NASA-URC Grant Cooperative Agreement NCC5-228. Computer and network support provided through the MU-SPIN/NASA office.

Houston PREP

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The Houston Prefreshman Enrichment Program (Houston PREP) is an eight-week summer enrichment program conducted at the campus of the University of Houston-Downtown (UHD). Houston PREP is geared towards high-achieving, yet economically and socially disadvantaged Houston area middle and high school students with an interest in engineering and science.

Houston PREP spans over four summers, and its academic components include Algebraic Structures, Engineering, Computer Science, Logic, Physics, Probability and Statistics, Problem Solving, SAT Preparatory Seminars, and Technical Writing.

The program faculty is composed of college instructors and local high school teachers. This year, six high school instructors were provided by Houston area school districts. These teachers were trained by UHD faculty members in advance to prepare for the PREP curriculum.

The program staff consists of program assistants, who are undergraduate students majoring in math, science, or engineering. These program assistants remain in contact with the students each day, and serve as tutors for the Houston PREP participants. They also prove to be great role models and mentors to the students.

Since Houston PREP targets economically and socially disadvantaged students, no tuition or fees are charged to the student. In addition, the program is an approved site for the Houston Works Program and The Texas Department of Human Services Summer Food Service Program (SFSP). This allows all Houston PREP participants to earn money and receive free breakfast and lunch for the tenure of the program.

A 1997 Follow Up survey of previous Houston PREP participants revealed a 99% high school graduation rate. Of the survey respondees, 91% were college students or college graduates; 57% were engineering or science majors; and 75% of these college students were minority.

Digital Libraries: Impact on Science, Medicine and Libraries

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Abstract

The Congressional Electronic Library Act of 1993, and the President and Vice-President in their report on "Technology for America's Economic Growth," called for the development of digital libraries. Workshops by the National Science Foundation (NSF) and others led to defining a research agenda for digital libraries. This was identified as a national challenge in the Information Infrastructure Technology Application component of the U.S. High Performance Computing and Communications Program. In late 1993 the National Aeronautics and Space Administration (NASA), NSF, and the Advanced Research Projects Administration (ARPA) jointly sponsored a requests for proposals on "digital libraries." The project focuses on dramatically advancing the means to collect, store, and organize information in digital forms; additionally, it focuses on making it available for searching, retrieving, and processing via communications networks in a user-friendly way. Multidisciplinarian collaborative projects were funded under this initiative at Carnegie-Mellon University, the University of California-Berkeley, University of California-Santa Barbara, Stanford University, University of Illinois Urbana-Champaign, and the University of Michigan. This poster focuses on current developments in digital library research and technology. It examines the impact of digital libraries in science, medicine and libraries in general. It addresses issues resulting from the development of digital libraries; and further discusses to what extent Historically Black Colleges and Universities (HBCUs) are involved this technology.

What is a Digital Library?

There are many definitions of a "digital library." Terms such as "electronic library" and "virtual library" are often used synonymously. The elements that have been identified as common to these definitions are:[6]

- The digital library is not a single entity
- The digital library requires technology to link the resources of many
- The linkages between the many digital libraries and information services are transparent to the end users
- Universal access to digital libraries and information services is a goal
- Digital library collections are not limited to document surrogates: they extend to digital artifacts that cannot be represented or distributed in printed formats.

In 1995 this broad definition was adopted by the Association of Research Libraries which is a major library organization mostly comprised of large academic libraries.

In essence, digital libraries use computer technology to store, manage, and disseminate vast amounts of information. The components of a digital library include assemblage of electronic data, cataloging and indexing mechanisms, tools for locating, searching, and browsing data collections. It also includes mechanisms to retrieve and potentially process data from remote and distributed locations, and interface tools. Each of these components allow tasks to be performed easily by non-expert users. Because each of these digital library entities requires expertise from several disciplines, collaborations are the norm—as evidence by several existing projects. [7] Often, multidisciplinarian teams consist of engineers, librarians, statisticians, computer scientists, and others. [1]

Impact on Science and Medicine

The production of scientific information since World War II has exponentially increased, especially in areas such as molecular biology. Endeavors such as the Human Genome Project generate large gene and protein sequence data which are being stored, and managed in computerized format for dissemination to scientists and the medical community worldwide in just a matter of seconds via the Internet.

Several scientific related government agencies have provided funding to support digital library technology. In 1993 the NASA, NSF, and ARPA jointly sponsored a requests for proposals on "digital libraries." The project focuses on dramatically advancing the means to collect, store, and organize information in digital forms; additionally, it focuses on making it available for searching, retrieving, and processing via communications networks in a user-friendly way. Six projects were funded under this initiative (see table 1). Since then projects have continued to grow; examples include: Global change datasets, climate and weather databases, Human Genome data, astronomy datasets, multimedia medical databases, social sciences databases, and other repositories. (see table 2).[1] Having this information available in digital format and disseminated via the Internet has greatly enhanced access and retrieval of scientific and other information needed for research and development.

Impact on Libraries

Digital technology has revolutionized libraries by empowering various libraries, serving various populations, to link together and even merge. As librarians try to adapt their contributions to a new role in the digital world, many have described the library. . . as a "gateway" to many information resources that is available electronically.[11] The "gateway" phenomenon requires not only that quality and authoritative information is available but also is accessible in a user-friendly environment. Concepts by libraries differ in aspiring toward the digital "gateway." For example some envision efforts to create digital libraries to further expand access, increase usability and effectiveness, and establish entirely new ways for individuals to interact with information; some envision a "hybrid" library—one that combines traditional print publications and new digitized information; and others view digital technology as a means of preserving deteriorating manuscript and rare books and have joined the "digital bandwagon." The following are examples of digitalization by libraries. 1) Cornell University has included more than 2,000 19th and early 20th century books in electronic format; 2) conservators of the Library of Congress, the British Library in London, and the Vatican Library in Rome all are digitizing their most treasured volumes; and 3) the Library of Congress expects to have 5 million books and images digitized by the year 2000.[10]

As documents are integrated into very large collections covering an entire field of study, links among the documents become increasingly important to help with searching and browsing. Who more than librarians have the expertise and experience to identify the important linkages between documents that should be incorporated within catalog entries?

Digital Libraries and Historically Black Colleges and Universities

To what extent are Historically Black Colleges and University (HBCU) libraries involved in digitalization and what are the potential impacts of this technology? A general perception is that the technological infrastructure is modest at most of these libraries. As for digital libraries, several HBCU libraries provide their users access to traditional journals, indexes, reference books, etc., through the World Wide Web. Although some of the most comprehensive and significant African Diaspora archival collections are located at HBCUs, only a few participate in digitizing their collections. Moreover, libraries owning such collections attract scholars nationally and internationally for research. The following is an overview of significant archival collections at some HBCUs which are potentially available for digitalization: 1) Moorland-Spingarn Collection at Howard University contains one of the most comprehensive collections on people of Africans descent throughout the Diaspora. The collection includes original documents of such notables as: Charles Drew (surgeon and blood storage pioneer), Frederick Douglass (abolitionist), Kwame Nkrumah (past president of Ghana and Panafricanist), Alan Locke (writer and Rhode Scholar), E.E. Just (zoologist and father of parthenogenesis), Paul Robeson (singer, actor, and scholar), Booker T. Washington (past president of Tuskegee University and educator), Carter G. Woodson (educator, historian and father of "Black History"), etc.; 2) the Clark Atlanta University Collection includes the John Henrik Clarke Africana and the Countee Cullen Memorial Collection of Graphic and Performing Artists; 3) and Fisk University houses original documents of W.E.B. Dubois (Panafricanist), Marcus Garvey (Panafricanist), Langston Hughes (writer), and Aaron Douglas (visual artist); and 4) South Carolina State University owns original documents of the 1896 organization, the Palmetto Medical, Dental and Pharmaceutical Association.

Some potential impacts of HBCUs digitizing its archival collections are: 1) to expand the use of these documents and promote resource sharing among institutions—ideally similar to Georgia's Galileo system, a digital library system consisting of resource sharing of the online catalog, electronic journals, indexes, and other resources among university, school, public, and technical school libraries; 2) to provide value added sources of information. That is, quality, authoritative, and substantive information could be digitized and disseminated nationwide to students, researchers, and others seeking scientific, medical, and other types of information—thus, promoting research and development from anywhere anytime.

Issues Related to Digital Libraries[3, 15, 4]

The following are major issues related to digital libraries:

1. Economics

   Where will we get the money to maintain current projects and fund future ones?
2. Selection

   What should we digitize (Archival materials, resources with high user demand, teaching resources, or materials where copyright has expired)?
3. Quality Control

   How do we add structure, organization, and validity to the Internet?
4. Interoperability

   How do library users at one location using one interface search digital collections of hundreds of libraries?
5. Copyright

How do we make materials widely available digitally while protecting the library rights of artists, writers, and publishers?

Conclusion

Given the many possibilities of digital technology, research and development in this area will proceed to new heights. HBCUs like other institutions need to enhance their technological infrastructure to ensure that digital libraries are fully functional—"no need to have the technology if it doesn't work." Institutions need to develop digital libraries with universal search engines with user friendly interfaces. Institutions must ensure that development of their digital libraries' infrastructure is within the regulations of copyright. Accordingly, institutions need to increase their library's budgets to enable subscriptions to more "value added" Internet resources, e.g., online journals, indexes, reference books, etc. By doing this, institutions will expand access to more quality Internet resources for students, faculty, and staff—Thus reducing or eliminating geographic and temporal barriers.

Table 1: Six Digital Libraries Projects[4,5,15]

Project Name	Project Description
Carnegie-Mellon University **Project Title:** *Informedia DigitalVideo Library*	Investigates how multimedia digital libraries can be established and used (video, audio, images and text); research is in the area of speech recognition, image understanding, and natural language processing supports. . .knowledge base and search retrieval.
University of California-Berkeley **Project Title:** *Environmental Planningand Geographic Information Systems*	Aims to develop the technologies for intelligent access to massive, distributed collections of photographs, satellite images, maps, full text documents, and multivalent" documents; research includes computer vision, databases and information retrieval, user needs assessments, etc.
University of California-Santa Barbara	Explores problems related to a distributed digital library for geographically referenced

Project Title: *The Alexandria Project: Spatially-Referenced Map Information*	information; comprised of digital maps, text, space shuttle and satellite images, and historic aerial photography of California.
Stanford University **Project Title:** *Interoperation Mechanisms among Heterogeneous Services*	Focuses on interoperability, i.e., how disparate databases can be treated as one by the user (Tennant,1997). The network will include not only books and journals, but data from private collections and scientific studies. The system employs software enabling people to browse through disparate sources at the same time.
University of Illinois Urbana-Champaign **Project Title:** *Federating Repositoriesof Scientific Literature*	Aims to provide full-text journals, magazines, and scientific literature primarily for engineers. Documents mostly in SGML (Standard Generalized Markup Language) and Adobe Acrobat. This system will provide people . . . at 10 large Midwestern universities remote access to full-text and pictures of tens of thousands of documents.
University of Michigan **Project Title:** *Intelligent Agents for Information Location*	Aims to develop sophisticated software programs which will allow librarians and users to search more efficiently for information on the subjects of earth and space science; JSTOR (Journal Storage Project), Humanities Text Initiative, etc.

Table 2: Other Digital Libraries Projects[4,8,9,12-16]

Project Name	Project Description
New York Public Library (NYPL) **Project Title:** Digital Library Collection	Includes digital images and texts files from the Schomburg Center for Research in Black Culture pertaining to women, dance, theater, music, etc.; and the NYPL finding aids.
Indiana Music Library **Project Title:** VARIATIONS Project	Focuses on digitalization of audio and video materials related to music.
University System of Georgia **Project Title:** Galileo	Provides statewide digital library resource sharing among Georgia's private and state universities, public libraries, technical schools, and public schools.
Library of Congress Digital Collections **Project Titles:** American Memory; and Thomas	Provides Historical Collections, and Legislative Information via the Internet.
Michael Hart, Executive Director **Project Title: Project Gutenberg**	Provides electronic textbook files available via the Internet.
Tufts University **Project Title: Perseus Project**	Provides multimedia library of information about Archaic and Classical Greece: Literature, history, art, and archaeology.
National Library of Medicine **Project Title:** Visible Human Project; and GeneBank	Provides anatomically 3-D representation of the male and female human body; NIH's genetic sequence database of all publicly available DNA and protein sequences.
Virginia Tech **Project Title:** Networked Digital Library of Theses and dissertations.	Consists of an initiative of 39 institutions to increase the availability via the Internet of student research by digitizing masters theses and doctoral dissertations.
University of Iowa **Project Title:** The Virtual Hospital	Includes a medical multimedia database containing materials for medical education, patient care, patient education, and continuing medical education. Available via the Internet.

References

1. Beard, Kate. "Digital spatial libraries: a context for engineering and library collaboration." *Information Technology and Libraries*. 14:79-84, 1995.
2. Buildings, Books, and Bytes: Public Visions, Private Reflections. http://www.benton.org/Library/Kellogg/chapter1.html#technolo (7 July 1998).
3. Chepesiuk, Ron. "The Future is here: America's libraries go digital," *American Libraries*. 28(1): 47-50, 1997.
4. Digital Library Projects. http://www.texshare.edu/Services/Professional/digital.html. (26 August 1998).
5. Digital Projects of the UC Berkeley Library: Summary July 1998. http://sunsite.berkeley.edu/R+D/ucblibrary.html (28 August 1998)
6. Drabenstott, Karen M. *Analytical review of the library of the future*. Washington, DC: Council Library Resources, 1994.
7. Fox, E. A., D. Hix, L.T. Nowell, D.J. Brueni, W.C. Wake, and L. Heath and D. Rao. "Users, user interfaces, and objects: Envision, a digital library," *American Society Information Science*. 44(8): 480-91, 1993.
8. Galileo: Georgia online learning online. http://www.galileo.peachnet.edu/Homepage.cgi. (4 September 1998).
9. Hart, Michael. What is Project Gutenburg: History and philosophy of the project. http://promo.net/pg/history.html (4 September 1998).
10. Lipkin, Richard. "The library that isn't there; digital libraries transform books, photos, and videos into bits and bytes," *Science News*. 147(22): 344-346, 1995.
11. Marcum, Deanna. "Digital Libraries: For whom? For what?" *Journal of Academic Librarianship*. 23(2): 81-84, 1997.
12. National Library of Medicine. National Institutes of Health. National Center for Biotechnology. http://ncbi.nlm.nih.gov/ Revised 25 Aug 98 (4 September 1998).
13. Networked Digital Library of Theses and Dissertations. http://www.ndltd.org/ (4 September 1998).
14. New York Public Library. Digital Library Collections. http://www.nypl.org/ (4 September 1998).
15. Tennant, Roy. "Digital Libraries: The grand challenges," *Library Journal*. 122: 31-32, 1997.
16. University of Iowa. The Virtual Hospital. http://indy.radiology.uiowa.edu/ (10 September 1998).

Technology and Libraries: Bringing Together Information Literacy and Diversity

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Summary

Academic librarians have redefined and expanded their traditional roles in to meet the changing needs of students. The increasing emphasis on computer literacy, access to electronic and digital formats, the Internet, and the globalization of education have prompted libraries to respond with creative and innovative programs and services for all users.

While these are exciting times, as we approach the 21st century minority graduation rates are still low all over the country. Research has proven that the dominant culture does not take in account unique differences in diverse groups, which should be nurtured and cultivated. Native Americans, along with other minority groups, sometimes do not know about the vast informational resources within mainstream universities. Nationally, libraries cannot continue to meet the needs of a diverse clientele by only recruiting and catering to people from the dominant culture. As Librarians and Women of Color, it's our responsibility to provide outreach, training and support for a variety of diverse groups.

This poster presentation will showcase library outreach projects and instruction, which is geared toward diversity education and life long learning. Librarians are organizing computerized information and evaluating new technology for:

- Web design and maintenance
- Curriculum development
- Interactive Instruction
- Multimedia Development

Goal

To provide an interactive and informative presentation on current University of Arizona projects focussing on diversity education and cultural development.

Methodology

Pre-Survey

The purpose of the survey is to tailor the participant,s interests and ideas with the information provided in our poster presentation.

Participants will fill out a short survey when they first approach the table. The survey will assess the individual's computer expertise, project interests and methods for learning information.

Learning Modules

- Internet- The projects which are accessible through the Internet will be bookmarked and available for viewing.
- Power Point Presentation - A continuous power point presentation will showcase the projects and provide background information.
- Poster Board Information - The poster board arranges all the special outreach projects, contact information and suggestion forms together.

Evaluation

After the presentation, an evaluation form will be distributed to each individual. The form will contain all the projects presented, URL's and contact information. The evaluation form can be a referral guide to consult at a later date. Pat and I will highlight any sections the person is interested in, and they can take the sheet back to their institution or business.

A separate sheet will be available for new ideas and suggestions from the participants. These ideas and contact information will be shared with our colleagues at the University of Arizona.

Conclusion

From this presentation, we want to share and gain knowledge about technology, information literacy, diversity and career development. The opportunity to teach, learn and interact with other professionals committed to diversity education is very exciting, enriching and rewarding.

Processing and Growth of Ag and Au Doped BiSCCO Superconducting Compounds

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Abstract

A NASA-funded undergraduate research assistant at South Carolina State University will present the results of a processing and growth study of Ag- and Au-doped bismuth-strontium-calcium-copper-oxide (BiSCCO) superconducting compounds. Proper stoichiometric ratios of all components are mixed to form a base compound powder. Different processes will be discussed including pellet formation and single crystal whisker growth. Pellet formation involves a high-pressure procedure to be discussed in detail. Whisker growth includes high-temperature (1200^0 C) sintering which leads to millimeter-sized or smaller crystals.

Introduction

This study is a part of a project that investigates the change in the properties of bismuth-based high-temperature superconductors as a portion of the copper is systematically replaced by either silver (Ag) or gold (Au). This substitution changes the material properties and probes the underlying mechanisms for superconductivity. Superconductors are marked by a rapid vanishing of resistance at the critical temperature (T_c). In conventional superconductors T_c ranges from less than 1 K up to 23 K for Nb_3Ge. High-temperature superconductors were first discovered in 1986 when Bednorz and Muller announced a transition temperature of up to 38 K in lanthanum copper oxide which had been doped with either strontium or barium. The laboratory at South Carolina State University investigates the properties of the bismuth-based materials ($Bi_2Sr_2Ca_{n-1}Cu_nO_{8+x}$ where n =1,2,3). In these studies the materials are doped with either Ag or Au as a substitute for a portion of the Cu resulting in $Bi_2Sr_2Ca_{n-1}Cu_{n-z}O_{8+x}$ where n =1,2,3 and z = 1 to n. The procedure described in this paper concentrates on the addition of Ag and results in bulk samples in the form of pellets. By a slight variation in the processing procedure single crystals of the materials (whiskers) can be produced. The properties of the samples are determined by examination of the transition curves and from the results of microprobe data.

Experimental Procedure

Several molar ratios of bismuth, strontium, calcium, silver and gold are chosen for this study and are outlined . Appropriate amounts of their oxides and carbonates are mixed together and ground to a fine homogeneous powder. These powders are then put in the furnace and calcined at 850^0 C for 6-8 hours. This step is repeated several times with intermediate grindings to ensure homogeneity. The calcined powders are then pressed into pellets at 7 tons and sintered at 850^0 C for 100 hours with an intermediate grinding. Afterwards, the pellets are cut and inspected under an optical microscope for surface textures and irregularities.

The phase of the processing that involves the formation of a glassy matrix from which single crystals or "whiskers" of the BiSCCO superconductor can be grown is similar. The pellets are heated up to 1200^{0} C for a sufficiently long time to make sure that they have melted completely, typically about 30 minutes. The melt is then poured onto a steel plate and simultaneously flattened by another steel plate. This step produces glassy shards less than 1 mm in thickness which are found to be ideal for whisker growth.

Finally, these shards are put in an alumina boats and annealed near their melting point for 120 hours in flowing oxygen. Upon cooling, a thick growth of whiskers can be observed on the shards. These whiskers can grow to lengths up to 5 mm and their width and thickness are in the order of a few hundred microns. These are then examined using an electron microscope equipped with a microprobe. Measurements of resistivity, thermal conductivity and calorimetry are also done on the samples.

Results

The addition Ag or Au to the initial compounds should result in substitution of these metals for Cu in the superconductor. The resulting materials are expected to exhibit shifts in the transition temperature as a result of the substitution. Electron microprobe results indicate that the Ag concentrated in regions within the pellet. The effect of the substitution on the transition temperature of the materials was inconclusive. Work is continuing on the effects of Au substitution.

Acknowledgment

Funding for this project is provided by the U.S. Department of Energy (Grant # DE-FG02-97ER45630) and the MU-SPIN/NASA Cooperative Agreement NCC5-116. Computer and network support provided through the MU-SPIN/NASA office.

Research Experience in Earth Systems Science at Norfolk State University

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Introduction

The understanding of the Earth as an intricately coupled system and the variables that influence climate changes has been a subject of interest for many years.[1-23] The study of interactions between the atmosphere, land, ice, oceans, and biota and their impact in the climate change has attracted scientists from many disciplines over the years. This has created the Earth System Science (ESS) interdisciplinary field. In the early days scientists made *in situ* observations of the atmosphere, land, ice, oceans, or biota and correlated those to the climate changes. These studies by did not provide the overall picture of the global changes. Satellites have revolutionized ESS studies allowing global coverage. Since satellites have been utilized as a research tool, vast amounts of data have been collected. Unfortunately, for years only atmospheric scientist had access to this valuable data. Now there is a large effort to disseminate this data by the various agencies involved. These stems from the easy distribution of the data through the Internet and availability of the computing power needed to produce images and store data to the average citizen. However, public awareness of the availability of this data and education on how to utilize it has lagged behind.

The six-week Research Experience in Earth System Science (REESS) summer program educated twelve MSET undergraduate students of the existence and usage of the vast data resources available from the ESE missions. This was accomplished by assignment of short research projects to the students and an intense educational program.

- Introduce undergraduate MSET students to relevant aspects of ESE programs and encourage usage of on-line NASA resources.
- Provide an enriching experience of scientific investigation in Earth System Science within a collaborative interdisciplinary environment.
- Exploit the Stratospheric Aerosol and Gas Experiment II (SAGE II) data for the determination and understanding of the global atmospheric water vapor variations from high to low tropical storm activity years and atmospheric aerosol concentrations influence in ozone depletion. Enhance SAGE II data visualization techniques. Study the earth radiation budget using the Earth Radiation Budget Experiment (ERBE) satellite data.
- Provide research opportunities and educational experiences to students from institutions, which are underrepresented in the ESE programs. This includes Historically Black Colleges and Universities, Hispanic Serving Institutions, and Junior Colleges.

Student Participants on the REESS 98 Program

Name	Educational Institution	Principal Residence
Darrick J. Belcher	**Norfolk State University**	Danville, KY
Khadijah Booth	**Xavier University**	Gloucester County, VA
Ilyanna Budak	Southwest Texas State University	Austin, Texas
Thomas Butler	**Howard University**	**Chicago, IL**
Erik V. Cope	Tidewater Community College	Norfolk, VA
Aaron M. Freeman	New York Institute of Technology	Brooklyn, NY
Sandra L. Gutierrez	Columbia University	Newark, NJ
Charmagne D. Harris	Norfolk State University	Norfolk, VA
Schrie L. Janet	Norfolk State University	Norfolk, VA
Johnny Ray Light	Thomas Nelson Community College	Yorktown, VA
C. Scott Michaels	Thomas Nelson Community College	York County, VA
Angela W. Parson	Norfolk State University	Norfolk, VA

Educational Activities

Lectures, seminars, demonstrations, and exercises to educate the students in various aspects of ESE were given throughout REESS. These activities were generally performed in the first two hours of each day.

Lecture Series

A series of lectures were delivered in order to expose the students to various aspects of the atmosphere, earth's climate, scientific research methodology, team work, data manipulation, and scientific visualization. Although the events are referred as lectures, extensive discussion took place between students and lecturer. The lecture titles were The Atmosphere and Earth; Remote Sensing, Ozone, Biomass Burning, and related NASA Programs; Paradigms and Team Work: Their Importance in Research; Dependent, Independent, and Interdependent Systems; Stratospheric Aerosol and Gas Experiment (SAGE) Series; Leader, Manager, Worker; Mission Statements; SAGE II Data Conditioning; Vision, Leadership, Management; Numerical Arrays; and Self Motivation and Teamwork: Importance in Research.

Seminar Series

The participants attended seminars delivered by prominent scientist. Seminars were followed by a discussion period to ensure understanding and encourage student involvement.

- The Human Adventure Continues
  Dr. William Smith, Virginia Air and Space Museum, Hampton, VA
- Sea Surface Temperature Variability
  Mrs. Elizabeth Smith, Center for Coastal Physical Oceanography, Norfolk, VA
- Stratospheric and Gas Experiments II and III
  Dr. William P. Chu, On campus
- Laser Development at NASA
  Dr. Norman P. Barnes, On campus
- Remote Sensing from Satellite
  Dr. James Russell, Hampton University, Hampton, VA
- Langley Aerospace Research Summer Scholars
  Mrs. Rafaela Schwan, On campus
- Graduate Student Research Program
  Mr. Lloyd B. Evans, On campus

Exercises

Various exercises were assigned throughout the program. These exercises were aimed to improve skills in data manipulation, scientific visualization, teamwork, and oral presentations. All these skills were not only necessary for the successful completion of the program but also for successful carriers. Some exercises were independently performed, but most were completed in teams. Mentors were available to answer questions. The exercises are described below.

- Excel Data Manipulation Exercise

  Students established competency in fundamental data manipulation, averaging, statistics and graphing using Microsoft Excel. This enabled the instructors to emphasize the quantitative nature of the task ahead without getting bogged down in low level syntax issues.
- Sea Surface Remote Sensing

  Students were taken to the Center for Coastal Physical Oceanography at Old Dominion University, where they were allowed to manipulate sea surface satellite data. Exercises related to the data were administered to the students.
- Literature and World Wide Web Review

  The first step of Scientific Research is to understand previous investigation in the topic of interest.
- Create Mission Statements for the REESS Program and Individual Teams

  Creation of a mission statement establishes the direction in which the program and teams are going as well as promotes teamwork.
- Create a Team Web Page

  Students were trained in Web Page authorizing techniques.

Student Presentations

In science, the dissemination of new discoveries is of primary importance. Teaching communication skills in a research environment is as important as the scientific work. In our program, the student research groups were required to prepare and deliver a weekly presentation. The format of this presentation will be equivalent to the format of a presentation at a major scientific conference: 10 minute of talk followed by a 2-minute question period. Everyone in the group was required to speak. Every Friday morning all research groups gave presentations on their progress. The first Friday their presentation consisted on their literature and World Wide Web review of their topic and subsequent Fridays the progress of their investigation was reported. The last Friday of the program a final presentation of their work with all results and conclusions were delivered.

BEST Fest

A day long series of talks and workshops was organized in concert with the Earth Systems Science Educator's program on campus where REESS students benefited from interaction with in-service and pre-service teachers. They answered questions on their own projects as well as attending mini-workshops offered by a staff member from NASA Goddard Space Flight Center.

Trips

Students were taken to two educational tours and the beach. The educational tours were to:

- Jefferson Laboratory
- Center for Coastal Physical Oceanography

Research Activities

The twelve students were divided into four research teams. The Water Vapor, Ozone and Aerosol, and IDL teams which primarily utilized data obtained from the SAGE II instrument, and the Earth Radiation Budget team which used data from the ERBE projects. The breakdown of the teams will be described in details in Section 5.5. The projects are described below.

Stratospheric Aerosol and Gas Experiment II (SAGE II) data was utilized for three research projects. The SAGE II is a solar occultation experiment mounted in the Earth Radiation Budget Satellite (ERBS). This satellite orbits the earth nearly 15 times a day allowing SAGE II to record a sunrise and a sunset event per orbit. Total earth coverage is achieved in one month with approximately 900 profiles. The water vapor concentrations are obtained by measuring the solar signal at the 940 nm water absorption line. The instrument self-calibrates by measuring the signal above the atmosphere before a sunset and after the sunrise events. The spatial resolution is 200 km through the earth limb and 1 km in vertical axis.[6] This resolution is large enough to comprise most of the vertical motions associated with convection, but small enough to observe individual areas.[2] The water vapor data has been validated with radiosonde results, frost point hygrometer, Lyman-a and LIMS satellite observations. The accuracy is estimated to be around 10%.

The ERBE data was utilized by using Worldwatcher, and innovative new visualization software from Northwestern University. Several ERBE data sets were available such as incoming radiation, outgoing radiation, albedo, reflectivity, surface temperature, and greenhouse effect. This software allowed easy comparison of differences in earth radiation budget activity over different geographical areas.

REESS Activity Schedule

Summary

The rigorous 6 week Research Experience in Earth System Science (REESS) program exceeded expectations in educating MSET undergraduate students in the manipulation, interpretation, and understanding of remote sensing data. This was achieved by the assignment of research projects relevant to ESE, coupled with an intense educational program. The research projects investigated global atmospheric water vapor, atmospheric aerosol and ozone concentrations, the Earth Radiation Budget and computer programming for enhanced data visualization. Faculty mentors guided the students through the entire scientific process, from the initial literature search to the final report. Since research projects were very specific, an educational component was incorporated into the REESS in order to broaden the experience. This component exposed students to other topics relevant to ESE, which may have not been covered by the research project alone. A lecture and seminar series provided a background on various topics of interest. The literature and World Wide Web searches exposed the students to data from other satellite platforms and acquainted them to a variety of remote sensing data. At the end of REESS the students; had an understanding of the earth as a coupled system in which many interactions are critical to climate change; understood satellite data manipulation and image creation; were capable of accessing and interpreting satellite images via Internet; and some of them became inspired to pursue further work in atmospheric sciences.

REESS also provided research opportunities and educational experiences to students from institutions, which are underrepresented in the ESE programs. This included Historically Black Colleges and Universities, and Junior Colleges.

The REESS program should become an integral part of Norfolk State University's summer activities since it will continue having a positive impact in the student participants. Particularly to groups which are underrepresented in the ESE programs.

References

1. Chu, W. P., E. W. Chiou, J. C. Larsen, L. W. Thomason, D. Rind, J. J. Buglia, S. Oltmans, M. P. McCormick, and L. R. McMaster, Algorithms and Sensitivity Analyses for Stratospheric Aerosol and Gas Experiment II Water Vapor Retrieval, *J. Geophys. Res.*, *98*, 4857-4866, 1993
2. Rind D., E. W. Chiou, W. Chu, J. Larsen, S. Oltmans, J. Lerner, M. P. McCormick, and L. McMaster, Positive water vapour feedback in Climate Models Confirmed by Satellite Data, *Letters to Nature*, *349*, 500-503, 1991.
3. Fortner, B., The Data Handbook, A Guide to Understanding the Organization and Visualization of Technical Data, Spyglass Inc., Champaign, Illinois, 1992.
4. Hidore, J. J., Global Environmental Change: Its Nature and Impact, Prentice-Hall, Inc., Upper Saddle River, New Jersey, 1996, pps. 166-178
5. Danielson, E. W., J. Levin, and E. Abrams, Meteorology, WCB/McGraw-Hill, New York, New York,1998, pps. 56-63.
6. Hill, J. W., D. K. Kolb, Chemistry for Changing Times, Eighth Edition, Prentice-Hall, Inc., Upper Saddle River, New Jersey, 1998, pps. 308-311.
7. Farman, J. C., B. G. Gardiner, and J. D. Shanklin, Large Losses of Total Ozone in Antarctica Reveal Seasonal ClO_x/NO_x Interaction, Nature, 315, 207, 1985.
8. Brasseur, G. P., X. X. Tie, and P. J. Rasch, A Three-Dimensional Simulation of the Antarctic Ozone

Hole: Impact of Anthropogenic Chlorine on the Lower Stratosphere and Upper Troposphere, J. Geophys. Res., 102, 8909, 1997.
9. Poole, L. R. and M. P. McCormick, Polar Stratospheric Clouds and the Antarctic Ozone Hole, J. Geophys. Res., 93, 8423, 1988.
10. Solomon, S., R. R. Garcia, F. S. Rowland, and D. J. Wuebbles, On the Depletion of Antarctic Ozone Nature, 321, 755, 1986.
11. Tolbert, M. A., Sulfate Aerosols and Polar Stratospheric Cloud Formation, Science, 264, 527, 1994.
12. Webster, C. R., R. D. May, D. W. Toohey, L. M. Avallone, J. G. Anderson, P. Newman, L. Lait, M. R. Schoeberl, J. W. Elkins, K. R. Chan, Chlorine Chemistry on Polar Stratospheric Cloud Particles in the Artic Winter, Science, 261, 1130, 1993.
13. Hanson, D. R., and A. R. Ravishankara, The Reaction Probabilities of $ClONO_2$ and N_2O_5 on Polar Stratospheric Cloud Materials, J. Geophys. Res., 96, 5081, 1991.
14. Molina, M. J., T.-L. Tso, L. T. Molina, F. C.-Y. Wang, Antarctic Stratospheric Chemistry of Chlorine Nitrate, Hydrogen Chloride, and Ice: Release of Active Chlorine, Science, 238, 1253, 1987.
15. Molina, L. T. and M. J. Molina, Production of Cl_2O_2 from Self-Reaction of the ClO Radical, J. Phys. Chem., 91, 433, 1987.
16. Sander, S. P., R. R. Friedl, Y. L. Yung, Rate of Formation of the ClO Dimer in the Polar Stratosphere: Implications for Ozone Loss, Science, 245, 1095, 1989.
17. Solomon, S., R. W. Portmann, R. R. Garcia, L. W. Thomason, L. R. Poole, and M. P. McCormick, The Role of Aerosol Variations in Anthropogenic Ozone Depletion at Northern Midlatitudes, J. Geophys. Res., 101, 6713, 1996.
18. Solomon, S. and J. S. Daniel, Impact of the Montreal Protocol and its Amendments on the Rate of Change of Global Radiative Forcing, Climate Change, 32, 7, 1996.
19. Sessler, J., M. P. Chipperfield, J. A. Pyle, and R. Toumi, Stratospheric OClO Measurements as a Poor Quantitative Indicator of Chlorine Activation, Geophys. Res. Lett., 22, 687, 1995.
20. Vaida, V., S. Solomon, E. C. Richard, E. Rühl, and A. Jefferson, Photoisomerization of OClO: A Possible Mechanism for Polar Ozone Depletion, Nature, 342, 405, 1989.
21. Vaida, V. and J. D. Simon, The Photoreactivity of Chlorine Dioxide, Science, 268, 1443, 1995.
22. Kreher K., J. G. Keys, P. V. Johnston, U. Platt, and X. Liu, Ground-Based Measurements of OClO and HCl in Austral Spring 1993 and Arrival Heights, Antarctica, Geophys. Res. Lett., 23, 1545, 1996.
23. Lanzendorf, E. J. and A. C. Kummel, Photodissociation of Condensed Films of Chlorine Dioxide, Geophys. Res. Lett., 23, 152, 1996.

Acknowledgements

- The Principal Investigator gratefully acknowledges Chevront Henderson for his assistance to the students participants .
- REESS was funded by NASA Grant # **NAG-5-6298.**

Object Oriented Programming (Visual Basic) and Graphical Programming (LabView) in the Study of Digital Arithmetic

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Abstract

Simulation software packages play an important role in the study of Digital Electronics. Some of the software packages currently used in the study of digital electronics are Electronics Workbench, PSPICE Schematics, and Logic Works III. These software packages have unique features and capabilities, but lack capabilities to address digital electronics concepts like number systems and digital arithmetic. This necessitates the design and development of simulation modules to address the limitation of the existing software packages. This presentation describes the development of simulation modules for number systems and digital arithmetic using object oriented programming language (Visual Basic) and graphical programming language (LabVIEW). These modules can be used in conjunction with existing software packages to effectively train students in the area of digital electronics.

1. Introduction

Digital principles and circuits is an important area of study since it is extensively used in the design and application of computers and other applications. Electrical Engineering and Computer Science curriculum consist courses in digital principles and application and various software packages (PSPICE, Logic Works III, Electronic Workbench, VHDL, OR-CAD etc.) are used to enhance the class room teaching. The students verify their designs using simulation software packages before assembling and testing it in the laboratory. These software packages have unique features and capabilities but unfortunately most of them have been unable to handle number systems, converting from one number system to another, complements, addition, subtraction, etc.. This necessitates design and development of software modules that can be used in conjunction with other simulation packages to effectively train our students in the study of digital principles and circuits.

These modules can be developed using programming languages such as FORTRAN, PASCAL, C/C++, QBASIC but it would require enormous lines of code to provide an effective module (menus, error messages, graphics, instructions to use the program etc.). One solution to this problem is the use of object oriented programming like Visual Basic or use of graphical programming (LabVIEW). One can develop effective module with less lines of code using these and modules developed using these languages will be industry standard.

The objective of this presentation is to discuss the design and development of simulation modules using Visual Basic and LabVIEW. These modules will be used to study issues associated with number systems and digital arithmetic. This will introduce the student to the concept of virtual instruments. It would help the faculty in instruction and research. The graphical interface and user friendliness of the modules will capture students' attention and make them more apt to learn the principles and applications of digital arithmetic.

The presentation is arranged in eight sections. Section 2 discusses the mathematical equations. Section 3 discusses different features of the module. Section 4 presents the source code of few of the features of section 3. This is necessary to show the simplicity associated with Visual Basic programming. Section 5 presents simulation and comparison results of few test cases. Section 6 presents simulation of number systems using LabVIEW. Section 7 presents conclusion and discussion. Section 8 presents a list of references.

2. Theoretical Background

Most of the steps and rules presented in this section can be found in any standard digital principles and applications book. We have used two books [1, 2] for our work.

A. Any Number System to Decimal Number System – **Rule 1**

Let us consider the source number as $A = (a_n a_{n-1} \ldots\ldots a_1 . a_{-1} a_{-2} \ldots\ldots a_{-n})_b$

where b = base and a = coefficients and the "a" values are between 0 and b-1.

Let the decimal equivalent of A be Deq

$$Deq = a_n*b^{n-1} + a_{n-1}*b^{n-2} + \ldots\ldots + a_2*b^1 + a_1*b^0 . a_{-1}*b^{-1} + a_{-2}*b^{-2} + \ldots + a_{-n}*b^{-n}$$

Example

Determine the decimal equivalent of binary number 111.11 or $(111.11)_2 = ( )_{10}$?

Decimal equivalent $Deq = 1*2^2 + 1*2^1 + 1*20 . 1*2^{-1} + 1*2^{-2} = (4+2+1) . (.5+.25) = (7.75)_{10}$

B. Decimal Number System to Any Number System - **Rule 2**

Let D be the integer part of the decimal number and D1 be the fraction part of the decimal number. The decimal number therefore is equal to D.D1. Let "b" be base or radix of the destination number.

Converting Integer part to base "b" Converting Fraction part to base "b"

Use process of repeated division. Process Use process of repeated multiplication.

Terminates when quotient = 0 Process

terminates when fraction part = 0

Quotient Remainder Integer Fraction

D/b q1 r1 D1*b I1 f1

q1/b q2 r2 f1*b I2 f2

. . . . . .

. . . . . .

qn/b 0 rn fn*b In 0

Integer Part = (rn ....r2 r1) Fraction part = (I1 I2 ....In)

Destination base "b" number = rn ... r2 r1 . I1 I2 .. In

Example

Determine the binary equivalent of decimal number 7.75 or $(7.75)_{10} = (\ )_2$

In this example D = 7, D1 = 0.75, and b = 2.

Converting integer part to binary Converting fraction part to binary

Quotient Remainder Integer Fraction

7/2 3 1 0.75*2 1 0.50

3/2 1 1 0.50*2 1 0

1/2 0 1

Binary equivalent of integer part = 111 Binary equivalent of fraction part = .11

Binary equivalent of decimal number 7.75 = 111.11

Note: There may be situations where the fraction part will fail to converge and may repeat. This situation can be addressed by limiting number of fractional digits in the destination number to a predefined integer value (say 6).

C. Complements – **Rule 3**

Let "r" be the radix or base of a number.

The (r-1)'s complement of a number can be determined by subtracting coefficient of each digit from (r-1). The r's complement can be determined by adding 1 to the least significant bit (LSB).

Example

Determine the (r-1)'s complement and r's complement of the hexadecimal number ABCDE.EE.

In this example r = 16. Therefore r-1 = 16-1 = 15. Also A = 10, B=11, C=12, D=13, E=14, and F=15.

r-1	15	15	15	15		15	15
Original Number	A	B	C	D	.	E	F
(r-1)'s Complement	5	4	3	2	.	1	0
Add 1 to LSB							1
r's Complement	5	4	3	2	.	1	1

D. Addition , Subtraction, Multiplication, and Division of two numbers – **Rule 4**

Binary numbers can be added, subtracted, multiplied, and divided just like any other radix number. Each numeral position has a value, and when the addition of two numbers produces a result that exceeds the value that can be represented by a character in the set, a carry is generated to the next higher position. Subtraction generates borrows when a larger number in a digit position is subtracted from a smaller. The multiplication table for binary is quite simple: 0 multiplied by either 0 or 1 =0, and 1 multiplied by 1 is 1. Binary division produces quotients with remainders like decimal division.

Example Example

Find the binary sum of X and Y. Find the following binary difference.

$X = 01110.10_2$ and $Y = 11011.11_2$

Carry 1 11111

X 01110.10 Minuend X 1011010_2

Y 11011.11 Subtrahend Y 0101110_2

Sum 1 01010.01 Difference 0101100_2

Example Example

Find X * Y. Find X/Y.

X=10110.1, Y =01001.1 X=11011.10, Y=101

$X_{10} = 22.5$ $X_{10}=27.5$

Y_{10}=9.5 Y_{10}=5

$(X*Y)_{10}$ = 22.5 * 9.5 = 213.75_{10} $(X/Y)_{10}$ = 27.5/5 = 5.5_{10}

$(X*Y)_2$ = 011010101.11_2 $(X/Y)_2$ = 00101.10_2

3. Features of Simulation Module

The simulation module is a menu driven computer program with menu items and other features. The following is a brief description of different menu items and other features.

- ABOUT Menu – Clicking on this menu gives a brief description of the program.
- CONVERT Menu – Clicking on this menu drops down two options; a) Any Number System to Decimal and b) Decimal to Any Number System. The user can select any of these options by clicking on it. Each option is provided with its input-output screen with input boxes and number of controls like RUN, PRINT, CANCEL, QUIT, etc., where the user can enter data and observe outputs, print the input and output, go back to main menu or quit the program. Also, the user input-output screen has an "INSTRUCTION TO RUN PROGAM" button and he user may click on it to see the steps to run the program.
- COMPLEMNTS Menu – This menu is designed to determine the r's and (r-1)'s complement of a number. Clicking on this menu provides the user with an input-output screen. The items in this screen are identical to the input-output screen in the CONVERT Menu options.
- ARITHMETIC Menu – This menu is designed to perform addition, subtraction, multiplication, and division. Clicking on this menu provides the user with an input-output screen. The items in this screen are identical to the input-output screen in the CONVERT Menu options.
- PRINT Menu – This menu is designed to print different forms. This has features like number of copies, color, font size and font type.
- QUIT Menu – This menu is designed to allow the user to quit the program.

The program is user friendly and works on a click and shoot principle. Built-in error handler routines provide the user with cause(s) of error and possible steps to remove the error.

4. Source Code Listings

Please refer to Appendix A for source code listings of few of the options. If Appendix A is missing (because of space limitations), please contact the authors.

5. Simulation Results and Comparison

Tables 1-3 provide results for various test cases. The results clearly indicate that the simulation modules performed satisfactorily in all test cases.

Table 1 – Theoretical and Simulation Results for Test Cases (Number System Conversion)

Number	Source Base	Destination Base	Calculated Result	Simulation Result	%Error
111.11	2 (Binary)	10 (Decimal)	7.75	7.75	0
101.10	8 (Octal)	10 (Decimal)	65.125	65.125	0
101.10	16 (Hexadecimal)	10 (Decimal)	257.0625	257.0625	0
100.125	10 (Decimal)	2 (Binary)	1100100.001	1100100.001	0
100.125	10 (Decimal)	8 (Octal)	144.1	144.1	0
100.125	10 (Decimal)	16 (Hexadecimal)	64.2	64.2	0

Table 2 – Theoretical and Simulation Results for Test Cases (Complements)

Number	Radix or Base "r"	(r-1)'s Complement			r's Complement		
		Calculated	Simulated	%Error	Calculated	Simulated	%Error
ABC.D	16	654.3	654.3	0	654.4	654.4	0

Table 3 – Theoretical and Simulation Results for Test Cases (Arithmetics)

Numbers $X=(01110.10)_2$ $Y=(11011.11)_2$	Calculated	Simulated	%Error
Addition (X + Y)	101010.01	101010.01	0
Subtraction (Y – X)	01101.01	01101.01	0

The multiplication and division modules are under development. We plan to present results of these modules in the conference.

6. Number Systems and Digital Arithmetic Using LabVIEW

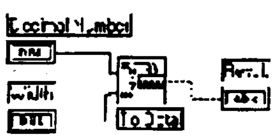
LabVIEW software from National Instruments is widely used for virtual instrumentation (vi) and control by industry. A number of academic institutions use this software to provide instruction and conduct research in virtual instrumentation and control. This software is versatile and consists of numerous vi library which can be used in various disciplines. As far as number systems and digital arithmetic is concerned LabVIEW consists of vi such as From and to Decimal, From and to Octal, From and to Hexadecimal, and From and to Binary. Thesevis can be directly used to perform number system conversions.The input and output can be observed in real time in the screen. The addition, subtraction, multiplication, and division can performed using appropriate vis.

In this section we will provide the diagrams for Decimal to Octal conversions. The other conversions and arithmetic will be presented in the conference.

Decimal to Octal

Inputs Output

Connection Diagram



7. Conclusion and Discussion

The simulation methodologies in this presentation are designed to assist the student and faculty to study number systems conversion and digital arithmetic effectively. The simulation modules were tested for various test conditions and produced correct results. The multiplication and division modules using Visual Basic and Digital Arithmetic modules using LabVIEW are currently developed and will be presented in the conference.

8. References

1. Yarbrough, John M., "Digital Logic – Applications and Design", West Publishing, 1997.
2. Floyd, Thomas L., "Digital Fundamentals", Prentice-Hall, 1997.
3. Sokoloff Leonard, "Basic Concepts of LabVIEW", Prentice-Hall, 1998.
4. Wells, Lisa K. and Travis Jeffery, "LabVIEW For Everyone – Graphical Programming Made Even Easier", Prentice-Hall, 1997.

Appendix A – Source Code Listing for Few Modules

This section provides the source listings of the Any Number System to Decimal Number System option. The other options will have their own source codes and it is not possible to present all of them here because of space limitations.

Variables used in the program

```
Global SB, SB1, NID, NFD, dml1, decimal2, dml1r, decimal2r As Integer

Global r1, r2, r3, r4, r5, r6, r7, r8 As Integer

Global r9, r10, r11, r12, r13, r14, r15 As Integer

Global r16, Iresult As Double

Global f1, f2, f3, f4, f5, f6, Fresult As Single

Global result As Double

Global Ic1, Ic2, Ic3, Ic4, Ic5, Ic6, Ic7, Ic8, Ic9, Ic10, Ic11, Ic12, Ic13, Ic14, Ic15, Ic16 As Integer

Global Fc1, Fc2, Fc3, Fc4, Fc5, Fc6 As Integer

Global Ix1, Ix2, Ix3, Ix4, Ix5, Ix6, Ix7, Ix8, Ix9, Ix10, Ix11, Ix12, Ix13, Ix14, Ix15, Ix16 As String

Global Fx1, Fx2, Fx3, Fx4, Fx5, Fx6 As String

Global IDN, DB, FD As Integer

Global rst, t1, vv2, X1, check, check1 As Integer

Global Counters(4 To 19) As Single

'Globaltext1(1 To 8), text2(1 To 8) As Single

Global dm, brs, octs, octb, obs, obsb, hdmls, hdmlb As Integer

Global dmf As Double

Global dmf1, fin, fin1, br, otl, hdml As String

Global Id1, Id2 As Integer
```

Source code associated with RUN button

```
Private Sub Command1_Click()

Label8.Visible = True

Label9.Visible = True
```

```
Label10.Visible = True
Label11.Visible = True
Text4.Visible = True
For Index% = 5 To 10
Text5(Index%).Visible = True
Next Index%
'For Decimal to Binary
If brs = 1 Then
brsb = 2
br1 = Log(dm) / Log(10)
br2 = Log(brsb) / Log(10)
br = (br1) / (br2)
br = Int(br)
For I% = 0 To br
X = (2) ^ (br)
If dm >= X Then
J$ = 1
Msg$ = Msg$ + J$
dm = dm - X
br = br - 1
ElseIf dm < X Or dm = 0 Then
J$ = 0
X = 0
Msg$ = Msg$ + J$
dm = dm - X
```

```
br = br - 1
End If
Next I%
Text4 = Msg$
If dmf > 0 Then
For Index% = 5 To 10
dmf1 = dmf * brsb
fin = Int(dmf1)
Text5(Index%) = fin
dmf = dmf1 - fin
Next Index%
End If
'End Decimal to Binary
'______________________________________________
'Decimal to Octal
ElseIf octs = 1 Then
otl = Oct(dm)
If dmf > 0 Then
For Index% = 5 To 10
dmf1 = dmf * octb
fin = Int(dmf1)
Text5(Index%) = fin
dmf = dmf1 - fin
Next Index%
End If
```

```
Text4 = otl
'End Decimal to Octal
'________________________________________
'Decimal to Hexadecimal
ElseIf hdmls = 1 Then
hdml = Hex(dm)
If dmf > 0 Then
For Index% = 5 To 10
dmf1 = dmf * hdmlb
fin = Int(dmf1)
fin1 = Hex(fin)
Text5(Index%) = fin1
dmf = dmf1 - fin
Next Index%
End If
Text4 = hdml
'End Decimal to Hexadecimal
'________________________________________
'Decimal to Other Base
ElseIf obs = 1 Then
br1 = Log(dm) / Log(10)
br2 = Log(obsb) / Log(10)
br = (br1) / (br2)
br = Int(br)
For I% = 0 To br
```

```
X = (obsb) ^ (br)

If dm >= X Then

X1 = dm Mod X

X2 = Int(dm / X)

J$ = X2

Msg$ = Msg$ + J$

X2 = Val(X2)

dm = dm - (X2 * X)

br = br - 1

ElseIf dm < X Or dm = 0 Then

J$ = 0

X = 0

Msg$ = Msg$ + J$

dm = dm - X

br = br - 1

End If

Next I%

Text4 = Msg$

If dmf > 0 Then

For Index% = 5 To 10

dmf1 = dmf * obsb

fin = Int(dmf1)

Text5(Index%) = fin

dmf = dmf1 - fin

Next Index%
```

```
End If
'End Decimal to Other Base
'________________________________________
End If
Command1.Enabled = False
End Sub
Private Sub Command2_Click()
Form7.PrintForm
End Sub
Private Sub Command3_Click()
End
End Sub

Private Sub Command4_Click()
Form1.Show
End Sub
Private Sub Form_Load()
OtherBases.AddItem "1"
OtherBases.AddItem "3"
OtherBases.AddItem "4"
OtherBases.AddItem "5"
OtherBases.AddItem "6"
OtherBases.AddItem "7"
OtherBases.AddItem "9"
OtherBases.AddItem "10"
```

```
OtherBases.AddItem "11"

OtherBases.AddItem "12"

OtherBases.AddItem "13"

OtherBases.AddItem "14"

OtherBases.AddItem "15"

End Sub


Private Sub Option1_Click()

Command1.Visible = True

Command2.Visible = True

brs = 1

End Sub

Private Sub Option2_Click()

Command1.Visible = True

Command2.Visible = True

octs = 1

octb = 8

End Sub

Private Sub Option3_Click()

Command1.Visible = True

Command2.Visible = True

hdmls = 1

hdmlb = 16

End Sub

Private Sub Option4_Click()
```

```
obs = 1
OtherBases.Visible = True
Text3.Visible = True
Label7.Visible = True
End Sub

Private Sub OtherBases_Click()
Text3 = OtherBases
Command1.Visible = True
Command2.Visible = True
obsb = Val(Text3)
End Sub

Private Sub text1_Change()
dm = Val(Text1)
End Sub

Private Sub text2_Change()
dmf = Val(Text2)
End Sub


Private Sub Command1_Click()
If Text5 = "" Then
Command1.Enabled = True
```

```
End If
Label2.Visible = True
Label3.Visible = True
Ic11 = Str(Ic6)
Msg11$ = "'s COMPLEMENT"
Label2.Caption = Ic11 + Msg11$
Ic13 = Str(Ic5)
Msg13$ = "'s COMPLEMENT"
Label3.Caption = Ic13 + Msg13$
'For Index% = 1 To 8
'ndex1 = Val(text1(Index%))
'text2(Index%).Visible = True
'text2(Index%) = cmpl - 1
'Next Index%
For Index% = 1 To 8
ndex1 = Text1(Index%)
If ndex1 = "A" Then
Id1 = 10
ElseIf ndex1 = "B" Then
Id1 = 11
ElseIf ndex1 = "C" Then
Id1 = 12
ElseIf ndex1 = "D" Then
Id1 = 13
ElseIf ndex1 = "E" Then
Id1 = 14
ElseIf ndex1 = "F" Then
```

```
Id1 = 15
Else: Id1 = Val(ndex1)
End If
'This calculates (R-1) Complement
Ic1 = Id1 'Val(text1(Index%))
Ic7 = Ic6 - Ic1 'Ic6 is the base
'If the (R-1) Complement equals 10 to 15, display it as a hex digit
If Ic7 = 10 Then
Ic7 = "A"
ElseIf Ic7 = 11 Then
Ic7 = "B"
ElseIf Ic7 = 12 Then
Ic7 = "C"
ElseIf Ic7 = 13 Then
Ic7 = "D"
ElseIf Ic7 = 14 Then
Ic7 = "E"
ElseIf Ic7 = 15 Then
Ic7 = "F"
Else: Ic7 = Val(Ic7)
End If
Text2(Index%) = Ic7
Text2(Index%).Visible = True
Text3(Index%).Visible = True
Next Index%
Ic10 = 0 'Ic10 is the carry
i2% = 8 'Starts calculating from 8th indexed number
Ic5 = Val(Text4) 'Ic5 is the base
'For Index% = 1 To 8
'Dim ndex2 As String
'Dim Id2 As String
```

```
'ndex2 = text2(Index%)
i1% = i2%
Ic8 = Val(Text2(i1%))
If Text2(i1%) = "A" Then
Ic8 = 10
ElseIf Text2(i1%) = "B" Then
Ic8 = 11
ElseIf Text2(i1%) = "C" Then
Ic8 = 12
ElseIf Text2(i1%) = "D" Then
Ic8 = 13
ElseIf Text2(i1%) = "E" Then
Ic8 = 14
ElseIf Text2(i1%) = "F" Then
Ic8 = 15
Else: Ic8 = Val(Text2(i1%))
End If
i2% = 8
Ic10 = 0
'This calculates R Complement
For Index% = 8 To 8
i1% = i2%
'Ic8 = Val(text2(i1%))
Ic9 = Ic8 + 1
If Ic9 = Ic5 Then
Ic10 = 1
Ic9 = 0
Else
Ic10 = 0
End If
```

```
i1% = i1% - 1
Next Index%
Text3(i2%) = Ic9
Ic11 = Ic10
i2% = 7
i3% = i2%
For Index% = 1 To 7
Ic8 = Text2(i3%)
If Ic8 = "A" Then
Ic8 = 10
ElseIf Ic8 = "B" Then
Ic8 = 11
ElseIf Ic8 = "C" Then
Ic8 = 12
ElseIf Ic8 = "D" Then
Ic8 = 13
ElseIf Ic8 = "E" Then
Ic8 = 14
ElseIf Ic8 = "F" Then
Ic8 = 15
Else: Ic8 = Val(Text2(i3%))
End If
'Ic8 = Val(text2(i1%))
Ic9 = Ic8 + Ic11
If Ic9 = Ic5 Then
Ic11 = 1
Ic9 = 0
Else
Ic11 = 0
End If
'Dim ndex3 As Integer
```

```
'Dim Id3 As String
'ndex3 = Val(text2(Index%))
'Dim Ic9 As String
If Ic9 = 10 Then
Ic9 = "A"
ElseIf Ic9 = 11 Then
Ic9 = "B"
ElseIf Ic9 = "12" Then
Ic9 = "C"
ElseIf Ic9 = "13" Then
Ic9 = "D"
ElseIf Ic9 = "14" Then
Ic9 = "E"
ElseIf Ic9 = "15" Then
Ic9 = "F"
Else: Ic9 = Val(Ic9)
End If
Text3(i3%) = Ic9
i3% = i3% - 1
Next Index%
Command1.Enabled = False
'End If
End Sub
Private Sub Command2_Click()
Form8.PrintForm
End Sub
Private Sub Command3_Click()
End
End Sub
Private Sub Command4_Click()
```

```
Text4 = ""
Text5 = ""
End Sub
Private Sub Command5_Click()
Form1.Show
End Sub
Private Sub Command6_Click()
For Index% = 1 To 8
Text1(Index%) = ""
Text2(Index%) = ""
Text3(Index%) = ""
Text2(Index%).Visible = False
Text3(Index%).Visible = False
Next Index%
Text4 = ""
Text5 = ""
Command1.Visible = False
Command2.Visible = False
Label2.Visible = False
Label3.Visible = False
'Command1.Enabled = True
End Sub
Private Sub Text4_Change()
Ic5 = Val(Text4)
Ic6 = (Ic5 - 1)
For Index% = 1 To 8
If Text1(Index%) >= Ic5 Then
Text5 = "Coefficients must be less than Destination Base. Press CONTINUE to Reenter."
Command1.Enabled = False
Command4.Enabled = True
ElseIf Text1(Index%) < Ic5 Then
```

```
Text5 = "OK"
Command4.Enabled = False
Command1.Enabled = True
End If
Next Index%
Command1.Visible = True
Command2.Visible = True
End Sub


Private Sub Command1_Click()
Select Case OptionButton
Case Addition
dummy1% = 8
dummy2% = 6
fraccarry = 0
fracr = 0
fracnr = 0
dml1r = 0
decimal2r = 0
test3 = 7
base = Val(Text5)
'Dim test3 As Integer
'Calculations for fraction portion
For Index% = 1 To 6
'For fraction number one
fracndex1 = Text11(dummy2%)
If fracndex1 = "A" Then
frac1 = 10
ElseIf fracndex1 = "B" Then
```

```
frac1 = 11
ElseIf fracndex1 = "C" Then
frac1 = 12
ElseIf fracndex1 = "D" Then
frac1 = 13
ElseIf fracndex1 = "E" Then
frac1 = 14
ElseIf fracndex1 = "F" Then
frac1 = 15
Else
frac1 = Val(fracndex1)
End If
'Dim test3 As Integer
fracn1 = frac1 * (base ^ (1 - test3))
fracnr = fracnr + fracn1
'For fraction number two
fracndex2 = Text12(dummy2%)
If fracndex2 = "A" Then
frac2 = 10
ElseIf fracndex2 = "B" Then
frac2 = 11
ElseIf fracndex2 = "C" Then
frac2 = 12
ElseIf fracndex2 = "D" Then
frac2 = 13
ElseIf fracndex2 = "E" Then
frac2 = 14
ElseIf fracndex2 = "F" Then
frac2 = 15
Else
frac2 = Val(fracndex2)
```

```
End If
fracn2 = (frac2) * ((base) ^ (1 - test3))
fracr = fracr + fracn2
'Fraction portion result
fracres = frac1 + frac2 + fraccarry
'Tells when to add a carry
base = Val(Text5)
If fracres < base Then
fraccarry = 0
ElseIf fracres >= base Then
fracres = fracres - base
fraccarry = 1
End If
'If fraction result is greater than 9, represent the number in hexadecimal notation
If fracres = 10 Then
fracres = "A"
ElseIf fracres = 11 Then
fracres = "B"
ElseIf fracres = 12 Then
fracres = "C"
ElseIf fracres = 13 Then
fracres = "D"
ElseIf fracres = 14 Then
fracres = "E"
ElseIf fracres = 15 Then
fracres = "F"
Else
fracres = fracres
End If
Text13(dummy2%) = fracres
```

```
dummy2% = dummy2% - 1
test3 = test3 - 1
Next Index%
carry = fraccarry
For Index% = 1 To 8
'Calculations for integer portion of first number
ndex1 = Text1(dummy1%)
If ndex1 = "A" Then
Id1 = 10
ElseIf ndex1 = "B" Then
Id1 = 11
ElseIf ndex1 = "C" Then
Id1 = 12
ElseIf ndex1 = "D" Then
Id1 = 13
ElseIf ndex1 = "E" Then
Id1 = 14
ElseIf ndex1 = "F" Then
Id1 = 15
Else
Id1 = Val(ndex1)
End If
dml1 = (Id1) * ((base) ^ (Index% - 1))
dml1r = dml1r + dml1
'Calculations for integer portion of second number
ndex2 = Text2(dummy1%)
If ndex2 = "A" Then
Id2 = 10
ElseIf ndex2 = "B" Then
Id2 = 11
ElseIf ndex2 = "C" Then
```

```
Id2 = 12
ElseIf ndex2 = "D" Then
Id2 = 13
ElseIf ndex2 = "E" Then
Id2 = 14
ElseIf ndex2 = "F" Then
Id2 = 15
Else
Id2 = Val(ndex2)
End If
decimal2 = (Id2) * ((base) ^ (Index% - 1))
decimal2r = decimal2r + decimal2
ndexres = Id1 + Id2 + carry 'Integer result
'Tell when to add a carry
base = Val(Text5)
If ndexres < base Then
carry = 0
ElseIf ndexres >= base Then
ndexres = ndexres - base
carry = 1
End If
If ndexres = 10 Then
ndexres = "A"
ElseIf ndexres = 11 Then
ndexres = "B"
ElseIf ndexres = 12 Then
ndexres = "C"
ElseIf ndexres = 13 Then
ndexres = "D"
ElseIf ndexres = 14 Then
```

```
ndexres = "E"
ElseIf ndexres = 15 Then
ndexres = "F"
Else
ndexres = ndexres
End If
Text3(dummy1%) = ndexres
dummy1% = dummy1% - 1
Next Index%
Text6 = dml1r + fracnr 'Integer plus fraction of first number
Text7 = decimal2r + fracr 'Integer plus fraction of second number
Text8 = Val(Text6) + Val(Text7)
If carry = 1 Then
Label15.Visible = True
Text4.Visible = True
Text4 = carry
End If
check1 = Val(Text4)
check = (check1) * ((base) ^ (8))
'Decimal Equivalent
dummy1% = 8 'Index starts calculating at 8th location for whole numbers.
For Index% = 1 To 8
ndex1 = Text3(dummy1%)
If ndex1 = "A" Then
Id1 =.10
ElseIf ndex1 = "B" Then
Id1 = 11
ElseIf ndex1 = "C" Then
Id1 = 12
ElseIf ndex1 = "D" Then
Id1 = 13
```

```
ElseIf ndex1 = "E" Then
Id1 = 14
ElseIf ndex1 = "F" Then
Id1 = 15
Else
Id1 = Val(ndex1)
End If
dml1 = (Id1) * ((base) ^ (Index% - 1))
check = check + dml1
'Text9 = check
dummy1% = dummy1% - 1
Next Index%
check2 = 0
dummy2% = 6
test3 = 7
For Index% = 1 To 6
ndex2 = Text13(dummy2%)
If ndex2 = "A" Then
Id2 = 10
ElseIf ndex2 = "B" Then
Id2 = 11
ElseIf ndex2 = "C" Then
Id2 = 12
ElseIf ndex2 = "D" Then
Id2 = 13
ElseIf ndex2 = "E" Then
Id2 = 14
ElseIf ndex2 = "F" Then
Id2 = 15
Else: Id2 = Val(ndex2)
```

```
End If
dml2 = ld2 * (base ^ (1 - test3))
check2 = check2 + dml2
test3 = test3 - 1
dummy2% = dummy2% - 1
Next Index%
Text9 = check + check2
'Display status message
If Text8 = Text9 Then
Msg$ = "CORRECT ANSWER"
Else
Msg$ = "INCORRECT ANSWER"
End If
Text10 = Msg$
Case Subtraction
End Select
End Sub
'Select Case OptionButton
' Case Option1
' For Index% = 1 To 8
' Text3(Index%) = Val(text1(Index%)) + Val(text2(Index%))
' Next Index%
'Case Option2
' For Index% = 1 To 8
' Text3(Index%) = Val(text1(Index%)) - Val(text2(Index%))
'Next Index%
'End Select
'End Sub
Private Sub Command2_Click()
Form9.PrintForm
End Sub
```

```
Private Sub Command3_Click()

End

End Sub

Private Sub Command4_Click()

Form1.Show

End Sub
```

The Processing of CCD Images of the Lagoon Nebula, M8

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Abstract

MU-SPIN NRTS sites at South Carolina State University and City College of New York have collaborated to fund student astrophysical research during the summer of 1998. The program was funded by a grant from the National Aeronautics and Space Administration (NASA), through MU-SPIN (NCC5-116), NASA-URC (NCC5-228) and other NASA sources. The results of one such student are presented.

Previously obtained CCD images taken in Baja, Mexico at the San Pedro Martir Observatory have been reduced and calibrated for future scientific examination. CCDs and their applications to astronomy are briefly discussed. The well known IRAF software package was used to reduce the images from raw to calibrated form. This included the removal of the following noise sources: bias frames, dark frames, bad pixel columns, cosmic rays, and flat field variations.

The data reduction was applied to images obtained at wavelengths of 5755 and 6584 angstroms emitted by the singly ionized nitrogen atom. The temperature map which results from this study will be compared to the temperature map obtained using emission line images from doubly ionized oxygen as discussed elsewhere in this conference (see Ely Duenas' poster).

Summary

Introduction

This work is the result of an eight-week collaboration between South Carolina State University (SCSU), City College of New York (CCNY), and Queensborough Community College (QCC). The principal investigator, Dr. Donald K. Walter is at SCSU, while the coordinator in New York is Dr. Shermane Austin of CCNY. At QCC the coordinator is Dr. Donald Cotten, Chairman of the Physics Department.

The object studied is one of the Messier objects known as M8, the eighth object in Messier's catalog. M8 is also called the Lagoon Nebula and is located in the constellation Sagittarius. Modern astronomers define it as an 'H II' region, meaning that it consists largely of protons and electrons freed from atomic hydrogen. In an H II region, which may be up to tens of light years across, atomic hydrogen is ionized by electromagnetic radiation of wavelength 912 Angstroms or shorter emanating from a star or stars embedded in the region. This creates a plasma of free protons and electrons. What we observe is radiation which is emitted when recombination takes place and energy is released in all the hydrogen series; Lyman, Balmer, and so forth.

Additionally, radiation is emitted from collisionally excited ions of the various chemical elements such as oxygen and nitrogen. As a result, M8 is also called an emission nebula.

CCD's

A CCD, or charge-coupled device, is an array of sensors which detect electromagnetic radiation. When electromagnetic radiation (e.g. visible light or ultraviolet light) strikes a CCD, individual photons impinge on the pixels and free electrons which remain inside the pixel until the end of the exposure, at which time the chip is "read out" and the data is stored in a computer. There is a direct relation between the charge and the intensity of the radiation to which the pixel was exposed. The information for a particular exposure can be displayed as a grid of numbers or as an image after being processed by a computer program.

Data Reduction

To process the images of M8 obtained previously by other astronomers, the author used a software package known as the Image Reduction and Analysis Facility (IRAF). This is a general purpose image processing package used in the analysis of astronomical data. IRAF was created by the National Optical Astronomy Observatories, under a cooperative agreement with the National Science Foundation. IRAF is a very versatile software facility, being able to execute a myriad of processes on an image, too numerous to list here. As an example, with one tool called 'cosmicrays' one can remove cosmic ray hits from an image.

When an image is recorded by a CCD, there are various unwanted effects (noise) which must be dealt with in processing the image. Sources of noise are cosmic rays, dark current, bias or read noise and flat fielding. During the course of this summer research project, all of these sources of noise were examined and removed from the images, leaving behind scientifically useful data.

Results

The reduction described above was applied to a set of CCD images of M8 previously obtained at the San Pedro Matir Observatory. The wavelengths of interest to this study were at 5755 and 6584 angstroms, both emitted by singly ionized nitrogen atoms. The ratio of these two images was used to derive a preliminary temperature map of the nebula. Final analysis of the map awaits further study, at which time it will be published and made available for use by other astronomers who study the interstellar medium.

Ground and Space-Based Observations of the Bubble Nebula

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Abstract

Recent observations made with the NASA Hubble Space Telescope (HST) and previous ground-based imagery and spectra of the Bubble Nebula (NGC 7635) are presented. This collaborative project between South Carolina State University (Lead Institution), Rice University and Arizona State University is discussed.

A multiwavelength study of this enigmatic object is being carried out at the three institutions and includes both spectroscopic data and imagery taken at select diagnostic emission lines important to an understanding of the physical and chemical conditions in the nebula. Cycle 7 observations of NGC 7635 have been made using three of HST's instruments, WFPC2, STIS and NICMOS, in October and December 1997. Future observations in April-May 1999 are in preparation. Preliminary results of the HST observations will be presented along with a summary of ground-based studies to date.

Funding and support for this project is provided by NASA under three separate grants or projects, MUSPIN (NCC 5-116), MUREP-URC (NCC 5-228) and the Space Telescope Science Institute (GO-07515.01-96A).

I. The Bubble Nebula

The spherical symmetry and bright rim of NGC 7635 are the reasons why this object has been given the nickname the "Bubble Nebula". Figure 1 is from our ground-based imagery taken with the Palomar 1.5m telescope. The nebula's nearly spherical shell is the result of a stellar mass-loss event which has taken place within the past one million years. Located in the Perseus arm of the Milky Way ($l=112°$, $b=+0.2°$, $\alpha=23^h$, $\delta=+61°$), NGC 7635 is part of the larger HII region S162. Features visible in Figure 1 include:

Central Star: The ionizing star is BD+60° 2522, an O6.5IIIf (Conti & Alschuler, 1971), with published wind velocities in the range 1800-2700 km/s (Christopoulou et al. 1995). Howarth & Prinja (1989) found that the star may be a class I supergiant with a mass of 44 solar masses and a mass-loss rate of 10^{-6} solar masses per year.

Rim: The work of Israel et al. (1973) showed that the bubble, with a diameter of 8 light years ($6x10^{12}$ miles), is a blister region on the face of a large, background molecular cloud. It is believed that the rim is a shock front advancing into the surrounding interstellar medium (ISM) which was previously ionized by the central star.

Interior Knots: Inside the rim and to the west (right in Figure 1) of the central star is a region of high density gas. These knots are likely a series of bright-rimmed globules interacting with the strong wind and radiation field of the ionizing star. Our HST observations will search for possible new stars being born inside the knots.

Exterior Knots: Numerous high density knots can be seen exterior the rim. Those of interest to this study are to the north (up in Figure 1) of the bubble rim. They differ from the interior knots in that while they have been ionized by the central star, they have not yet interacted with the high speed rim shock which compresses and heats the ISM.

Second Bubble: A larger, fainter, second bubble can be seen exterior to the first. It has not been examined by earlier studies and is not the subject of this study. Speculation as to its origin includes a possible, earlier episode of stellar ejection.

II. The Research Team

The investigators assembled for this study have strong backgrounds in the study of the ISM and include:

1. Dr. Donald K. Walter, Principal Investigator, South Carolina State Univ.
2. Dr. Reginald Dufour, CoInvestigator, Rice University
3. Dr. Patrick Hartigan, CoInvestigator, Rice University
4. Dr. Jeff Hester , CoInvestigator, Arizona State Univ.
5. Dr. Paul Scowen, CoInvestigator, Arizona State Univ.

III. Use of HST

Thirteen (13) orbits of telescope time have been awarded in Cycle 7 for this study GO-7515. During each orbit one instrument on the telescope is pointed at the primary field of view while simultaneously one or two additional instruments are observing in parallel fields of view which are offset from the primary field but are still in the nebula. The location of a parallel observation is serendipitous and determined by the location and orientation of the primary instrument. The instruments used for this study include: Wide Field Planetary Camera 2 (WFPC2), Space Telescope Imaging Spectrograph (STIS) and Near Infrared Camera and Multi-Object Spectrometer (NICMOS). See Table 1 for details. Figure 2 shows the HST FOV with the instrument apertures in their relative locations and orientations.

STIS: STIS has been used as the primary instrument in order to obtain spectra of the interior knots and across the bubble rim to the northeast of the central star. These observations are critical to understanding the detailed physics of the nebula (temperature, density, chemical composition) at a spatial resolution of 0.2 arcseconds, an order of magnitude improvement over what is available from the ground. Parallel observations with STIS will also be made of the outlying regions of the nebula during WFPC2 primary in 1999.

WFPC2: The WFPC2 will be used as the primary instrument to study the interior knots, northern rim and exterior knots to the north of the bubble. The high spatial resolution of the WF chips (0.1 arcseconds) and the PC chip (0.043 arcseconds) will provide the investigators with more than an order of magnitude improvement over ground observations; including a look at previously unresolved morphological features, possibly including protostellar features. The locations of the parallel WFPC2 fields taken in October and November 1997 can be seen in Figure 3.

NICMOS: The NICMOS was used only as a parallel instrument during the October and November 1997 STIS-primary observations with hope of locating shock-heated gas which in turn would pinpoint regions of active star formation.

IV. Ground Based Observations

The investigators have assembled an extensive set of ground-based imagery and spectra of NGC 7635. This data will supplement the HST observations. The spatial resolution of the ground-based observations is not as good as the HST observations; however, they cover more of the nebula and include regions not observed by HST. The details of the ground-based observations are given in Table 2 and the observatories are shown in Figure 4.

V. Current Results

STIS-Primary (RIM) The November 1997 observations with the STIS slit perpendicular to the rim northwest of the central star were successful. Figures 5 and 6 show the results for the blue and red regions of the spectrum respectively.

The 2-dimenstional nature of the STIS longslit allows for coverage in wavelength as well as across the nebula. By tracing a given bright line along the slit (see Figure 6), one is able to measure the variation in emission strength of the nebular gas. This in turn will allow the investigators to measure such quantities as temperature, density, dust extinction and chemical composition of each region of the nebula.

STIS-Primary (KNOTS) The October 1997 observations were taken through the interior knots. The results from the optical region of the spectrum show even greater local variation in emission line strength due to the very clumpy nature of the knots as shown in Figure 7. The ultraviolet spectra taken by the STIS-MAMA, unfortunately, do not show any nebular emission. This is due to the low surface brightness of NGC 7635 and the large amount of interstellar extinction (A_V =2-4 magnitudes) caused by dust in the nebula.

WFPC2 Parallel An example of WFPC2 parallel observations taken during the STIS-primary observations in 1997 are shown in Figures 8 and 9.

NICMOS Parallel The largest NICMOS aperture (NIC 3) was out of focus during our data run because of the well-known cryogenic leak. The other apertures, NIC1 and NIC2 are only 11 and 19 arcseconds square respectively. It was unlikely they would serendipitously fall on areas of interest, and to date no interesting features have been discovered from the NICMOS observations of NGC 7635.

VI. Future Work

HST Observations: Five (5) orbits of WFPC2 observations remain to be taken and preparations are being made to complete those in April or May 1999.

Ground Observations: Additional spectrophotometric data will be obtained in the fall of 1999 to more accurately determine the spatial variation in the physical conditions in the nebula (e.g. electron temperature, density, extinction).

Modeling: Photoionization modeling of the nebula will begin once current STIS and ground-based spectrophotometry are reduced. Shock modeling of the rim and the cooling zone behind the rim will begin after the WFPC2 imagery is gathered and reduced in the spring and summer of 1999.

Additional Objects & HST: The study of NGC 7635 is part of an ongoing study of the ISM and starburst galaxies by the author in collaboration with the above individuals and others. Additional HST Cycle 8 proposals were submitted by the author to study these objects. Further ground-based studies are also underway or in the planning stage, including the acquisition and reduction of imagery, longslit spectra and Fabry-Perot spectra.

VII. MUSPIN & NASA Support

This and other research conducted by D.K. Walter would not be possible without the generous support of NASA. The study of NGC 7635 receives support from the following three programs:

MUSPIN: Cooperative Agreement NCC5-116, awarded to South Carolina State University and managed by the MUSPIN office, has provided the network hardware and UNIX systems support which is absolutely essential to this project. Participation in HST projects requires heavy use of the WWW. Proposals to the Space Telescope Science Institute (STScI) are now submitted entirely online. Documentation and extensive resources such as software and data are only accessible through high speed data lines. Communication with colleagues at other institutions is only possible through the web. Without the network and systems support of MUSPIN, the author would not be able to successfully compete for HST time as well as other research programs.

MUREP-URC: Agreement NCC 5-228 was awarded to Tennessee State University and includes a subcontract to D.K. Walter at South Carolina State for the use in faculty and student astronomical research. Salaries, travel, equipment, supplies and funds for publications are possible under this subcontract. This in turn has allowed the author the opportunity to develop collaborations and carryout research at Arizona State, Caltech, Rice University, University of Maryland, Palomar Observatory and Steward Observatory.

STScI: Funding for summer salary, travel and publication costs are provided by grant GO-07515.01-96A from the Space Telescope Science Institute, which in turn is funded by NASA.

References

1. Christopoulou, P.E. et al. 1995, A&A, 295, 509
2. Conti, P.S., & Alschuler, W. R. 1971, ApJ, 170, 325
3. Howarth, I.D. & Prinja, R.K. 1989, ApJS, 69, 527
4. Israel, F.P., Habing, H.J. & de Jong, T. 1973, A&A, 27, 143

Figures are proprietary and are not currently available for release.

Table 1: Cycle 7 HST Observations of NGC 7635

Date	Primary Instrument	# Orbits	Wavelength (Angstroms)	Primary Field	Parallel Instruments
April-99	WFPC2	5	6730,6584,6563 5470,5007,4861	Rim, Interior Knots, Exterior Knots	STIS
Oct-97	STIS-MAMA	2	1600-3200	Interior Knots	WFPC2,NICMOS
Oct-97	STIS-CCD	4	2900-6900	Interior Knots	WFPC2,NICMOS
Nov-97	STIS-CCD	2	2900-5700 6500-7000	NE Rim	WFPC2,NICMOS

Table 2: Ground-Based Observations of NGC 7635

Data Type	Wavelength (Angstroms)	Observatory	Telescope
Spectra	3300-6900	Steward	2.3m
Imagery	6724,6584,6563 6450,5100,5007	Steward	2.3m
Imagery	6724,6584,6563 6450,5007,4861 4805	Palomar	1.5m

Call for Participation Papers

Dr. Shermane Austin
City College of New York

Ms. Dorothy Russell
Morgan State University

Ms. Maureen Smith
University of Maine

Mr. Jose C'de Baca
New Mexico Highlands University

METNET/CCNY

Shermane Austin, CS Department
Stanley Gedzelman, EAS Department

METNET Project

- MUSPIN-funded network of weather stations in K-12 schools and CUNY colleges
- Weather-related research and investigations in the NYC metropolitan area
- Stimulate education in earth and environmental science

New York City Network

Combined Metropolitan Area

- NYC Network
- Weather Access
- South Jersey Network
- NWS Stations

METNET Investigations

- Urban Heat Island(UHI)
- Sea Breezes
- Thunderstorms
- Cold Fronts - understanding and forecasting mesoscale behavior

Urban Heat Island(UHI)

- Concrete, asphalt, glass and vertical surfaces absorb more solar radiation than natural vegetation
- More heat energy added due to industrial activity, transportation
- Lack of evaporative cooling
- Warmer than countryside on calm, clear nights

UHI Example

Sea Breeze Example

Thunderstorms - IR snapshot

Thunderstorms - Surface Data

Cold Fronts - Mesoscale Behavior

Educational Component

- Teacher-training
- Summer Program
- NYC Board of Education Staff Development
- Identifying mesoscale and microscale investigations
- Interdisciplinary context

Partners

- Institute for Climate and Planets/GISS
- National Weather Service
- Cablevision
- AWS
- Community Partners
  - Parks Department
  - Operation Green Grocer
  - Environmental Organizations

High Performance Computing Summer Institute: Foundation of Faculty/Student Technological and Scientific Investigations

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Abstract

The High Performance Computing Summer Institute (HPCSI) at Morgan State University has provided a platform for the enhancement of faculty and student development and research opportunities in the investigation of technological and scientific phenomena. This eight-week program is designed for undergraduate students to engage in research with a faculty mentor while employing leading edge technologies to solve a wide range of problems in science, engineering, and mathematics (SEM). Over the past five years, the HPCSI has evolved into one that is national in scope representing students and faculty from universities in the Baltimore-Washington region and a number of historically black colleges and universities (HBCUs). Initially funded by the National Science Foundation with strong in-kind support from the National Aeronautics and Space Administration Goddard Space Flight Center (NASA GSFC) and MUSPIN, the HPCSI now leverages resources from other federal agencies, including DoD and DoE. In this paper, the ideas and concepts behind the establishment of the HPCSI and the role that it has played in preparing undergraduate students for greater challenges of high technology employment and entrance to graduate schools are discussed. An extrapolation of how this model might be extended to include participation from more HBCUs and Tribal Colleges will be posed. Examples of the research topics that have emanated from the activity will be presented.

Introduction

In 1993, Morgan State University and other coalition members of the Washington-Baltimore Hampton Roads Alliance (WBHR) successfully received funding from the National Science Foundation (NSF) that was designed to improve their chances of graduating and their potential to enter graduate education. The purpose of the funding was to enable undergraduates to participate in a wide range of activities that otherwise would not be available to them. At the same time, other events had catapulted high performance computing into the forefront of academia and research. Mosaic and its successor browsers were transforming the Internet into the super information highway making it possible for widespread dissemination of information. Advances in computer technology, the establishment of the supercomputer centers nine years earlier, the emerging field of computational science and engineering, and the ETA-10 supercomputer acquired with the assistance of NASA GSFC precipitated the development of the High Performance Computing Summer Institute (HPCSI) at Morgan State University. Those involved in the development of the HPCSI proposed to provide greater access for undergraduates to the tremendous high performance computing (HPC) technologies that were finding greater use in the fields of science, engineering, and mathematics.

The success of the HPCSI has met and exceeded the expectations of those involved in its early development. It has been the foundation of Computational Science and Engineering course development and the integration of research into the undergraduate educational experience. It has laid the foundation for faculty research by providing initial funding and student support. It has enabled the University to obtain additional research and development funds. Further, the HPCSI has become a program of excellence providing high performance computing training to undergraduates and promoting the use of high performance computing technologies in the investigation of scientific and technological phenomena.

In this paper, the role the HPCSI has played in preparing undergraduate students for greater challenges of high technology employment and entrance to graduate schools will be discussed. The impact that it has had on the University and how this concept might be extended to include participation from more HBCU's and tribal colleges will be posed. In addition, some of the research topics that have emanated from the activity will be presented.

The High Performance Computing Summer Institute

Since its inception, the HPCSI has trained more than eighty students to use advanced computational technologies. A number of these students have graduated and entered the workforce and are now applying high performance computing technologies to real world problems. Others have entered graduate schools where their knowledge and capability of high performance computing can be used in their academic studies and research.

Program Goals

The purpose of the High Performance Computing Summer Institute has been to introduce undergraduate students to the state-of-the-art in HPC technologies. The goals of the institute since its inception are to:

1. enhance the computing skills and expertise of the students;
2. promote the use of advanced computing technologies in the undergraduate educational experience, research and in the classroom;
3. encourage students to pursue advanced degrees that will allow them to employ high performance computing; and
4. develop graduates that enter the workforce who are capable of applying advanced computing technologies to challenging problems which arise in the workplace.

Program Description

The HPCSI is an eight-week residential program held each summer for undergraduate students. It is a multi-disciplinary program with two major components: an intensive training course in HPC and individual or team research projects. The training course includes lectures on parallel architectures, parallel computational models, high-speed networking technologies and applications, and scientific visualization. The students are exposed to traditional supercomputing through the use of a parallel vector processor, a Cray J916 supercomputer that serves as a replacement for the ETA-10. In addition, the students have been exposed to the message passing model of parallel computation utilizing a network of workstations this past year.

Research projects are an integral component of the HPCSI. The research projects provide an opportunity for the students to apply technologies and applications in solving real world problems. In addition, the research project component exposes the students to the full range of research activities. Among the activities are:

1. review and employ research techniques in the development of a project with the assistance of a mentor;

2. enhance and improve communication skills through a series of oral presentations;

3. document the project through the writing of a technical paper;

4. present the technical paper at a research symposium at the end of the program; and

5. submit the technical paper for presentations at conferences and/or publication to a journal.

In addition to training and research experiences, the HPCSI also includes weekly seminars, where invited speakers present applications of high-performance computing. These seminars are designed to expose the students to how high performance computing is applied to research in science, engineering, and mathematics. Students attend professional development sessions where they are exposed to technical writing, designing presentations, and techniques in communicating significant aspects of their results.

Impact of HPCSI on Undergraduate Students

One of the most important benefits of the HPCSI at Morgan State University is the excellent opportunity it provides students to uniquely broaden their training. This effort has enabled students to expand their horizon while at the same time improving their competitiveness for entry into the technological workforce. They are afforded the opportunity to engage in computing on several computational platforms. Through teaming activities, the students learn to investigate problems in their respective fields of study and to gain a greater appreciation of the knowledge that is required from many other disciplines to effectively solve problems of national importance.

The HPCSI has enabled students to participate in HPC through faculty-sponsored research, internships with national centers in HPC, and in the classroom. The faculty-sponsored research begins in the summer and is continued during the academic year. One of the primary mechanisms for the continuation of research is the NASA/Morgan Undergraduate Research Scholars program. The HPCSI has prepared other students to participate as interns at national supercomputer centers, to attend and present at conferences and to be useful to other research projects.

In addition to the students who have benefited from the education related HPC activities, there are those who have gained practical hands-on experience in HPC technologies. These students have served as interns in the Information Systems and Academic Computing Center on campus. They design and install local area networks, enable parallel computing by connecting workstations into clusters or network of workstations, and are trained in the administration of supercomputers and workstations.

Students have expressed the importance of their experiences in the HPCSI through surveys and personal correspondence. One student comments were as follows:

> "Participation in the HPCSI provided an opportunity to solve a practical engineering problem that most undergraduates do not have the opportunity to solve. Courses provide textbook problems that are very simplistic and show only one element of the problem. Through this program I was able to use different computing platforms, a supercomputer running ANSYS software and workstation for post-processing using a structural engineering visualization package (EnSight). These are some of the tools that I will use in my future career. This experience will be invaluable in the remainder of my studies as an undergraduate and as I pursue advanced degrees in engineering. It will strengthen my competitive edge as I enter a professional career."

Another student expressed the impact the HPCI had on his personal development with the following comments:

> "The opportunity afforded me to assist in the design and installation of the computer-based classroom training facility will be invaluable for the rest of my academic and professional career. The experience has reinforced classes that I have taken in computer science, in particular networking. Every student in computer science should have this or a similar experience before graduation."

Example Research Topics of HPCSI

A number of excellent research topics that had their beginnings as projects in the HPCSI are presently under investigation as faculty research. A number in this group are presently funded through a federal agency. These topics include: *Modeling of Flow Separation around Single and Arrayed Bluff Bodies*, *Determining Lithology Using An Information Processing Model*, *Finite Element Analysis of Liquid Storage Tanks: A Parametric Study* , and *Simulation of Solid State Ultraviolet Photodetectors for Earth Observing Instruments*.

Finite Element Analysis of Liquid Storage Tanks: A Parametric Study investigated the dynamic behavior of liquid storage tanks as the tanks are subjected to stresses from natural disasters such as earthquakes and natural elements such as the wind, or those stresses simply caused by flow fluid over the tank. The research project has important implications in many areas. Liquid storage tanks are in widespread use in various branches of industry such as Petroleum and Natural Gas for on-shore storage facilities, the space exploration program for liquid fuel tanks, and for water distribution facilities maintained by public works departments.

One summer, a student research project involved the design of a neural network in electrical engineering applications. As she continued her project during the academic year, she began to construct a model of a neural network that could analyze subsurface data and use the results to classify the various types of rocks present in the strata. The title of her research is *Determining Lithology Using An Information Processing Model* and it classifies rock types by analyzing the data values associated with various rock characteristics. It is proposed to be an alternative to extracting numerous core samples and analyzing each individual layer, thus eliminating the need to perform expensive drilling.

The research project, *Simulation of Solid State Ultraviolet Photodetectors for Earth Observing Instruments*, was instrumental in the advisor submitting and receiving an award for research from the NASA GSFC. As a team research effort in the HPCSI, the purpose of the project was to employ high performance computing technologies to simulate the material properties, device topologies, and manufacturabilty of the photodetectors. Its significance to NASA stems from the agency's need for compact, lightweight, high performance, low cost photodetectors to build ultraviolet (UV) instruments for future space missions.

Extension of Model to other HBCUs and Tribal Colleges

We feel that this model is an excellent one and that it can be easily extended to include a larger number of HBCUs, HSIs and the Tribal Colleges. MUSPIN member institutions are excellent candidates for inclusion. Participation from a few of its members has already begun; included among those are Central State University, Elizabeth City State University, Jackson State University, North Carolina A&T, and Tennessee State University.

In most instances, the participation has been through individual students who are paired with a faculty mentor at Morgan State University. While this approach enables the students to gain invaluable experiences during the summer, it has not allowed the student to continue to develop once the student returned to his/her home institution. An alternative to this approach is for participation by both faculty and students from a visiting university. In the summer of 1997, participants from Central State University of Ohio used this approach.

Wabanaki Science and Math Project: Walking Successfully in Two Worlds: A Model Program for Integrating Culture into the Curriculum

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Introduction

The Wabanaki people of Maine (Maliseet, Micmac, Penobscot, and Passamaquoddy Tribes) have a long, rich history. There has been comparatively little research done on this group with few curriculum materials developed specifically about them and for them. Through a grant from City College of New York and the Muspin Program of NASA, the University of MaineŽs Native American Programs was able to develop a program designed to integrate Wabanaki culture into the study of math and science. The hope is to increase the interest Wabanaki youth have in pursuing careers in math and science.

As part of a three year initiative, we began the project in Spring, 1998. We have several approaches to meeting the goals of our program. We believe the only way to achieve success with the students is to include the schools, the parents, and the communities. We engaged many individuals from each group in all of our efforts.

We worked with K-12 educators working with Native youth to increase their knowledge and comfort level with integrating Wabanaki curriculum materials into their classrooms. This began with a 4-day workshop held during the Summer of 1998. While, the focus of the initiative is geared toward students in 4th through 8th grade, we recognize that the educators at other grade levels have a significant impact on students and their aptitude and attitude toward school in general, and math and science in particular. We define Native educators as teachers, community people and Native parents.

Obviously, students are the keys to success for this project. To provide direct services to 4th through8th grade students, we developed a Native American Science Career day for the fall of 1998. This day would be designed to show students how fun and interesting science can be. We engaged Native scientists from many fields who presented information on their areas of expertise by involving the students in hands-on activities. Throughout the year, students will travel to various laboratories and reservation science departments to see the importance of science in Native life in the Wabanaki Saturday Science Project. Included in each of these activities are tribal elders balancing the Western scientific knowledge with the traditional Native stories and uses to continually encourage Wabanaki youth to see both the relevance and traditional importance of science in the Native world, both past and present.

This workshop will discuss the process we engaged in, the struggles we contended with, and the successes we found. While the program is still in progress, the process for the development of the program and the initial efforts have taught all of us many lessons. We believe we can offer insights into our efforts that may assist others, as well as solicit information from others who have experienced similar struggles and successes.

The Project

The Wabanaki Math and Science Project is funded though a subcontract with the City College of New York. City College of New York receives its funding from Mu-Spin (Minority University-Space Interdisciplinary Network), a program created through NASAŽs Office of Equal Opportunity Programs. The program seeks to increase minority universities and under-represented minority participation into the fields of math and science. While programs are primarily geared toward minority universities, the University of Maine is not such an institution, however, the outreach to increase the number of Native students involved in math and science fields enabled us to become involved in this program.

The Native American Programs at the University of Maine received funding on May 1, 1998. While we ha developed programs to assist us with the achievement of our goal, to date we have only held the Native Science Teachers Institute. While this institute is the focus of our presentation, it may be helpful to see the kinds of activities we hope to engage in the following years.

The Native American Programs has an interest in the development of academically strong Native studentsŽ K-12. We are committed to long term efforts intended to produce systemic change. This requires attention to both long and short term strategies.

Our goal is to create the conditions which will provide support and encouragement for Native students to adequately prepare themselves to choose among a wide range of educational pursuits and career options, and provide a firm foundation for lifelong learning. We are particularly concerned with the development of improved skills for all students in mathematics and science recognizing the importance of these disciplines in preparing for a variety of careers. In particular, we hope to engender in students an appreciation for the importance of math and science to Native communities most especially in the management of natural resources. Collaborations with the University of Maine will provide Native people with opportunities to utilize science in ways that will have a positive outcome for Native communities. While we would expect significant progress in three years, we are committed to a long term effort, building capacity as we go.

Our identified target population for this project is at both the elementary and middle school. We will direct our primary efforts to 4th and 8th grade Native students. Both of these ages provide additional challenges and it is often at these junctures that more Native students drop out or develop a lack of confidence in their academic capabilities, especially in math and science. We also recognize the need to utilize the outstanding Native students in the science, math and education areas here at the University of Maine. Many of them hav outstanding leadership potential and would serve as excellent role models for the younger students. Therefore, they would also be included in the students we are working with.

In order to meet the needs of the targeted population, we will need to work with educators of Wabanaki youth. Taking a holistic approach to education, educators of the youth include classroom teachers, parents, community members, teacher aids and other concerned individuals. The project will assist them to adequately teach and nurture students. We believe we must begin to assist educators of Wabanaki youth in grades 4 through 8th. As this project is viewed as long-term, we believe we must recognize education begin before preschool and therefore, we must attempt to be inclusive of individuals designated as educators.

These are the objectives we hope to accomplish:

Objective 1:

- To increase the number of Wabanaki Native youth in grades 4 through 8th interested and adequately prepared to enter post-secondary science and other related majors.

  In order to achieve objective one, the project would provide: Increased awareness for the targeted students of the relevance of science for Native people
- Increased interest in science careers by Native students
- Increased skills of Native youth in science

Method for achievement of objective 1:

Native American Science Career Day

To increase interest for Wabanaki youth in science careers for Natives, a Native American Science Career Day will be held. This Science Career Day will be held at the University of Maine, organized and facilitated by University of Maine Native students. This event will kick-off the Wabanaki Saturday Science Program. It will provide an opportunity for 25 students to see science methods being studied at the University and then see the same science methods applied in a tribal setting at the Penobscot Reservation. Students will see examples of forestry, water quality and GIS. Tribal elders and Native community leaders will be included in the day to ensure that the activities are grounded in the traditional beliefs of the Wabanaki traditions.

Wabanaki Saturday Science Project

To continue to increase interest in science for Wabanaki youth, Saturday programs will be offered. The Saturday program will meet at various locations throughout Maine. The intent of each of these programs will be to allow students hands-on experiences with scientific instruments and provide students an opportunity to see how science can impact upon their tribes or are utilized by them.

The program will include site visits to the various scientific programs on the campus of the University of Maine and surrounding areas. The other site visits will be held at the various reservations and surrounding tribal lands throughout the state. The students will visit a tribal water quality program, a tribal GIS station, and a tribal forestry management program.

Wabanaki Pre-College Science Program

In the summer, a Wabanaki Pre-College Science Program will be held at the University of Maine. Ten eighth-grade students will have an opportunity to spend a week on campus working with U.M. Native science students, as well as U.M. faculty in a structured academic program for part of the day. The program, while academic, will be experientially based enabling students hands-on experiences in diverse science and technological areas. An additional component of the program will provide 8th grade students a balanced approach to traditional beliefs with the use of tribal elders. Affective domains will also be addressed particularly transitional issues as these young people move from their reservation schools to various high schools throughout the state. Through the program, we also hope to increase the studentŽs proficiency in computers to enable them to communicate with one another, as well as project staff, throughout the following years. The anticipated outcomes of the Wabanaki Pre-College Science Program will be: Increased confidence in their ability to do math and science Increased math and science skills A four-year academic plan with sufficient math and science to enable the students to choose virtually any career they want Enhanced cultural knowledge Enhanced computer skills Enhanced self-esteem

Objective 2:

To provide resources to enable 4th through 8th grade educators to better teach Wabanaki youth in the science areas. To achieve this objective, we propose to:

- To increase the number of 4th - 8th grade teachers adequately prepared to effectively teach science to Wabanaki youth from all four tribes
- To find, develop and implement A Wabanaki science and math curriculum and culturally relevant pedagogy
- To facilitate coordination and cooperation between Native communities and educational institutions serving their youth in developing an interest in science.
- To encourage teacher participation and maintain enthusiasm for educators who have participated in Native Science Teachers Institute follow-up throughout the year will be provided. All participants will attend 2 one-day meetings to discuss outcomes, progress and areas of improvement in initiating and further developing their summer projects. Additionally, the project coordinator will make site visits to review the outcomes.

Native Science Teachers Institute

In order to increase the number of educators better prepared to effectively instruct students in science, we propose the Native Science Teachers Institute held in the summer. This institute will ask teachers of Wabanaki youth to form teams with community members, Native para-professionals, tribal school board members, and others to identify, develop and implement Wabanaki science curriculum and culturally appropriate pedagogy for 4th and 8th grade science courses. We will provide training for individuals to deliver the outcome. We propose using Native educators as consultants to work with teams, as well as other individuals knowledgeable in their designated fields. The outcome from this project will be a specific action plan developed by each participant.

The focus of the program is to develop, implement, and create curriculum and pedagogy that are Wabanaki based. Therefore, the expertise of tribal elders and knowledgeable tribal community leaders will be integral at every juncture of the institute, from planning to implementation. Tribal input will be the cornerstone for the institute, providing guidance and expertise to all program participants for their youth consisting of culturally relevant Wabanaki-focused science curriculums. Because we believe educators and communities are interested in the outcomes of programs, we will also encourage teams to look at the new learning outcomes initiated for the State of MaineŽs students. The institute can provide a means of dialogue between stakeholders in the process and outcomes, and prepare materials to meet several constituencies. This provides a formidable challenge, but a promise for Native education. This institute could become a prototype for the kind of partnerships we envision, developing a process for partnerships with tribes. It also will address the real concerns of assessment and Native American students. A consultant familiar with these assessments utilized in Maine will be contracted.

We also want to encourage program participants to utilize technology as a resource tool. Therefore, a technological component will be added. We will hire a consultant with extensive expertise in technological development and a Native Maine educator with technological and tribal cultural knowledge.

We hope to have schools and communities provide tribal elders and community resource people. The coordinator will assist in this process. We will ask participants to share a detailed action plan for the upcoming year, integrating Wabanaki curriculum, and Native pedagogy into math and science projects/lessons, etc. Additionally, we will seek written comments, numerical rating scales and narrative on the programŽs strengths and areas of improvement. The coordinator will develop an in-depth evaluation report on the institute with suggestions for improvements and areas of strength to be used for future program development.

Objective 3:

To facilitate collaborations with tribal agencies and available technological and scientific resources, specifically in the State of Maine and at the University of Maine To begin the facilitation of collaborations between tribal agencies and available technological and scientific resources, the project coordinator will meet with tribal leaders and community members to ascertain needs. He/she will also begin the process of networking with campus technological and scientific professionals with expertise, interest, and willingness to participate. This process will be on-going and developmental. The development of a process that will enhance tribal/University relations is critical to the success of the program. We would like to eventually develop a manes to formalize such relationships. As a beginning step, we will create a directory of University of Maine faculty interested in working with the tribes and their areas of expertise. We will then distribute this directory to the tribes to determine if there exists a fit between faculty expertise and tribal needs.

Objective 4:

To utilize the leadership and further develop the potential of University of Maine Native students, Native high school students, and Native para-professionals. The process to achieve this objective was discussed throughout the project description. To summarize, University of Maine students in science, technology, math and education specialties, Native high school students and Native para-professionals will be an integral part of the entire project. These individuals will be used at the project outset to design and implement the project. In the first year, they will:

- work closely with the coordinator to conduct the survey of educational institutions
- network with campus facilities and tribal agencies
- assists with the logistics of the Native Science Teacher's Institute
- attend the Native Science Teacher's Institute to assist the coordinator in the development of strategies for working with the Wabanaki youth
- become trained in responsibilities and expectations of a formalized mentor role
- develop and implement, in cooperation with the coordinator, the Saturday Science Program
- develop and implement, in cooperation with the coordinator, the Wabanaki Science Career Fair
- serve as residential assistants and tutors in the Wabanaki Pre-College Science program

The Project: Native Science Teachers Institute:

The project staff determined that we should hold the Native Science Teachers Institute during the summer. Due to the late date of beginning the project, we needed to quickly, but thoroughly, inform teachers of Native youth, community members, parents, and other interested individuals of the project and what it hoped to accomplish. The latter part of May and the beginning part of June, project staff met with these individuals. We met with the faculty of the three Maine Indian Education Schools, tribal education directors, tribal councils, various tribal offices, and attended activities related to the two non-reservation communities. We were fortunate to have two individuals familiar with the population, the Superintendent of Maine Indian Education and the Project Coordinator for an ongoing Maine Math and Science Alliance, involved in this initial process.

The focus of the program was to begin to develop, implement, and create curriculum and pedagogy that are Wabanaki based. Therefore, the expertises of knowledgeable tribal community leaders were utilized throughout the institute, from planning to implementation. Tribal input was the cornerstone for the institute, providing guidance and expertise to all program participants for their youth consisting of culturally a relevant Wabanaki-focused science curriculum.

Because we believe educators and communities are interested in the outcomes of programs, we provided an opportunity to look at the new learning outcomes initiated for the State of MaineŽs students. The institutes provided a means of dialog between stakeholders in the process and outcomes, and prepared materials to meet several constituencies. A consultant familiar with these assessments utilized in Maine was contracted.

We also wanted to encourage program participants to utilize technology as a resource tool. Therefore, a technological component was included. We hired a Native Maine educator with technological and tribal cultural knowledge.

When we began to design the institute, we wanted to be sure that we provided enough latitude to the educators to enable them to pursue their own interests, but enough structure to enable participants to develop concrete ideas for inclusion in the curriculum. We chose baskets as a theme due to the importance of baskets and basket making to all of the four Maine tribes. Such a theme provided common areas of discussion in the development of a curriculum. However, we attempted to carefully articulate that the basket, itself, is not the curriculum. The importance of baskets to Wabanaki culture, the community impact of baskets, and the math and science required to make baskets was what was of critical importance.

Specifics of the Institute

There was a total of 13 people who attended the institute, among those who attended there were: Seven teachers who teach either at a native school or at a non-native school with significant native students. Of these seven teachers, four of them were native and two were non-native teaching at a native school and one was a high school non-native teacher who teaches a large number of native students. There were two teacherŽs aides, one was native and the other was a nonnative. They both work at a native school. There were three community members present and they represented different tribes. Two of these individuals work with the Higher Education Departments on the reservations and the third served as a cultural consultant to his tribe. Additionally, there was one native student, who had just graduated with his degree in Elementary Education.

The first day of the institute, Norbert Hill, Jr, (Oneida) former Executive Director of the American Indian Science and Engineering Society provided the initial group building activities and conceptualized the importance of integrating science and math with the traditional and contemporary Native communities.. He introduced issues pertaining to Native education and asked participants to explore the impact of race on education. This was an activity that had a few feeling a little uncomfortable. The day ended with a discussion of what actually constitutes culturally appropriate curriculum.

The second day of the institute, we began to focus on specific curriculum materials using baskets as our model. Gail Sockabasin (Passamaquoddy) presented the community context of basket making. Fred Tomah (Maliseet) presented specifics on making a basket and how math and science were fundamental to basket making.

The second afternoon was dedicated to curriculum ideas and curriculum location. The library staff assisted participants in locating curriculum and ideas of integrating culture into their own curriculum. Presentations were made regarding how to evaluate curriculum materials for authenticity, accuracy, and educational value. Participants broke in groups brainstorming ideas that to use in the classroom. The groups then presented their ideas to the whole group.

The third morning was dedicated to the actual implementation of Native culture with math and science. Irene Attean (Penobscot) introduced how beading could be used in teaching math. She gave some specific classroom ideas that could be used. Some examples were; development of a bilingual counting book for lower grades, investigating mathematical concepts of the Aztec Calendar, and loom work to teach geometry.

The afternoon session required participants to break into groups to begin to develop specific lesson plans to be used in the classroom and were shared with the whole group. The final presentation was by Ed Bassett (Passamaquoddy), who shared with us, his CD that he made to teach the Passamaquoddy Language. The participants further discussed how to use the computer in the classroom culturally. The final activity of the day pertained to the Maine Learning Results and allowing participants to utilize culturally appropriate curriculum to meet the assessment tasks. On the final day, Laura Massey, Ph.D. (Penobscot) Associate Professor of Education presented programs in place that connect math, science, and culture. She presented pedagogical strategies that are effective with Native students. The institution ended with a commitment from the participants to continue the process begun during the institute.

Evaluation:

We are still in the process of analyzing the data from surveys presented to participants. Overall opinions of the participants were uniform in that the beginning portion of the institute seemed to lack clear goals and objectives. However, by the end, participants felt very positive for the majority that they found it very productive and received a large amount of useful information from the institute overall. Participants were very anxious to try out new ideas from the institute in their classes and stressed their desire to continue the process the institute had begun.

Significance of the Project:

In order to understand why this program is noteworthy, it is important to understand the history of Maine, the Wabanaki people, and the interactions of both. While there were many models we were able to choose from throughout the nation, we see the significance of this program in Maine. It is not so much the uniqueness of our project when viewed from a national perspective, it is innovative within this state.

The history of Native people in Maine is somewhat unique and to add context to the project, and it must be briefly explored. Obviously, European contact was early, beginning in the 16th century. The French were the predominant first Europeans to explore Maine. Due to this influence, the French Catholic Church sent missionaries early to the area. Their influence on the Native people was profound. Given the epidemics in 1616, the destruction of forests with hunting decreased, the significant fur trade and other factors brought about by European contact, many tribal members converted to Christianity.

Because Maine was initially a part of Massachusetts, it was seen as one of the 13 original colonies. Through this event, the tribes fell under the jurisdiction of the state. When Maine became a separate state in 1820, it assumed responsibility for addressing American Indian issues. The State treated the Native people with paternalism and the legislature assumed authority to make whatever decisions it deemed necessary. Due to the stateŽs perceived role in Indian affairs, Native parents were often not an integral part of their studentsŽ education.

The connection between the Catholic Church and the tribes had a long history and, therefore, the church continued its role in education of Indian youth. Still, today, the Sisters of Mercy have a few remaining nuns teaching in reservation schools. The Sisters of Mercy had staffed reservation schools for more than 100 years. Throughout the history of Maine Indian education, the teachers were predominately Catholic sisters with lay teachers hired by the State when there were shortages.

In 1966, Maine became the first state to have a Department of Indian Affairs. State Board of Education acted as the local school board and the Commissioner of Education served as a local school superintendent. This further took the education of Native youth to a more centralized, yet more remote, location. Additionally, Maine was the last state in the country to enfranchise its Indian citizens in 1967.

The history described above does not include two tribes of Maine. An additional considerations were the Maliseet and Micmac bands living in Aroostook County. These Indians did not have reservations and were often under-served or completely unserved. Viewed as non-reservation Indians, they were forced to basically fend for themselves in the White society which looked down upon them. In 1969, the two bands formed the Association of Aroostook Indians to assist their members in receiving services. However, still today these two tribes have no reservation schools and are in attendance in various schools throughout that county. In 1973, these two tribes were recognized by the State of Maine.

When the Land Claims Settlement was settled, the Penobscot and Passamaquoddy tribes became federally recognized. With the recognition came the services of the federal government. It was only after this occurred in 1980 that Indian tribes in Maine were able to establish schools funded through the Bureau of Indian Education. Soon after, Maine Indian Education was established for the three reservations (Penobscot, Pleasant Point Passamaquoddy, and Indian Township Passamaquoddy).

From a historical perspective, Maine Indians have experienced a history far different from many other tribes nationwide. This history impacts on how educational policy has been developed. The many administrative changes within the recent past have kept the small tribes of Maine focused on the administration of the schools and how to continue to enable them to run. It is now that individuals are able to focus on what is being taught in sufficient detail to make such a program successful.

An additional consideration in developing the kind of project we envisioned, is the lack of resources available regarding the Wabanaki tribes. Because there is not a wealth of information readily available that addresses the history and culture of Maine Indians, the development of curriculum materials requires extensive research. Such a lack of information makes the development of culturally relevant and appropriate curriculum a difficult and time-consuming task

This project is also unique in that the university initiated the project in consultation with the tribes. We encouraged community members to participate because part of our goal is to strengthen community and K-12 school relationships. While this was begun on a small scale, we hope to expand on this concept in the future. We hope to further develop the scholarship about the Wabanaki people, culture, and history through the process of curriculum development. The link between this project, the newly formed Native American Studies at the University of Maine, the K-12 schools serving all Maine Natives, and the communities offers a promising beginning for the future education of Wabanaki youth.

Research on American IndiansŽ Learning Methods Approaches to Learning

Because the concept of learning styles and the relationship to American Indian students has been an issue of interest and concern to educators for the past two decades, the project will also focus on this aspect. Much of the interest stems from the concern regarding Native students' academic performance, due to the fact that these students comprise a disproportionately large portion of student dropouts. Some educators maintain that the current use of the term "learning styles" is only a polite way to replace the "deficiency" rhetoric of the 1960's, but the intent is the same (Kleinfeld & Nelson, 1991). In other words, some believe the term "learning styles" is merely a tactful way to say Native students come from deprived homes and therefore, are probably unable to succeed academically.

In the mid 1970s and early 1980s, research began to explore hemispheric specialization of learning and the possibility that diverse groups may process information using predominately one or the other hemisphere's cognitive approach to learning. Additionally, this research examined the possibility that certain academic tasks seemed to be more effectively processed in a certain hemisphere. Resultant from this research was the hypothesis that the reason so many students of color were failing academically was due to the mismatch between their hemispheric strengths and the academic requirements.

In regard to Native American students, this meant that because they tended to be predominately "right brain" learners and the majority of academic tasks were "left brain" specific, a reason for their failure was associated with this lack of congruence. This lead to an interest among American Indian educators regarding the preferred pedagogy for teaching Native students so that they could succeed in school (Ross, 1982).

This line of research encountered a great deal of controversy. If the academic tasks required in mainstream American schools did not match the hemispheric strength of this race of students, did that mean that American Indian students could not learn? Using that frame of reference, if American Indian students were, in essence, "hardwired" for right hemispheric tasks and the schools required left hemispheric tasks, then Native students would be incapable of ever succeeding in traditional educational environments.

Inherent within the controversy is the differential in the definition of learning styles. The term learning styles has been described in many different and varied ways, especially as applied to American Indians, it has been "used to refer to an ill-defined assortment of abilities and modes of processing information: spatial abilities, right-brain hemispheric dominance, visual memory, field dependence, holistic or successive rather than sequential patterns of information processing, preference for visual sensory modality, and so forth" (Kleinfeld & Nelson, 1991, p. 274).

To avoid feeding into the controversy with the terminology, in the context of this project, the concept of learning approaches will be discussed. Learning approaches in this background refer to the way Native students confront a learning task. This approach is based upon culturally developed constructed behaviors. These actions are based on the lived experiences of tribal people. Inherent within this socially constructed behavior are the critical beliefs and values that many Native American students bring to the educational setting.

While all humans have similar needs, the means to meet these needs are cultivated through one's culture. Pipes and her colleagues indicated that "The approach that an individual takes to learning and the demonstration of learning is, however, culturally determined. Additionally, early socialization experiences influence the ways in which children learn prior to entering school" (Pipes, Westby, & Inglebret, 1993, p. 156).

In general, American Indians tend to approach a new task from the perspective of first listening and watching before acting. Competence precedes production. A study conducted by Sawyer and Rodriguez (1992) indicated respondents had "an overwhelming preference for some variation of a 'watch then do' approach" when learning a new task or skill (p. 292). The Native learner needs to carefully, quietly and individually watch the skill or process to be learned before feeling comfortable to perform.

The thought process for many Native people is circular and holistic. Therefore, the whole is considered to b more important than the parts. While the parts can be studied, it is better if they are considered only in relation to the whole. For many American Indian students it is only through holistic thinking that sense can be made of the idea or concept. Further research demonstrates that through sense making, the Native American child can better problem solve (Hankes, 1995). Examination has shown that when Native students engage in simultaneous processing and global processing they are much more successful in learning and retention.

Much of the research confirms that many Native students have strengths in visual spatial processing. Therefore, students can code information better by using imagery on both verbal and visual material. Many Native students appear to be relatively weaker in sequential processing, verbal coding and verbal understanding (Kleinfled & Nelson, 1991; Pipes, et.al., 1993).

Often these least preferred modes of learning are the predominant method of instruction in many mainstream schools. Research documents that instruction in schools is mismatched with Native learning strengths.

Curriculum

Pedagogy and content cannot be separated. Therefore, while it is insufficient for teachers to adjust only the curriculum to be culturally responsive, it is a critical area of concern for teachers. Culturally relevant curriculum can be an area of confusion. However, today there are excellent curriculums developed and available.

Traditionally, curricular materials were tied to real-life problems. The lessons were student generated so students often chose their own curriculum based on what was important to them (Hankes, 1995). Many American Indian students today continue to find a need for curricular materials to be relevant and meaningful in the context of their lives. Historically, Native children have often found no relevance or an accurate portrayal of themselves in the traditional classroom.

If students do not see themselves in the curriculum materials, they feel as if they don't exist, are not important and/or don't matter to other people. Such a feeling of a lack of significance or existence can lead a student to lower their sense of self-worth. Therefore, it is recommended that teachers use culturally appropriate curricular materials to assist students in developing positive self-esteem (Sawyer and Rodriguez, 1992).

The National Indian Brotherhood summed up the importance of culture on identity in this way, "Unless a child learns about the forces which shape him; the history of his people, their values and customs, their language, he will never really know himself of his potential as a human being." (As quoted in Haig-Brown, 1988, pg. 132).

Responsive teachers will find ways to make sure the child finds people like him/herself with similar experiences in the curriculum. If a child is to be accepted and viewed as important, their experiences must be a part of what the child reads and sees. A child cannot be expected to succeed if he/she never sees role models in their lives or in their books. Teachers must assist their students to feel they are an integral part of the classroom, the curriculum and the school. (Reyhner and Garcia, 1989).

Inclusion of American Indians and their culture in the curriculum is a necessary step in helping Native students to increase performance and to see themselves as an integral part of the school. However, caution must be used when one is attempting to select curriculum for Native Americans. It is critical that teachers not perpetuate the stereotypes Natives Indians. Often educators are tempted to discuss American Indians in the past, as if they disappeared after the 1860s. While history is a critical component of any well thought out curriculum, it is crucial that teachers help American Indians and non-Natives realize that Native Americans are still here and are contributing members of society.

Culturally appropriate curriculum must become an integral part of the core curriculum. It must focus on life processes rather than on products and must strike a balance between historical and contemporary information. Social relationships and value systems are more appropriate reflections of culture than physical artifacts. It is more valuable for students to concentrate on real life issues than it is for them to examine artifacts in a museum. Students should be exposed to realistic contemporary and often controversial issues. Culturally pertinent curriculum should be evaluated continuously by students, teachers and communities and modified when necessary. It is high in quality when it is authentic, relevant, compatible, complete and neutral in content (Butterfield, 1984). Materials need to be authenticated and reauthenticated with the Indian community. While the curricular ideas presented above regarding American Indians focused primarily upon the social science areas, it is important that other content areas should also receive emphasis. It is perhaps easier to find a place in social science to explore cultural issues. However, it is the complexity and challenge of integrating the diversity throughout the curriculum that demands educators attention.

In order for culturally appropriate curriculum to be effective, it must be infused throughout all subject areas. If the student is to develop a true appreciation of the diversity and importance of American Indian cultures, the school must present the contributions as valid in an interdisciplinary manner (Banks, 1987). It is within the context of an ethnic studies model that Garcia (1984) stresses the importance of teaching across disciplines.

In science, it is possible to look at alternative theories to the creation of the earth, to study the biological concept of race, to look at famous people of color who have contributed to the scientific arena, or to study folk (traditional) medicines to find their botanical implications. However, for many American Indian students, conventional science can pose a problem. Because many traditional Native students learn that one must co-exist with nature, not master it, some science experiments run counter to their belief system. "Belief in the supernatural, mythology, and nonscientific explanations of natural phenomena continues" (Little Soldier, 1992a, page 147). Therefore the teacher must use culturally appropriate judgment when designing experiments for Native students. Matthews and Smith (1994) reported that using science curriculum that was culturally relevant to American Indians increased their achievement levels significantly and their attitude toward science was increased profoundly.

Perceptions and attitudes about science need to be changed. Many Native students perceive science, with its analytical nature and reductionistic approach, can be only relevant in the dominant culture. Teachers can assist students to see that traditional American Indians used science all the time. It would be beneficial to compare traditional explanation of things with "scientific" explanations and verify that each is valide scientific thinking. Often science is seen as too compartmental and students have difficulty seeing the overview or big picture. Teachers need to help students see data as sequential using hands on or manipulatives. They also need to clearly demonstrate interconnections (Butterfield, 1994; Greer, 1992).

Concepts of time and space are often different for different cultures, the study of the varying theories could help students to comprehend differences in a mathematical model. The calculations of the seasons of the year and the calculations of star placement and travel could demonstrate to students the great intelligence individuals had without the use of written material.

Attitudes regarding math must also be changed. Native students need to see that there is relevance in math using real world problems, preferably dealing with Native American culturally relevant concepts and traditions. However, content is not enough. Teachers need to help American Indian students deal with math anxiety and improve their attitudes toward math. One very effective strategy to help students decrease math anxiety is to rid the classroom of the remedial math concept. Instead, allow students to work together and the stronger students will work with the less talented to learn math in a cooperative setting (Anderson and Stein, 1992; Garcia, 1984; Hadfeel, Martin, Wooden 1992).

When considering reading curriculum, it is important to select materials that depict the Native student's home and background. Basal readers rarely reflect the various cultures. Therefore, it may be necessary for the teacher to find or develop appropriate reading materials that bridge home and school (Reyhner and Garcia, 1989).

Whole language has been suggested as a culturally relevant means of instruction. According to Kasten (1992), whole language principles are in complete alliance with Native cultural beliefs. Whole language classrooms function in a communal fashion, in an oral tradition using stories. Whole language is holistic, it teaches the whole and then students learn the parts. The instruction is far less teacher directed and, in fact, is usually student initiated (Kasten, 1992; Sawyer and Rodriguez, 1992). This method of instruction shows definite promise for Native American students.

Communication Style

American Indian tribes had a rich oral tradition which served successfully to pass on necessary information to individuals through stories. Because American Indians often regard time, space and motion differently than do non-Natives, their writings and oral presentations may seem to be disorganized, wandering and not goal-directed. Understanding that for many Native people the world, time, space and motion are all circular and reciprocal and not linear helps educators to understand that stories and writings may not follow the linear thinking so prized in academia. It is critical that educators not judge this difference as deficient. Getting to the point is not a particularly prized value in many Native American communities (Brown, 1982; Pipes, et. al, 1993).

Traditionally, Native individuals who need to ask for something often do so in a very indirect ambiguous manner. It is viewed as inappropriate behavior to come out and just ask for something one desires. Part of the rationale for this approach is to save face, both for the one making the request and the one to whom the request is made. If the ambiguous request is ignored, neither party needs to feel embarrassed for either asking or for refusing the request. Therefore, social harmony can better be preserved.

The discomfort many non-Natives feel toward silence is not necessarily shared by many American Indian people. In fact, silence is seen as a virtue and an expectation. Talking constantly is seen as odd and somewhat inappropriate. If one has nothing to say, one should be quiet. If a question appears to be sufficiently answered by another, many Native students find no need to add their input. This tendency can affect American Indian students in the classroom when active participation is required (Pipes, et.al., 1993).

American Indian students often feel embarrassed by calling attention to themselves in class. Traditionally, one is taught that such notice tends to break from group cohesiveness and is therefore inappropriate. It is important for educators to be aware of this value since often teachers use individual public praise to reinforce suitable behavior. For many Native students this public praise would be very embarrassing and therefore not a reward at all!

Additionally, if another student gives the "wrong" answer to the teacher's question, it would not be seemly to answer correctly. If there appears to be only one right answer, often American Indian students will not respond to the teacher's question. They often feel they may not know the absolutely correct answer the teacher has in mind and they cannot risk answering incorrectly. If the individual is wrong, this person will feel very embarrassed and jeopardize their honor. If they are correct in answering they may stand out (Little Soldier, 1992b).

Another area of confusion is in the area of eye contact. Most educators have become familiar with the notion that for some tribes, direct eye contact is inappropriate and a sign of disrespect. This lack of direct eye contact is often misconstrued by educators to mean the student is not paying attention. However, it is critical such judgement be avoided. While it is true that eye contact is different for American Indians, it is not absent. For many Native people, the amount and intensity of eye contact is much less than that used in mainstream culture. As Pipes, et. al, (1993) state, "It is important to note that Native Americans do not demonstrate an absence of eye contact. Rather their culture may reinforce a different schedule and patterning of eye contact" (page 155).

One last area of consideration when dealing with American Indian students and their communication style is the need to be traditionally polite. In this instance for many tribes, if an individual is offered anything from another it is rude to not accept. Therefore if an individual is offered food and he/she is not hungry, it is considered rude to not accept the food and eat it. Rejection of another's gift is inappropriate (Ackley, personal communication, August, 1995). It is often the custom when asking for something from a traditional Native person, even information, it is appropriate to give tobacco to the individual when one asks. It is a sign of respect for the individual and the individual's culture.

Cooperative grouping techniques have been shown to be especially effective with American Indian students. Because they traditionally have been taught the need to work together, such a strategy is a natural means of helping students develop skills and share expertise without appearing stupid or boastful. In the American Indian tradition, students who are academically proficient in one area will assist those who aren't. It is understood each child has his or her own gifts and strengths given by the Creator. At some point, the skills of the less proficient student in one setting will be needed in another setting (Hankes, 1995).

Time Orientation

The time orientation for many American Indian students, is very different than mainstream culture. For many Natives, the focus is on the present. Therefore students will often not be terribly concerned about the future.

Another aspect of time is the idea of "Indian time". When one attends an Indian function, such as a pow-wow, it is rare indeed if it begins exactly when it is scheduled to start. Indian time lacks exactness of mainstream American societal standards.

For many American Indians, it is considered very impolite to leave an individual one is talking with only so that the individual may remain on schedule . Therefore, it is not uncommon for Native Americans to not be on time for a meeting or school.

Indian time can be considered problematic in the mainstream world of hurry, haste and future orientation. To assist American Indian students who may not share the long term goals or future orientation that many non-Native people have, the teacher can assist students by clearly breaking down assignments into manageable bits, setting deadlines and explaining the rationale for students to do and learn this approach to learning. Due to the lack of focus on future expectations many Native American students lack, it would be helpful to many Native students if teachers set short-term goals."Instruction based on specific, short-term objectives using appropriate reinforcers that closely follow desired behavior changes is more likely to be effective" (Little Soldier, 1992a, page. 147).

Since far reaching goals may seem too far away to matter and if the reward for accomplishment is not immediate, many American Indians may feel they will never actually receive the reward at all . Teachers can assist Native American students in learning new ways to approach deadlines. They can discuss with student that the tendency to be too present thinking, while such an approach is important and admirable in their home communities, it may be maladaptive in educational settings at times.

In traditionally Native education, instruction was time-generous. The lessons were learned when they were learned, not according to some schedule or some clock. Teachers need to allow flexible time periods, especially with complex, difficult and/or critical skills and concepts to assist Native American children feel there is time for them to learn. Because there is time, the material must be important and because it is important, there must be adequate time (Little Soldier, 1992a; Hankes, 1995).

Conclusion

Utilizing the history, the research on American Indian learning styles, and the interest of the people involved in the project can assist this project to be successful. However, the main intent of the project is to provide systemic changes in the way education is viewed. In particular, we hope to have Native students well prepared to be successful in their academic endeavors, especially math and science. We believe our attempts will be successful based on the strong beginning foundation.

American Indian Science & Technology Education Consortium (AISTEC)

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Welcome Statement:

Thank you for attending our presentation. We hope that within the limited time, we will be able to articulate our mission, and highlight the accomplishments of the AISTEC project and describe how it relates to the theme of this Conference: "Strengthening Partnerships Between Tribal and Non-Indian Institutions".

History:

Six years ago NASA sponsored a gathering in Santa Fe, NM and invited 10 universities and colleges to attend. NASA posed a challenge to the attendees to develop an initiative that would ultimately produce a work force from the American Indian community that would be qualified to be hired as scientists, technologists and engineers by NASA. Several meetings later, we produced a proposal to NASA, which created AISTEC. AISTEC thus began on the heels of executive order 13021 which elevated the status of Tribal Colleges to that of Historically Black Colleges and Universities and Hispanic Serving Institutions.

Mission:

The mission of AISTEC therefore, is to develop and nurture American Indian students for careers in Science, Engineering and Mathematics, with a focus on the primary role of the Tribal Colleges.

AISTEC consists of 10 Universities and Colleges:

Arizona State University, Diné College, D-Q University, Haskell Indian Nations University, New Mexico Highlands University, Oklahoma State University, Salish Kootenai College, South Dakota School of Mines & Technology, University of New Mexico and the University of Washington.

You will note that the 10 institutions range from large universities to tribal colleges. Also included in this range are four, 4-year institutions. AISTEC is NASA's premier tribal college serving consortium for science, engineering, and math (SEM) development.

We have five PH.D granting institutions:

Arizona State University, Oklahoma State University, South Dakota School of Mines & Technology, University of New Mexico, and the University of Washington.

Currently these institutions are engaged in a recruiting effort to identify and recruit American Indian student who express an interest in SEMT. These institutions also offer tutoring & counseling programs for those American Indian students on a science career path. We are also in the process of developing MOU's and articulation agreements with the AISTEC Tribal Colleges and HINU, which will align SEM curriculum and serve as a model for other tribal colleges.

Four-year institutions:

Haskell Indian Nations University, New Mexico Highlands University, Salish Kootenai College, and South Dakota School of Mines & Technology are engaged in a variety of activities aimed at pre-college students, developing distance learning courses, and the AISTECNet, and basic math skills.

The consortium includes 4 American Indian colleges 2 of which I already mentioned. The other two are Diné College formerly known as Navajo Community College and D-Q University, which is located in Northern California. At SKC & DQU, we are developing curricular infrastructure and providing tutoring anc counseling to AI/AN.

Diné College offers a summer program in developing science skills for 7th and 8th graders in a Navajo context and a summer bridge program in science for students transcending from high school to tribal college.

Project Goals:

1. To assist AISTEC tribal colleges to develop curricular and technological infrastructure
2. To develop SEM articulation agreements between and among AISTEC tribal colleges, 4-year AISTEC universities and their affiliated tribal colleges.
3. To develop and implement transition and SEM skills development programs at pre-college, 2-year and university levels.

   These three goals have been consistent throughout 4 years of the project. In general we have been attempting to build a path for students leading to an eventual career in SMET. On this path we have concentrated on skill development, motivation, and an infrastructure which supports the traveler along the way. Our success to date has led us to add two additional goals:

4. To strengthen the role of and emphasis on tribal colleges
5. To disseminate and replicate models successfully developed within individual AISTEC institutions

Goals 4 and 5 will serve to broaden our impact with a focus on the Tribal Colleges.

Year 4 project outcomes:

During this past year we have worked with Salish Kootenai College, D-Q University, and Cheyenne River Community College to increase SEM degree offerings from four to eight, a 100 percent increase.

We have developed and implemented five new SEM distant learning courses offered through five tribal colleges.

AISTEC recruited and developed two American Indian faculty members: a calculus instructor at Diné College and an engineering instructor at Southwest Indian Polytechnic Institution.

South Dakota School of Mines & Technology hosed a summit on engineering articulation attended by seven tribal colleges and seven engineering universities. Three MOU's have been signed and three are under development.

AISTEC institutions provided SEM enhancement to 339 American Indian students at the pre-college level, and tutoring and mentoring to 648 American Indian college students. More than half of these students completed SEM courses with a grade of B or better.

At Ft. Peck Reservations we have 18 classrooms in operation from kindergarten to the tribal college who are developing basic math skills. At the elementary level more than 50% of the students are performing at or above grade level as measured by the Comprehensive Tests of Basic Skills (CTBS).

AISTEC provided college entry and financial aid information to 679 American Indian students; fifty percent of who were high school seniors or transfer students. Over 100 of those college-ready students have matriculated into tribal colleges or tribal serving universities.

AISTEC initiated two technology transfer partnerships involving tribal entities, government agencies, and the corporate sector. One of these already is generating revenue.

AISTEC established a partnership with Microsoft to develop technological capabilities at tribal colleges.

Our recruitment effort has been one of the most successful of the components of the AISTEC effort. During Year 5 we have designed a recruitment effort that will have 4 times the impact. We will have full time recruiters at ASU, OSU, UNM, UW and SDSM&T. We will conduct a vigorous campaign to identify AI/AN students and show them the path that AISTEC has helped create for careers in SEMT.

AI/AN Graduates in SEM

Year	BS	MS	PhD
1987	N/A	N/A	30
1988	N/A	N/A	27
1989	585	119	34
1990	537	79	17
1991	579	97	34
1992	611	98	41
1993	680	118	21
1994	793	128	33
1995	896	122	38
1996	N/A	N/A	53

Source: NSF Division of Science Resources Studies Directorate for Social, Behavioral, and Economic Sciences

Year 5 and Beyond...

During this next year AISTEC will appoint an Advisory Committee consisting of 5 members: 3 from tribal colleges, 1 from an American Indian serving University, 1 from government/industry. This group will be charged with evaluating the goals to satisfy the needs of both NASA and the NA communities that AISTEC serves. Also, AISTEC will work with SKC to develop a mechanism to evaluate proposals for new projects from TC outside the current AISTEC membership. In subsequent years, this process will continue so that a continual flow of graduating old projects and incoming new projects will be established. Thus AISTEC will began to function as an incubator for TC projects, allowing TC to gain experience with the processes of proposing for and carrying out projects in a NASA context. Graduating projects should emerge ready to compete for awards such as NASA's PACE and MASTAP.

To assist in the long-term support of successful projects and to expand into additional areas, AISTEC is actively developing alternate sources of income:

1. AISTEC has reached an agreement with Microsoft Corporation for developing computer capabilities for tribal colleges: NWIC, SKC, and HINU.
2. We have successfully completed a transfer technology license agreement with the JSC for the development of an absorbent pillow for hazardous waste into a potential income-producing commercial product that will be manufactured by a tribal industry.
3. AISTEC completed software development on a JSC patent issued to a Native American firm. Revenues from these agreements (2 & 3) will be used to further AISTEC goals.
4. During the 1999 grant year, AISTEC will use its experience in technology transfer to assist tribal colleges and their communities in using technology transfer to generate sources of income.
5. AISTEC also has developed distributive computing software applied to basic mathematics. This technology will soon be utilized with AI/AN schools who have limited bandwidth capability on AISTECNet to help improve basic math skills.

Pre-College MSET Break-out Session I

Dr. Marino Alvarez
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Explorers of the Universe: Meaningful Learning Contexts

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Introduction

The primary goal of the Explorers of the Universe educational project is to involve middle and high school teachers and their students, and postsecondary students in a quality research program that is interdisciplinary rather than compartmentalized by domain. The focus is to engage students and their teachers in authentic tasks and materials couched in problem-oriented formats within meaningful learning contexts that foster thinking and learning. Authentic in that students construct meaning from real data and are asked to make sense of the world around them. Students pursue individual paths of inquiry using critical and imaginative thinking, and engage in social and solitary contexts that involve them in writing, intervening, and reflecting on ideas gleaned from conversations and readings (electronic and conventional). The process engages students in formal skills such as written communication, literacy, logic, and calculation.

The science and literacy skills needed to learn, make connections within and among disciplines, and communicate to others are vital to learners who are expected to achieve educational goals espoused by the academies (e.g., American Association for the Advancement of Science, 1989; International Reading Association, 1992; National Science and Technology Council, 1995; Science Council of Canada, 1984; Royal Society, 1985). So, too, are the specific ways in which these learners use language and instructional tools, and technology for literacy learning and applying scientific and mathematical concepts (NASA's Education Program, 1993).

To promote a quality education plan that meet scientific, mathematical, literacy, and technology standards, we provide challenging opportunities for both teachers and students to think and construct knowledge generated in meaningful contexts. Students "showing" what they can do is a goal of this educational plan. This goal differs from those educational programs that are aimed at convergent projects, student-directed on-task modules, fixed curriculums, vast numbers of participants, and restricted standardized measures of assessments. Instead, the educational objective is to involve students in meaningful learning activities using self-directed cases, metacognitive tools (e.g., hierarchical concept maps, and vee diagrams) to plan, carry-out, and finalize their research investigations, and an emergent educational curriculum plan that stimulates critical and imaginative thinking.

TSU/Explorers of the Universe and Related NASA Projects

The Explorers of the Universe Project (http://coe2.tsuniv.edu/explorers) is a scientific/literacy project that serves as the principal educational partner in several NASA projects. The project is directed toward the intrinsic value of activities in the classroom. These activities are intellectual and provide opportunities for learners to make-decisions while simultaneously making use of existing procedures and standards among disciplines that create opportunities to share knowledge and negotiate meaning. The principal investigator for the project is Dr. Marino C. Alvarez, Professor of Education.

The project is situated within the Center of Excellence in Information Systems, at Tennessee State University, with NASA Center for Automated Space Science (CASS), NASA Network Resources Training Site (NRTS) which is under the auspices of MU-SPIN, and NSF Center for Systems Science Research (CSSR). The Director of the Center of Excellence in Information Systems is Dr. Michael R. Busby.

The project has expanded to include six high schools, a middle school, and postsecondary students enrolled at TSU. The schools involved are: University School of Nashville, Hunters Lane High School, and Davidson Academy, Nashville, Tennessee; Thomas Jefferson High School for Science and Technology, Alexandria, Virginia; Wellington School, in Columbus, Ohio; George Washington High School Campus, New York City; and, Kodiak High School, in Kodiak Island, Alaska.

Funding for the Explorers of the Universe is provided by the NASA Tennessee Space Grant Consortium, and by NASA through NRTS. Three areas of related study are represented by this project: TSU Variable Stars Project; NASA Goddard Space Flight Center's Mars Orbital Laser Altimeter (MOLA), and their Vegetation Canopy Lidar (VCL) Mission scheduled for launch February 2000. Teachers and students participate in these research investigations. Schools, under the auspicious of NASA Minority University Space Interdisciplinary Network (MU-SPIN), are included in this project'seducational network. High school astronomy, physics, and earth/space teachers and their students are involved in receiving and analyzing data from automatic telescopes located at Washington Camp in the Patagonia Mountains in Arizona via the Internet, and from the MOLA Mission on Mars. Students are also involved in research studies with the VCL Mission. These student research investigations become longitudinal studies with subsequent students involved in pre-launch and post launch research activities in this mission.

Within the spirit of a multilateral international collaboration for these projects, students who represent a diversified multicultural population in the Explorers of the Universe Project benefit from shared knowledge and experience resulting from discussions and research evolving from these investigations. Teachers and students are involved with this educational mission working collaboratively on various aspects of solar and magnetic interpretations and resolving their cases using mathematical and scientific principles from which to reach multiple perspectives.

The building of a "community of thinkers," defined as an active group of students and teachers striving to learn more about a discipline by engaging in the processes of critical and imaginative thinking, will be the cornerstone of this educational outreach plan (Alvarez, 1995, 1996a 1997). We differentiate between thinking and learning. Thinking is a process that has some initial beginning, and moves to some conclusion or solution rather than increasing skill or perfecting the execution of the solutions (Russell (1956). It is during the learning process that thinking takes place, but learning is an intermediate phase rather than a final product. Thinking of ways to achieve learning outcomes are different from focusing on ways that learning outcomes can be achieved. The former is process oriented; the latter product-oriented (Alvarez, 1996a).

In an effort to increase learning efficiency, teachers and students in the Explorers of the Universe project focus on the processes of thinking: selecting, eliminating, searching, manipulating, and organizing information. Emphasis is placed on thinking as a process involving a sequence of ideas moving from some beginning thought, through a series of a pattern of relationships, to some goal or resolution. Within our community of thinkers, teachers and students ask questions, seek answers, and reflect on their thoughts and feelings as they engage in action research case-based investigations.

Educational Features

The educational plan has several unique aspects. The sun/earth/space science educational mission involves middle, secondary, and postsecondary students promoting science and literacy in ways that differ from conventionally funded science programs that guide students to prescribed product outcomes using prepackaged materials.

First, students who are enrolled in astronomy, physics, and earth science classes and their teachers are targeted to participate. Due to the nature of the philosophy that underlies this educational plan, it is necessary that the teachers selected are willing to learn more about their subject area and think along with their students.

Second, these student researchers are involved with incremental stages of phases of their cases. During each phase, students enter their notes, observations, findings, log notations, data analyses, and so forth onto a text file and publish their papers on the World Wide Web that serves as a resource for other students to access and share their thoughts. This collection becomes part of each student's computer-based working and report portfolios that are used as a tool for self-assessment and for mediating knowledge with the teacher and their peers. A *Case Guide CD* has been developed that describes, narrates, and shows animations of concept maps and vee diagrams, video clips of teachers and students discussing these metacogntive tools, an Action Research Strategy, a Notebook that allows students to correspond directly to our server via the World Wide Web by entering notations, and an illustrated framework from which students can formulate, carry-out, and report their research (see Alvarez, 1998a).

Third, students are actively engaged in self-directed, case-based research for which they are directly responsible. They research open-ended cases for which there are, in most instances, an absence of a prescribed set of "right" answers. These teachers and students use critical and imaginative thinking to solve authentic tasks that are set in problem-oriented formats.

Fourth, students use interactive learning environments to design and share their concept maps over the Internet (e.g., Inspiration 5.0), communicate with scientists via e-mail, and engage in interactive research and collaborative planning using the *Interactive Vee Diagram* on the World Wide Web (Alvarez, in press, 1998b, 1997).

Fifth, students publish their papers on the World Wide Web and receive feedback from "faceless" and "unknown" persons from throughout the world. This process not only enhances technology and literacy skills, but also develops a respect for interpreting and representing new knowledge (Alvarez, 1996b).

Sixth, students keep logs, correspond with astronomers and others via electronic mail, record observations and findings, make discerning judgments of papers accessed on the Internet, and incorporate related facts, concepts, and information from other content disciplines. During this process students are taught to use two metacognitive tools: concept maps and vee diagrams. These educational tools enable them to conceptualize and represent their ideas and plan their research. This collection becomes part of each student's computer-based working portfolio that is used as a tool for self-assessment and for mediating knowledge with the teacher and their peers. Students share their observations and findings among the participating schools and within their own school.

Seventh, students collaborate with other students affiliated with the project who share common research topics. They share information electronically via the Internet and World Wide Web and receive feedback.

Eighth, community resources (people and places) are an integral feature of this melding of the societal curriculum with the formal school curriculum.

Ninth, teachers and their students present at scientific, mathematical, literacy, and technology conferences so their voices can be heard about their research endeavors (e.g., Alvarez et. al., 1998).

Tenth, teachers develop manuals that will aid other teachers and their students to record, analyze, and report the data received from the missions. Students field-test these manuals and provide input. The manuals are placed on the World Wide Web for public access. (This was done with the Explorers of the Universe Variable Star Project whereby teachers (Rodriguez & Hennig, 1997) wrote a manual after learning about data computations and had their students field-test the entries.)

Interfacing Educational Programs

Students interface their case research with others who are affiliated with similar scientific projects in the Explorers of the Universe NASA sponsored educational programs. Although several aspects of the Mars Orbital Laser Altimeter (Stockman, Alvarez, & Albert, 1998) lends itself to related areas of study, the Variable Star Project and the Vegetation Canopy Lidar (VCL) Mission seem to be more with each others mission goals and objectives; and therefore, offer multiple pathways for interfacing student research investigations.

Public Outreach

Another unique aspect of this project is the melding of the societal and formal school curriculums. The societal curriculum is evidenced in not only what students bring to the classroom from their home, community, and religious environments, but also by involving the public in meaningful ways. Community resources (people and places), locally, nationally, and internationally become an integral part of the educational process. Throughout their case research, students are in contact with persons, state and federal agencies, archives, libraries, colleges/universities either directly or through electronic communications. Students conduct interviews with persons having pertinent information to their case study.

Students publish their papers on the WWW. Teachers, students, and university educators co-author articles for publication in science, literacy, and technology journals. Students develop CD ROMs of their research studies. Teachers write manuals about technical, mathematical, and scientific aspects of the mission for other teachers and their students to use as a springboard for other research. Teachers and their students present at science, mathematics, literacy, and technology conferences. Information gathered and researched about Solar B's Mission is displayed on web sites of participating schools, NASA Centers, and the TSU Center of Excellence in Information Systems - Explorers of the Universe Project.

NASA/NRTS is housed in TSU's Center of Excellence in Information Systems. The NRTS Project Director is Dr. Willard Smith. NRTS is charged with networking and connecting schools having under represented student populations to the WWW. NRTS has an added role of developing and conveying distance learning programs. TSU's Center of Excellence is responsible for this distance learning project and plans to promote these NASA science initiative nationally. Distance learning, via WWW, offers extended opportunities to enjoin school populations and persons in disperse communities and provide forums for them to become participants in this research.

References

1. Alvarez, M.C. (1998a). *Explorers of the Universe Case Guide CD-ROM.* Center of Excellence in Information Systems. Nashville, TN: Tennessee State University.
2. Alvarez, M.C. (1998b). Interactive vee diagrams as a metacognitive tool for learning. In S. McNeil, J.D. Price, S. Boger-Mehall, B. Robin, & J.Willis (Eds.), *Technology and Teacher Education Annual, 1998, Vol 2. (pp. 1245-1248).* Proceedings of SITE 98. 9th International Conference of the Society for Information Technology and Teacher Education (SITE), Charlottesville,VA: Association for the Advancement of Computing in Education (AACE).
3. Alvarez, M.C (1997). Thinking and learning with technology: Helping students construct meaning. National Association of Secondary School Principals. *NASSP Bulletin*, 81, 592, 66-72.
4. Alvarez, M.C. (June 1997). *Thinking about learning*. In R. Abrams (Ed.), From Misconceptions to Constructed Understanding. The Fourth International Seminar on Misconceptions Research, Cornell University, Ithaca, New York. Santa Cruz, CA: The Meaningful Learning Research Group.
5. Alvarez, M.C. (1997). Communities of thinkers: Investigating interactive scientific literacy environments. In J. Willis, J.D. Price, S. McNeil, B Robin, & D.A. Willis (Eds.), *Technology and Teacher Education Annual, 1997* (pp. 1236-1239). Proceedings of SITE 97. Eighth International Conference of the Society for Information Technology and Teacher Education (SITE), Charlottesville, VA: Association for the Advancement of Computing in Education (AACE).
6. Alvarez, M.C. (1996a). A Community of Thinkers: Literacy environments with interactive technology. In K. Camperell & B.L. Hayes (Eds.),*Literacy: The information highway to success* (pp. 17-29). Sixteenth Yearbook of the American Reading Forum. Logan, UT: Utah State University.
7. Alvarez, M.C. (1996b). Explorers of the Universe - Students using the world wide web to improve their reading and writing. In B. Neate (Ed.), *Literacy saves lives* (pp. 140-145). Winchester, England: United Kingdom Reading Association.
8. Alvarez, M.C. (1995). Explorers of the Universe: An action research scientific literacy project. In K. Camperell, B.L. Hayes, & R. Telfer (Eds.), *Linking literacy: Past, present, and future* (pp. 55-62). American Reading Forum, vol. 15.
9. Alvarez. M.C., Busby, M.R., Sotoohi, G., Rodriguez, W.J., Hennig, L.A., Berenty, J., King, T., Grener, D., & Kruzan, J. (1998). Explorers of the Universe. In T.L. Coleman, B. White, S. Goodman, P. Sakimoto, L. Randolph, & D. Rickman (Eds.), *NASA Research Center Technical Advances in Aeronautic Space Sciences, Global Hydrology, and Education (pp. 468-473).* Albuquerque, NM: TSI Press.
10. Alvarez, M.C., & Rodriguez, W.J. (1995). Explorers of the Universe: A Pilot study. In W.M. Linek & E.G. Sturtevant (Eds.), *Generations of Literacy* (pp. 221-236). The Seventeenth Yearbook of the College Reading Association.
11. American Association for the Advance of Science. (1989). Science for all Americans. Washington, D.C.: Author.
12. International Reading Association. (1992). Standards for reading professionals. Newark, Delaware.
13. National Aeronautics and Space Adminstration. (1993). *NASA's Education Program.* Washington, D.C.: Office of Human Resources and Education. Education Division.
14. National Science and Technology Council. (1995). *A strategic planning document for meeting the 21st century.* Committee on Education and Training. Washington, D.C.: U.S. Department of Education
15. Rodriguez, W.J., & Hennig, L.A. *Finding periods in variable star data. Technical Manual 101-97.* Center of Excellence in Information Systems. Nashville, TN: Tennessee State University.
16. Royal Society. (1985). The public understanding of science. London: Author.
17. Russell, D.H. (1956). *Children's thinking.* Waltham, MA: Blaisdell Publishing Company.
18. Science Council of Canada. (1984). Science for every student: Educating Canadians for tomorrow's world. (Report No. 36). Ottawa: Author.
19. Stockman, S.A., Alvarez, M.C., & Albert, Jr., T.J. (1998). Bringing Mars exploration into the K-12

classroom: The Mars Orbiter Laser Altimeter Education Program. *Proceedings of the 29th Lunar and Planetary Science Conference*. Houston, Texas.

Networking Break-out Session I

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The American Indian Network Information Center (AINIC) started out in 1997 and is a three-year grant program, funded by the National Aeronautics Space Administration (NASA). AINIC is based at DinÈ College, formerly known as Navajo Community College, in Tsaile, Arizona on the Navajo Reservation.

AINIC was created to bring Internet Resources to K-12 schools on the Navajo Nation. Many of the schools on the Navajo Reservation lack funds to keep their libraries and textbooks updated and having access to the internet would bring neverending resources to these schools. The AINIC program is helping schools that have access to the Internet or are planning to get connected very soon to learn how to use Internet resources effectively and also to integrate the Internet into their school curricula.

Currently, AINIC is focusing on K-12 schools on the Navajo Reservation. We have eight participating teachers at this point. Our goal is to get twelve teachers by the end of the Fall 1998 semester. The AINIC program staff provides technical assistance on how to get connected to the World Wide Web. We also provide basic Internet training: how to search for on-line resources, where to get free e-mail and eventually how to upload your own web page.

At this point in time, our goals are to find a base of twelve teachers in the fields of Science, Math, Engineering & Technology. We are training these teachers to learn how integrate the Internet effectively as a learning tool in their classrooms. AINIC is providing Macintosh G3 computers for the base twelve teachers. We are also providing scanners and digital cameras for the schools to use. Other Incentives of the AINIC program that teachers and students receive are T-shirts, pencils and other school supplies when they completed the on-line curriculum.

These teachers in turn would train other teachers how to use the Internet and so on, thus creating a "Train-the-Trainers" model. The teachers objectives are to upload an on-line curriculum that they can use to teach their students lessons in Earth Science and eventually we will expand into other subjects.

We are also providing a Role Models Database composed of Native American professionals and college students in the fields of Science, Math, Engineering & Technology (SMET). These Role Models will contact the AINIC K-12 student participants through e-mail and on-line conference rooms in order to guide them and encourage them to continue school and to pursue careers in the SMET fields.

The AINIC staff has provided a web site that will serve as a one-stop resource for the AINIC teachers and students. The web site consists of NASA resource links, a web page developer, on-line conference rooms, Role Models Database, AINIC Teacher Directory and other resource links. The web site is located at ainic.ncc.cc.nm.us which will soon be moved to www.ainic.org.

Many goals have been set for the success of the American Indian Network Information Center. But if we can collaborate with other technology organizations, we can integrate the Internet into more schools, offering endless resources, and a better means of communication and collaboration among the community of teachers. The main objective of AINIC is to provide Native American youth the chance to see the world through the Internet and to learn to interact with technology in the classroom. This may already be happening in other schools in the U.S. but on the Navajo Reservation, this has never been done before and we have the chance to make it happen.

Distance Learning Break-out Session

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Exploiting Distant Learning as a Portal (Among Minority Institutions) to Emerging Technologies

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Abstract

Grambling State University (GSU), in retrospect, has had its share of the painful demise of other minority institutions - that of involuntary depravation of access to equal opportunities in select technological resources. The unfortunate result has been a progressively widening technological gap forged not along sheer aptitude, as would be expected, but rather predominantly along cultural contrivances. More unfortunate, perhaps, is the vast un-tapped repository of, rarely-exploited, talents and enduring persistence to be found in these camps.

Our present civilization is resting on the threshold of the portals of unfathomable technological breakthroughs and opportunities. Computer technology - especially networking and parallel distributed processing, for example, are spearheading the migration from our traditionally formal classroom pedagogies to more liberal alternatives to better embrace new or emerging technologies and the resulting prolific problem solving paradigms and capabilities that come with them. For once, even previously underprivileged institutions stand equal chances of leveraging their strengths and creativity in shaping the trends of these emerging technologies. GSU's experience with interactive telecasting (partly through the DoD's HPCMP/PET* initiative) is rich and replete with what is perceived to mirror the kind of productive partnership envisaged between tribal and non-Indian institutions for effective participation in the NASA Science and Technology initiatives of the future.

Introduction

One of the prominent benefits of the advent of telecommunication was the undoing of the geographical and ideological barriers that characterized the cultures of the world as we knew them then. Granted that those barriers, legally, do no longer exist but the disparate rate at which minorities were granted access to these technologies, beginning with the telephone, the television and, now, computer technology, has resulted in an undeniable technological gap which will continue to be an enigma to the latter group. This fact is supported by a recent study conducted by some University of Maryland scholars in which they noted the lingering long term hurt of a racial divide on minorities [1]. It is further supported by some recent, highly profiled, speeches or rhetoric by key government officials on the digital divide and its potential effects on minorities [2 - 4].

The Digital & Economic Divide

The studies and speeches alluded to above all attest to the fact that our capitalistic society, though promoting the notion of equal opportunities for all, is riddled over and over, in practice, with the dilemma of bridging the gaps resulting from previous malpractices of unfair depravation of access to basic amenities. The unfortunate evidence of this dilemma, even amid a prodigious economic and technological growth, is the involuntary widening rather than narrowing of the economic and technological gap with the affluent getting more affluent and the destitute getting even more so.

These could be said to be particularly exciting times. New or emerging technologies, especially in parallel and distributed computing, are redefining the landscape of the way we solve problems and, similarly, the process of formulation and introducing such technologies. Due to the exorbitant cost of pioneering new technologies only the technologically or economically privileged institutions will frequently be among the favored to receive the cream of the cash to research these emerging technologies. The under-privileged institutions are perceived, on the other hand, to be a real liability or big risk often not worth taking. From the perspective of a privileged institution it makes every sense to maintain a clear divide and distinction between the institutions.

A primary motivation for the digital divide, therefore, can be shown to be economic and thus the estrangement of the rhetoric already alluded to. A case in point is the recent White House initiative and funding for the collaborative research, specification and design of internet II - the next generation of the ubiquitous network of networks. Of the institutions selected for funding for this research, there is no minority or tribal institution. The actions of the government, therefore, are inconsistent with their rhetoric and there does not appear to be any real concerted effort to bridge the technological gap.

The one thing that could be worse than the foregoing, perhaps, is when a privileged institution, trying to make room for new state-of-the-art equipment, occasionally offloads its mundane equipment stock pile (in a typically well publicized act of charity) to an under-privileged institution. Admittedly the intention is frequently to bridge or narrow the technological gap between the former and the latter. In practice, however, such acts of charity do not narrow but rather further broaden the gap because the creative energies of the recipient(s) are now removed from more innovative pursuits to focus on often futile attempts to tinker with obsolete equipment that the donor(s) had probably, themselves, given up on.

A Winning Strategy for Tribal & Minority Institutions

To better prepare to embrace the new or emergent technologies new alliances are needed among minority and tribal institutions. Not necessarily with privileged institutions in which the former will always be considered a parasite but rather with any one with whom they can leverage mutual strengths. It is considered futile to re-invent the wheel but it is considered innovative to leverage the efforts of the inventor of the wheel to further advance the state of the technology. New sources of funding must be sought not as under-dogs to some other institution(s) but rather as mutual partners whose strategic accomplishments depend on the synergy resulting from the collective strengths of all involved. The emphasis must be on these strengths (what the one can contribute) rather than status (what one used to be).

The Virtual Classroom

The current technological proliferation has liberated our traditional classroom pedagogy from the practice of confinement and protectionism to a service-oriented one that knows little or no bounds. To achieve the mutual collaboration dictated by the new economies of scale of computing as well as the widely cherished distributed processing paradigm, distant learning promises to be a very effective and non-intimidating tool. Since the medium is completely voluntary, contributors are esteemed for the quality and usefulness of their contribution rather than status. Better still, there is no reason to be inhibited by a fear of losing one's privileged status. The privileged and under-privileged alike have a lot to contribute in this medium and thus can forge new alliances.

GSU's Experience

GSU has now been involved with the DoD's HPCMP/PET project for two and a half years. The goals of this project are: (a). To upgrade the present DoD's computing infrastructure located at various major shared resource centers, to support the warfighter, by an order of magnitude over the five year duration of the of the project. (b). Develop new problem solving techniques to exploit that computing power to command a decisive global supremacy. (c). To develop training programs to disseminate the new techniques and tools to all participants and users alike.

GSU, which would otherwise be estranged to the current emerging technologies, has instead benefited from a formal distant learning program thanks to the third goal above. Although this report does not cover the technical design and implementation of a distant learning production and delivery facility, ample references [5] to authoritative sources of such information exist. GSU's own distant learning production facility is quite primitive but effective for the scope of its designated goal.

A tool that might become very useful in the future for a broader scale distant learning effort is one developed at Syracuse university under the auspices of the PET program. Syracuse's distant learning package centers around a proprietary tool called Tango and has been widely tested at Jackson State University. The latter product, unfortunately, limits distant learning to a mere production and packaging of lectures to be viewed (off-line) using a number of media [6]. Effective learning, in our view, has always been interactive and nothing short of that will even begin to bridge any technological gaps between participants. Microsoft is also developing proprietary tools to make distant learning a common practice, hopefully, in the future [7].

Conclusion

In the wake of the advent of exciting emerging technologies previously under-privileged institutions must plan their strategies carefully in order to have a role in shaping the new technologies. Any viable strategy must leverage the formidable strengths, which have laid dormant and un-exploited in the past, of these institutions. New sources of funding must emphasize the free expression of such suppressed talents rather than foster the existing technological divide resulting from a skewed view of potential contributions to new technologies.

References

1. Bianca P. Floyd, " U. of Maryland Studies Racial Gap in Technology Access", The Chronicle of Higher Education, P. A19, Dec. 20, 1996.
2. Kennard, Speech, http://www.fcc.gov/speeches/kennard/spwek821.html and spwek824.html.
3. Gore, Speech, http://policy.com/go.asp?url=/docs/wh/gore061098.html
4. gov, http://www.ntia.doc.gov/ntiahome/net2/presentation/slide2.html
5. Tools and Resources for Distant Learning, http://www.sport.ussa.edu/distant/dlresour.htm. University

of Alberta's Guide to Distant Learning Resources, http://www.atl.ualberta.ca/

6. Fox Geoffrey, Colloquium on Distant Learning and Collaboration, DoD HPC User Group Conference, Rice Univ, June 1-5, 1998.
1. Anoop Gupta, Colloquium on Distant Learning and Collaboration, DoD HPC User Group Conference, Rice Univ, June 1-5, 1998.

Internet Break-out Session

Mr. James Holloway & Mr. Charlie Wrenn
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Designing Web Pages

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Greatest Challenge to Writing Web Documents:

Keep the user oriented; provide a coherent structure in which the relationship of each page to the rest of the document is clear. An important point to remember when writing web pages; just because you can do something with the Web doesn't mean that it's a good idea.

Types of Links:

Truly Hyper:

- **Every document is linked to every other document**
- **Can lead to circular navigation**
- **Frustrates the user**
- **Difficult to maintain**

Pure Linear Design:

- **Easy to follow**
- **Users are actually more likely to read the pages**
- **Boringgggggg!**
- **Best used for reference manuals, short stories, prose**
- **Easy to maintain**

Tree:

- Single page serves as jumping off point to other pages
- Easy to navigate - each page contains 3 links
- The concept is easily extended to other layers
- Easy to maintain

Your job:

Make sure that no matter where the user enters your document tree, she can always find her way back to the start.

Accomplish this by:

- Creating a structure that makes sense
- Placing textual and visual clues in your documents that make the structure obvious

Two categories of navigational aids are used:

1. Landmarks
2. A hyperspace compass

Landmarks:

- Welcome Page - top-level page of your site
- Home Page - entry point to a particular author's collection of documents
- Title Page - entry point to a multipage document
- Table of contents - set of links to a multipart document
- Index/Search Page - document text search and retrieval
- Comment Page - e-mail or other contact method

The Hyperspace Compass:

Six directions:

1. Forward

2. Back

3. Next

4. Previous

5. Up

6. Down

Forward and Back:

Refer to the series of pages that the user visits in the order in which they were visited. Note: Avoid creating links labeled *forward* and *back*.

Next and Previous:

Used to navigate a series of pages that are linked in a linear way (i.e., subsections of a manual).

Up and Down:

Up takes the reader up a level to the next higher level of organization. Down takes the reader down a level in the tree, i.e., from a table of contents to the start of a chapter. Note: *Top* is often used to take the reader all the way up to a main entry point such as a title page or welcome page.

Navigational bars are a useful tool for making navigation easy and obvious.

Pitfalls to avoid:

- Don't try to fight HTML's word-wrapping by adding
 tags, extra blank lines, or long series of hyphens or stars. What will look good on your browser will look terrible on someone else's.
- Overlapping tags, such as <STRONG> Hi <EM> Mom! </STRONG> </EM> will always break somebody's browser.
- Series of <P> tags with no text between them will produce different results on different browsers. Avoid them.

Optimizing Performance:

- **The most beautiful, best organized, most interesting Web page in the world is utterly worthless if it takes too long to download.**
- **Main principle for maximizing performance:** ***keep it small and simple.***
- **Keep graphics as small as possible. JPEG images tend to be smaller than GIF images; consider JPEG for thumbnails.**
- **Focus your attention on reducing the size of the most frequently accessed documents.**

Reference

- ***How to Set Up and Maintain a World Wide Web Site,*** **Lincoln D. Stein, ISBN 0-201-63389-2**

Pre-College MSET Break-out Session II

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Criteria for Successful Internet Projects

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Introduction

Ten years ago the School of Education of the City College of New York developed the idea for an electronic mail network know as the Global Education Telecommunications Network (GETN) Project that would link 10 primary and secondary schools in New York with the counterparts in London. Today, GETN links more than 60 schools in New York with schools in more than 30 countries around the globe. The network is centered around inquiry-based projects developed by teachers who are introduced to one another through the Internet. Teachers are not provided with pre-designed projects that they complete with their classes. Instead, they negotiate with one another and identify ideas for projects that will best meet the needs of their students and fulfill their responsibilities to their curriculum

As the project developed, I have come to realize its potential for improving teaching and learning in the New York City Public Schools. Giving teachers the opportunity to design their own activities spawns enormous creativity and has led to the creation of many innovative and exciting projects. These projects, in turn, help to transform often dull and lifeless classrooms into places where children are actively engaged in authentic work that they own and could share with their partners abroad. While individual project are important for GETN's success, even more important is what teachers are learning as a result of participating in the project and in the graduate courses that support the network. We developed our own education rationale for E-mail projects that has become embodied in a set of criteria for the design of GETN projects. Examples of some of the GETN projects include:

- The Fast Plant Project
- International Cookbooks
- Weather Comparison

City College not only created GETN. It continues to provide ongoing support so important in sustaining GETN's network and helping it to grow. Support is provided in a variety of ways including courses for participating teachers, on-site technical training, online mentoring and monitoring of projects, recruiting new participants and sponsoring annual Internet conferences.

Findings From Early Experiences

Several issues must be addressed if Internet projects are to be successful. In my 10 years experience with the Internet projects, I found teacher training to be of primary importance. Projects should succeed if teachers are comfortable with both the technical and curriculum aspects of the program. Teacher-training programs should include courses that will prepare teachers to use the computer in the classroom as a word processor and to access the Internet to do research and communicate with counterparts.

Teacher training courses have also met another need. Teachers developed the pedagogical skills, heretofore, untapped, which linked telecommunications applications to general curriculum development. These pedagogical skills were most successful when focused on the development of projects that included cross-curricular instruction and provocative international topics.

A form of orientation must also be provided to principals and other supervisors to assure that they fully understand and can be supportive of these Internet projects on a school-wide basis. With their support, the creation of a time period within the school program to accommodate an Internet strand as an integral part of the curriculum can be more easily realized. When an entire school community felt a sense of ownership of the Internet project, the project in which they were involved seemed to enjoy a far greater degree of success.

Internet projects also need careful coordination and management. It is necessary to provide the curriculum support for individual school projects and to collaborate with the primary and secondary schools to establish international links for the participating classes. As part of its coordination responsibilities, the coordinator needs to carefully monitor the participating schools and their activities. In addition, dissemination of information about the project, such as evaluation reports the development of training manuals, the creation of new links and preparation of user lists and web sites lists should also be part of the projects coordination. International conferences provided further coordination and new linkages which are needed to keep more life into the program.

Finally, if the Internet is to be an effective tool, projects should be designed with specific goals, activities and out-comes, compatible with age/grade level and subject/topic area. This can be achieved by having teachers talk online before any project begins. In the GETN program, the most successful projects had extensive students participating in the planning process. A project timeline with beginning and ending dates should also be prepared, specifically setting deadlines for data collections and transmission. Once the projects are complete, the results and evaluation of the experience should be shared.

The teachers who participate in Internet projects agreed that there were several pedagogical reasons for implementing telecommunications into the existing curriculum. They concluded that telecommunications facilitated several education objectives including: increased international understanding, the encouragement of respect for cultural differences, highly motivate learning through the timely sharing of information with a real audience, attaining technological skills whose uses extend beyond the classroom, learning in a content-integrated environment, a genuine opportunity to engage in inquiry-based learning and the enrichment of the school curriculum.

Assessment of a Telecommuncations Projects

Education programs are traditionally assessed by the actual knowledge and skills students acquire and/or by change in their effective behaviors resulting from a particular set of learning activities. Although it would be possible to assess some Internet activities in terms of cognitive achievement, it is believed that the goals and characteristics of Internet programs more properly point to assessment, focusing on both teacher and student attitudes and on the learning process. For example, has this international intervention motivated students sufficiently to increase their receptivity to other more traditional learning modes? Has the use of this technology rejuvenated teachers to a point where their attitudes toward their instruction has motivated them to be more effective in the classroom? Has the range, concentration, and treatment of topics studied been increased to a point where learning becomes more meaningful? Has the mode of instruction had the spin-off effect of making both students and teachers able to deal with the technologically advancing society more easily and with less anxiety? Does this medium enable students to get a better understanding of other cultures and ideas so as to better understand their own? These and related questions should form the basis on an evaluation. A traditional program evaluation may be inappropriate in a non-traditional program.

The experience of GETN teachers has consistently been that involving students in meaningful learning activities via telecommunications strengthens instruction dramatically. Students are far more motivated to read materials that they get from colleagues abroad and they are excited abut responding to them through writing. They know that their work and efforts will reach a receptive peer audience. Written work that is shared through the Internet is received in a from that can be easily read, revised, and reprinted. Instruction in academic subject areas is brought to life trough student-to-student dialogues.

The Internet is now beginning to alter the approach to education, and as the technology advances it will play a key role in bringing the latest information to students, whether from national or international peer audiences or from the other areas on the information superhighway. It can be expected that within a short time, with increased technological support and increased familiarity by educators, student learning will be enhanced and enriched through active involvement in real project, resulting in personal satisfaction and improved achievement.

Teachers report that our project is exciting and motivating for students, especially in the primary grades. They help to engage learners who have been disinterested in school by providing the occasions for real, meaningful work that are owned by students and can be shared with others. We are also curious about the extent to which the GETN projects promoted a change in teachers' assumptions about teaching and learning, as well as in changes in curriculum and instruction. We are presently investigating these questions.

Criteria for Successful Internet Projects
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The Nine Planets
http://seds.lpl.arizona.edu/billa/tnp

Overview of the Solar System
http://seds.lpl.arizona.edu/billa/tnp/express.html

The NASA Home Page
http://www.nasa.gov/hqpao/library.html

National Air and Space Museum
http://www.nasm.si.edu

The Virtual Sun
http://www.astro.uva.nl/michiellb/sun/kaft.htm

Views of the Solar System
http://bang.lanl.gov/solarsys/homepage.htm

Lunar and Planetary Institute
http://cass.jsc.nasa.gov/lpi.html

Overview of the Solar System
http://seds.lpl.arizona.edu/billa/tnp/overview.html

USA Today Weather
http://www.usatoday.com/weather/wfront.htm

Weather Forecasting
http://www.usatoday.com/weather/wforcst0.htm

Storm Systems and Fronts
http://www.usatoday.com/weather/wstorm0.htm

Welcome to "Ask Jack"
http://www.usatoday.com/weather/asjack/wjack1.htm

Web Earth Science for Teachers
http://www.usatoday.com/weather/wteach.htm

The Martian Sun –Times
http://www.atmos.uiuc.edu

Guide to Hurricane Information
http://www.usatoday.com/weather/whur0.htm

Project VISION (Very Intensive Scientific Intercurricular On-Site Education): Using Technology to Enhance the Science and Math Curriculum in the Middle Schools

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Introduction:

The nation is experiencing severe changes in its national economy as a result of the world's continuing transformation into a global market. Greater numbers of scientists, mathematicians, and engineers will be required if our nation is to remain competitive in an increasingly technology-driven world economy. In recent educational surveys, our nation has been shown as trailing behind most of the industrialized nations in the quality of science and math education provided at the elementary, middle and senior high school levels. Comparison of test scores with those of other nations proves that our students' foundation in science and mathematics is greatly inferior. Without a quality science and mathematics background, our nation's students start their academic careers at a disadvantage when compared to the students from other industrialized nations. This disparity will eventually lead to a national shortage of highly qualified scientists, engineers, and mathematicians.

Another fact about our nation is that it has one of the best, if not the best higher educational system in the world. The large numbers of students from foreign countries who flock to enroll in our nation's institutions of higher learning attest to this fact. Our higher education system is an asset that we must harness for the benefit of those students still in the beginning stages of their academic careers.

In addition to the institutions of higher learning, our nation has another valuable asset that can be utilized to assist the public schools, the National Aeronautics and Space Administration (NASA). NASA, as mandated by Congress and directed in its strategic mission, has developed a wealth of up-to-date educational information and materials available for the public's use. Project VISION plans to maximize the use of this information and materials by identifying, adopting, and then adapting them to the middle school curriculum. (NASA's Spacelink website address is http://spacelink.nasa.gov)

Project VISION strives to develop a methodology by which the resources of NASA and our higher education system can be tapped in order to assist the nation's public schools in developing brighter, more resourceful scientists, mathematicians, and engineers. Project VISION will develop a systemic approach to solidifying an alliance among NASA, two institutions of higher learning, and two local public school systems. The methods and successes, as well as failures, developed by this project will serve as a critical guide to expanding these activities nation-wide. The extent of our educational crisis is such that a model should be developed that could be replicated at every public school system in order to achieve the significant results needed to overcome this crisis.

Background:

Project VISION (Very Intensive Scientific Intercurricular On-Site Education) is a joint effort among NASA/John F. Kennedy Space Center, Florida International University, Universidad del Turabo. Miami-Dade County Public Schools and the Caguas/Gurabo Public Schools in Puerto Rico. The project's main mission is to institutionalize change among the middle school science and math teachers at participating public middle schools.

Project VISION is tasked by the National Aeronautics and Space Administration (NASA) to support the President's Executive Order 12821, *Improving Mathematics and Science Education in Support of the National Education Goals*. The ability of the US to maintain leadership in the world economy depends in part on its ability as a Nation to educate and train talented scientists and engineers. This process must begin as early as Kindergarten, or even sooner.

In order for college students to succeed in careers in science, math or engineering, they must first be prepared at the precollege level. This preparation must include instilling motivation and enthusiasm for the subject matter, as well as producing an in-depth understanding of the principles of mathematics and science. Project VISION attempts to achieve these requisites, and at the same time, institutionalize the correlating methodology that produce these achievements through the use of learning modules with their hands-on and minds-on activities.

The use of learning modules that require hands-on and minds-on activities in a classroom setting garners great enthusiasm and motivation on the part of the target students for the understanding of the lesson's underlying math and science principles. With this enthusiasm and motivation, comes acceptance, attention, discipline, acquiescence, and collaboration. Additionally, the use of hands-on activities may also require learning through a gamut of senses. Not only can the student use his/her eyes and ears during these activities, but most times, they can also use their senses of touch, smell, and taste, as well as intuition. Learning is, therefore, achieved using most or all the senses. The combination of motivation/enthusiasm and the use of multiple senses creates an ideal environment conducive to learning at a profound level.

The importance of this project is not its ability to achieve by itself these sets of conditions that will result in better prepared students. Its importance lies in the fact that the project strives to institutionalize these conditions among the participating public school teachers, so as to establish an enduring system of experimentation and hands-on activities that will last long after the project's termination.

The project did not need to generate any new educational materials to fulfill its mission. Rather, Project VISION has used the vast quantities of high quality learning modules, hands-on experiments and additional educational materials available at NASA (http://spacelink.nasa.gov) and other scientific depositories. The project identified, adopted, adapted, tested and then implemented those learning modules that best met the needs and capabilities of the target student and teacher populations. The project also provided the participating teachers with training on the use of computer technology and on accessing the Internet.

Both Florida International University and the *Universidad del Turabo* "adopted" middle schools to participate in this project. During the first year of operations, the project focused on 7th grade science and math teachers, as well as all the 7th grade students. During the second year, this project will be expanded to include the 6th and 8th (8th and 9th grades in Puerto Rico) science and math teachers, as well as the students from those grades.

The Project VISION staff implemented three two learning modules with each participating science and math teacher. These teachers served as both assistants and observers during the first two implementations. During the third implementation, the teacher worked alone to identify, adopt, adapt, test and implement learning modules on his/her own. The result is the institutionalization of the process of bringing learning modules, with their hands-on and minds-on activities, from the Internet to the classroom curriculum. Each of these teachers now have access to unlimited quantities of educational materials/learning modules to complement or supplement their regular class curriculums. Project VISION has even established a website that contains links to hundreds of learning modules the project's staff located on the Internet (http://www.eng.fiu.edu/vision). These links are grouped by educational level, and by subject (math or science). Additionally, they have also been classified according to the Competency Based Curriculum (CBC) of the Miami-Dade County Public Schools. Plans are being made to also classify them according to the national educational students so as to serve the entire national community of teachers and students.

Project VISION's Major Goals and Objectives:

The following are the major goals and objectives of Project VISION:

1. Develop a model of collaboration between the NASA/John F. Kennedy Space Center, public school systems, industry representatives, science and math public middle school teachers, public middle school students, two institutions of higher learning, and faculty and students from science, mathematics, education, and engineering disciplines.
2. Enhance the public middle school science and mathematics curriculum through the use of NASA electronic resources and educational materials, as well as other sources.
3. Empower the public school teachers by enhancing their understanding of mathematics and science principles and by enhancing their science and math curriculum through the use of state-of-the-art materials integrated within their teaching methodology.

4. Establish greater participation in existing academic competitions (i.e. Science Fairs, SECME District Olympiads, etc.).
5. Increase the average scores in science and math subjects, as well as in the regular classes, and increase the overall average scores in the standardized tests.
6. Increased parental involvement in the educational process of their middle school children in order to foster a greater sense of motivation and responsibility within the children.
7. Expose the middle school students to examples of real industry professionals/ mentors so as that they can see, first-hand, the rewards and challenges of a professional career in science and engineering.

The Project VISION Training Methodology

Project VISION provides training for the science and math teachers at participating public school consistent with the use of learning modules, with their hands-on and minds-on activities. The learning modules selected were derived from a variety of sources, mostly from the Internet, from the areas of math and science, based on the level and capabilities of the intended target student audience as well as in deference to the preferences of the participating teachers and school administrators. The Project VISION Training Methodology consists of three components: *Learning Modules, Personnel*, and the *Training Process*.

Learning Modules

A basic premise of Project VISION is that there already exists sufficient educational materials (learning modules) in all the data repositories of the federal, state, and local governments, at public and private libraries, and at public and private universities, to compliment almost every subject, for every level of study from Kindergarten through 12th grade. Therefore, it is not that there is a lack of learning modules that prevents local public school systems and teachers from incorporating them, with their hands-on activities or experiments, into the regular academic curriculum. Instead, it is a combination of not knowing where these learning modules are to be found, not knowing how to access them, not knowing where they fit into the competency based curriculum (CBC) or equivalent educational standards, and not knowing how to adapt these learning modules for use in the classroom. It is precisely at this point where the activities of Project VISION couples existing educational resources with prevailing needs in order to create an enhanced science and mathematics curriculum.

The process began with the formation of clusters or teams consisting of a university professor, a university student, a public middle school teacher, and the Teacher Trainer. The university student, under the direction and supervision of the university faculty, sought potential learning modules on the internet or other electronic or printed sources. An excellent location of potential learning modules is the NASA Spacelink website located at the following Internet address: http://spacelink.nasa.gov/.index.html. This site provides thousands of excellent learning modules, and also has links with hundreds of other sites that have similar high quality educational materials.

The university students searched for learning modules that were appropriate for the grade level, subject and topics that are part of the competency based curriculum (CBC) of the target student audience. Once a potential learning module was identified, and its appropriateness was determined, then it was adopted for this project. This learning module may have needed a few modifications, such as class exercises, homework, etc., therefore, it was adapted or refined accordingly.

Once the learning module has been adapted to meet the requirements of the CBC, it is then ready to be tested. However, before the testing can begin, the cluster meets to coordinate the location, date and time where the learning module will be presented. Once these specifics are established, the public school teacher becomes familiar with the material that will be presented. Before the learning module is presented, the public school teacher presents to the students the theoretical background or material related to the module, and which is provided in the students' regular science or math textbook. The students are also given reading materials beforehand which compliments the materials and activities that will be presented in the learning module.

During pilot testing, the learning module was presented by the university faculty and/or university student to a classroom of students at the public middle school. In attendance was also the public school teacher, the university student/faculty, and the Teacher Trainer. While the faculty/student makes the presentation, the other team members assist and observe the flow of the presentation and the hands-on activities. They make notes of any needed changes or corrections that will make the learning module more effective. After the presentation, the cluster members meet to finalize any changes that are deemed necessary. The changes are incorporated into the learning module and it is then finalized. At this point, there is a fully adapted learning module available for use by the Teacher Trainer for use in the training process. The project has accumulated a large listing of learning modules identified for this purpose and has created its own website with links to these learning modules. The website address for Project VISION is http://www.eng.fiu.edu/vision.

Personnel

In order to perform the training, the following personnel will be involved at one stage or another. These individuals perform a specific

Public School Teacher: This is the individual towards which the training is directed. For the purposes of this program, this teacher should instruct math and/or science classes at the participating public school. The teacher should already be familiar with computer software and hardware, and should be able to access and navigate the Internet with ease. If not, an additional training component in this area could be offered to bring his/her skills up to requirements for this program.

Teacher Trainer: This is the individual who will perform the actual training and evaluation. The individual selected for this position should, ideally, be an experienced teacher, preferably with a Ph.D. in Education or Pedagogy. The Teacher Trainer will present the first learning module alone, the second in collaboration with the public school teacher, and will serve as an observer during the third learning module presentation.

Training Assistant: This is the individual who assists the Teacher Trainer to obtain the necessary materials and supplies, present the learning module, coordinate the hands-on activities, and serves as a general assistant during the entire process. Though the goal of this training program is that each teacher can present learning modules on his/her own, and the presence of two trainers may belay this in the mind of the teacher, the presence of the Training Assistant is important and does not disavow the program's assumption of individual accomplishment. Rather, the Training Assistant allows the Teacher Trainer to be able to conduct observation that will allow for evaluation to take place. Therefore, the Teacher Trainer's valuable time is freed for conducting evaluations, and not spent on procuring supplies and other, more menial tasks.

The Training Process

The Learning Module Training Process consists of 8 steps as follows:

- Step 1: Consultation and Coordination

- Step 2: Learning Module 1 – Pre-presentation Classroom Preparation
- Step 3: Learning Module 1 – Presentation (Initial Learning Module)
- Step 4: Learning Module 2 – Pre-presentation Classroom Preparation
- Step 5: Learning Module 2 – Presentation (Pre-Solo Learning Module)
- Step 6: Learning Module 3 – Pre-presentation Classroom Preparation
- Step 7: Learning Module 3 – Presentation (Solo Learning Module)
- Step 8: Evaluation and Feedback

Step 1: Consultation and Coordination

During this initial step in the training system, the Teacher Trainer and the participating public school teacher meet to discuss delivery schedules, choose two learning modules (Initial and Pre-Solo) and coordinate other matters.

Step 2: Learning Module 1 (Initial) – Pre-presentation Classroom Preparation

In step 2, the public school teacher presents to the target classroom the theoretical information that correlates with the subject matter of the learning module. This background materials is obtained from the assigned textbook, the learning module, or other sources of information that the teacher would normally use for class lectures. The Teacher Trainer is present solely as an observer during this first pre-presentation class. The public school teacher will be engaged in three learning modules. Each learning module will be divided into two sections: Pre-presentation Classroom Preparation and the Presentation. During each of the three Pre-presentation Classroom Preparations, the teacher presents the theoretical background on the subject matter to be presented during the learning modules. This preparation material and information is obtained from the assigned class textbook, handouts, or other sources. This pre

Step 3: Learning Module 1 (Initial) – Presentation

In this step, the Teacher Trainer and an assistant present the learning module to the target classroom. This presentation includes the hands-on activities that involve all the students in the classroom. The public school teacher serves as an observer during this presentation. However, the responsibility for class discipline remains with the public school teacher. The supplies and materials needed for this activity are obtained and funded by Project VISION.

Step 4: Learning Module 2 (Pre-Solo) – Pre-presentation Classroom Preparation

During this next step, the public school teacher presents to the target classroom the theoretical information that correlates with the subject matter of the second learning module. Again, this background material is obtained from the assigned textbook, the learning module, or any other sources chosen by the teacher. The Teacher Trainer is not present during this pre-presentation class.

Step 5: Learning Module 2 (Pre-Solo) – Presentation

In this step, the Teacher Trainer and the public school teacher present the learning module to the target classroom jointly. This presentation should be a team effort involving both individuals. The responsibility for class discipline remains with the public school teacher. The supplies and materials needed for this activity are obtained by the public school teacher, but are funded by Project VISION.

Step 6: Learning Module 3 (Solo) – Pre-presentation Classroom Preparation

During this next step, the public school teacher presents to the target classroom the theoretical information that correlates with the subject matter of the third and final learning module. Again, this background material is obtained from the assigned textbook, the learning module, or any other sources chosen by the teacher. The Teacher Trainer is not present during this pre-presentation class.

Step 7: Learning Module 3 (Solo) – Presentation

In this step, the public school teacher presents the learning module to the target classroom. The Teacher Trainer is present during the presentation, but only serves as an observer and guide. The responsibility for class discipline remains with the public school teacher. The supplies and materials needed for this activity are obtained by the public school teacher and are funded by Kinloch Middle School.

Step 8: Evaluation and Feedback

In the last step of the training system, the Teacher Trainer provides the public school teacher with feedback concerning his/her performance during the learning module presentations. The feedback is provided in a fully professional manner, and an evaluation is provided to the teacher that list the possible strengths and weaknesses observed. If requested, the Teacher Trainer may provide the administration of the participating school with confidential and specific written results based upon observation and evaluation conducted during the training

Additional Obligations of the Participating Middle School

The participating middle school will be responsible for funding the materials and supplies needed for the third learning module for each teacher trained. This is a very important component of the training process. The public school teachers, as well as the school's administration and staff, must become experienced in the financial aspect (budgeting, purchasing, reimbursing, allocating, etc.) of presenting learning modules at the school. In order for this activity to be institutionalized, all persons involved in supporting the presentation of learning modules at the school must become familiar with every step of the financing learning modules in order to achieve successful results. Therefore, procedures and routines must be established

Conclusion:

With the advent of the Internet, the first step in providing instantaneous, low-cost, and standardized educational materials to all parts of the nation has been achieved. Building upon the Internet, many federal and state agencies, as well as public and private institutions have created and compiled outstanding repositories of high quality education materials, with their hands-on and minds-on activities, that can be used to enrich local classroom curriculums. This enriching process may make the difference between producing students with a standard or mediocre understanding of the principles of math and science, or students who have mastered these areas and have the potential, as well as the motivation to become the next generation of scientists, mathematicians, engineers and leaders.

References

1. Goals 2000: Educate America Act (A Teacher's Guide to the U.S. Department of Education – Fall 1995), Internet address: http://www.ed.gov/pubs/TeachersGuide/pt5.html
2. Raising the educational Achievement of Secondary School Students. Internet address: http://inet.ed.gov/pubs/Raising/brochure/brochure.html
3. Extending Learning Time for Disadvantaged Students. Internet address: http://inet.ed.gov/pubs/Extending/brochure/index.html
4. Prisoners of Time – April 1994: Recommendations. Internet address: http://www.ed.gov/pubs/PrisonersOfTime/Recommendations.html
5. Roig, Gustavo, et. al., "Project VISION: A Partnership Among NASA/John F. Kennedy Space Center, Florida International University, Universidad del Turabo, Miami-Dade County Public Schools, and the Caguas/Gurabo Public Schools," presented at NASA's Thirty-Fifth Space Congress in Cocoa Beach, Florida, April 27th – May 1st, 1998.

Networking Break-out Session II

Mr. Samir Maniar
South Carolina State University
and
Mr. Carl Taylor
Prairie View A&M University

Video Conferencing

Closing Distance, Improving Learning

Presenters: Mr. Carl Taylor and Mr. Samir Maniar

(Prairie View) (SCSU)

Date: October 22, 1998

Location: SIPI - Albuquerque, NM

Video Conferencing

- Videoconferencing is the ideal way to [illegible] geographically dispersed people together, face-to-face, to facilitate decision-making and productive collaboration.
- Videoconferencing used to be the technology that everyone planned to install sometime in the future-once they ironed out all the bugs and the technology could be had for a reasonable price.
  - That time has arrived.

Video Conferencing

- The price of videoconferencing has come down considerably.
- Key PC players have taken steps to bring this valuable technology to the desktop at a price that corporate and educational budgets can afford.
- Video networking is the network that supports Video Conferencing.
- Connections can be to directed to multiple locations at different bandwidths, on a call-by-call basis.

Group Video Conferencing

- One or more people sharing/using on[illegible] for video communication to the remote sites.
- Who should use GVC system?
  - If video conferencing requirement involves many people or group of people using the system at one time then - YOU should have Group VC system.
- Where should you Install?
  - It is recommended that you install this type of system in a one large room. It is also necessary to have the easy access to video conferencing components and access to the network(LAN/WAN)

GVC - Continued

- Why should you use GVC system?
  - First of all, many users can share the same system at one time. It gives you the true meaning of the Group Video Conferencing between one or more remote sites.
  - It offers the high speed connectivity and we will see the details on this in later section.
  - It offers multiple Audio/Video options for video conferencing standards.
  - This type of system comes with all the necessary components in one box, and it is much cost effective and easy to install and use.

GVC -Hardware

- Basic Hardware for Group Video Conferencing System is as given below:
  - Display Unit or Monitor/TV
  - Capturing Camera
  - Speaker and Microphone
  - Computer System
  - CODEC (Compression/De-Compression)Unit
- Most of the GVC system in market today comes with all of the above described components.

GVC - Hardware - Continued.

- One more required component is the high speed communication line.
- ISDN (Integrated Services Digital Network) communication line is the widely used and accepted method for the purpose of video conferencing.
- With the inclusion of ISDN line - one more component is required that is IMUX or Inverse MUltipleXer. This unit connect multiple ISDN lines and creates a wider pipeline for use by GVC system.

Communication Line - ISDN

- Minimum bandwidth of a ISDN line is 64 kbps.
- The minimum required bandwidth or speed for Video Conferencing is 128 KBPS (2 x 64) or 1 BRI circuit line.
- The recommend bandwidth for video conferencing data transfer is 384 KBPS or 3 BRI circuits.
- The speed of 384 KBPS or 3 BRI gives a real boost in performance and smooth image transmission in video conferencing.

ITU Standards

- ITU - International Telecommunication Union
- ITU - a part of United Nations (UN) [redacted] responsible for defining standards in video conferencing components.
- ITU has defined 3 classes for Video Conferencing.
  - Class 1 => minimum requirements and support
  - Class 2 => Class 1 + some optional features
  - Class 3 => supports all available features & options
- Will look at each of these in conjunction with Audio standards and Video standards.

Video Encoding & Compression

- ITU has defined many standard for compression.
- H. 261
  - Earlier standard for video encoding - supports only NTSC data format and at a max speed of 384 KBPS.
- H.320
  - Widely used and internationally accepted standard for video compression - supports both NTSC and PAL - works well with data rate of 64 KBPS - 1.544 MBPS.
- H.323
  - A standard for compression and encoding dedicated to be used for Video Conferencing over LAN/WAN - this works over the IP/IPX Local Area Network

Video Compression - Continued

- H.324
  - newest among the core - dedicated for de[illegible]o conferencing using 28.8 KBPS modem lines.
- The selection of standard is based on the system that you purchase and the bandwidth that is available to you.
- Most all system do support the H.320 standards, but H.261 is the native standard for most of the group video conferencing system.
- Class 1 system supports only H .261, while Class 2 and 3 system support H.261 and H.320.

Audio Encoding & Compression

- ITU also has some defined standards for Audio Compression.
- G. 711
  - Earlier standard - Uses 48-64kbps of bandwidth - gives 3 kHz Telephone Quality Sound.
- G. 722
  - Popular standard - Uses 48-64kbps of bandwidth - gives 7 kHz Stereo Quality Sound.
- G. 728
  - newer standard - used with desktop video conferencing and uses 16 KBPS and gives telephone quality sound.

Audio Compression - Continued.

- Class 1 type of system supports only G.711 while Class 2 and 3 supports all the audio standards.
- Now, what kind of audio quality you can afford is dependent on the available ISDN bandwidth.
- These compression standards are choices within most systems and you can choose on per need basis.
- The recommendations are to have H.320 compliant system and use G.722 as the audio standard with 3 BRI ISDN bandwidth.

Critical Success Factors

- Cost of application and WAN access equipment
- No. of video conferencing stations per location
- Average volume of videoconference calls (hours/day) that you will make
- Size and type of the WAN connection required to handle that volume (BRI,PRI,T1,E1)
- Network transport services (private Vs. public Vs. virtual connections)
- Support for multiple carrier standards (regional and country-specific)
- Life-cycle costs (the cumulative of ownership)

Videoconferencing Application

- Video conferencing equipment (CODECs, cameras and other peripherals) is available in various configurations
  - including dedicated room systems
  - roll-about systems
  - desktop products
- Video conferencing is highly valuable because it enables businesses and educational facilities to conduct high-content, visual communications over distances that otherwise could only be bridged by time-consuming travel.
- The longer the distance the higher the value.

True Cost of Videoconferencing

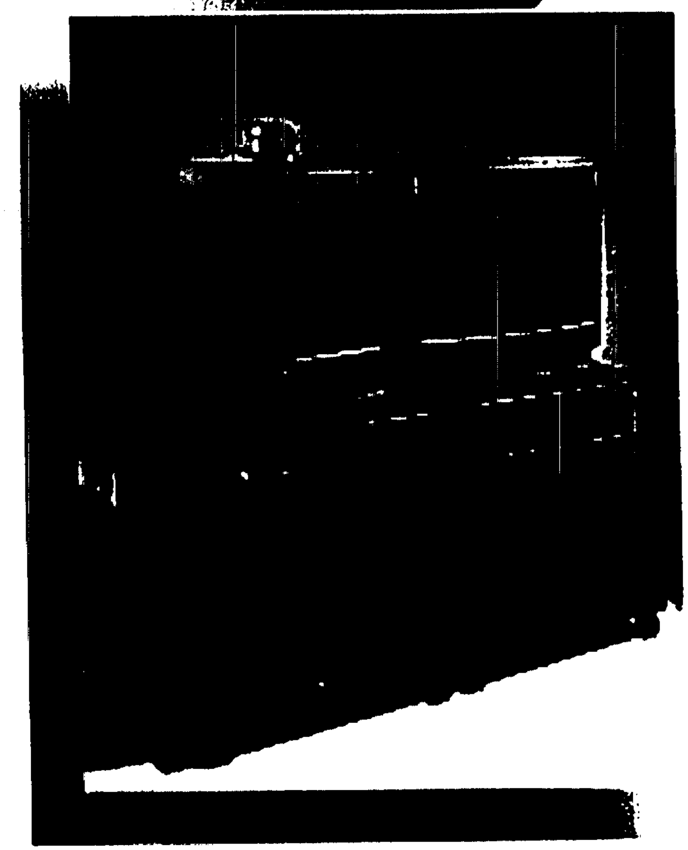
- Bulk cost of ownership of a WAN videoconferencing system is not the video application equipment (CODEC, cameras) or even the WAN access equipment (Imux, switch), but in the wide area network costs.
- WAN video networks are dominated by carrier charges.
- Cost figures are significant unlike the one-time equipment charges.
- Local and long-distance carrier service is an ongoing expense.

Videoconferencing Transport Services

- Network transport services come in three basic varieties
- Public Switched Digital
  - a digital transport service that is available in bandwidths of switched 56/64 KBPS.
- Dedicated-Private Network
  - typically available via T1/E1 access lines. This service is also provided in fractions of T1.
- Virtual-Private Network
  - a special switched network service that carriers typically offer to high-volume customers which commits to a long-term agreement in return for a substantial discount on basic service.

Featured System - VTEL TC2000

- VTEL - A Texas based corporation has many products in the market of Video Conferen[illegible]
- Shown here is a picture of VTEL's TC2000 Video Conferencing system. This System comes with two 35" monitor, camera , microphone, speaker and its proprietary PC with built in CODEC and Inverse MUltipleXer units.



- The competitive system to this one is VENUS 2000 Model 30 and Model 50 from PictureTel Inc.

Multimedia Break-out Session

Mr. Curtis Sollohub
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Hypermedia and the Textbook Teaching C++

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I. The Late Age of Print

In his book, Writing Space, Jay David Bolter (1991) talks about "the late age of print." He argues that we will soon witness the end of the book as a bound collection of paper pages with a preset beginning and end. What will take its place will be the electronic book, without a necessarily fixed content, order, or boundary. In the electronic book, the content can be modified by author or even by reader as needs be, the order will depend on how the reader chooses to follow a set of hypertext links (an extension of the links we see in Internet web documents), and the boundaries will be shattered by hypertext links that reach beyond the immediate document under consideration. This paper discusses the implications of this notion with regards to the textbook and presents the rudimentary beginnings of such a text to teach the programming language C++.

The traditional printed textbook emphasizes the author as expert and the reader as passive recipient of that expertise. In such a book, the author's expertise often shines through and the instructor can get excited about the possibility of using the product of the author's efforts. At the same time, given the ways of professorship, the instructor usually finds aspects of the text that are not 'quite right' and wishes that the good could be borrowed while the inappropriate is discarded.

The student has a different experience of such a text. Ironically, the author's expertise often gets in the way of student usage of the material. The student reader is confronted with a hardbound volume, with well-laid out, authoritative text and figures. Such a book becomes something to revere, not something to read critically and mark up, let alone modify.

Computer-based hypermedia changes the relationship between writer and reader. The nature of the text almost requires that the reader be an active participant, as reading becomes an exploration. Each click of the mouse to follow a link is a decision by the reader. The more links, the more decisions. The reader can choose to:

- follow along in the physical order laid out by the author
- review already explored material
- consider an example
- explore an alternative explanation
- skip to a summary
- call up a tutorial
- send email to the instructor.

On a more practical level, a section can be printed out, marked up, and even modified as the student struggles to understand the material and rephrase it in his or her own words.

For instructors, such a text can easily become a collaborative effort, with each instructor choosing which sections to accept as a whole, which to modify, and which to completely rewrite. The 'same' text can have multiple paths as instructor-authors add their own contributions.

As envisioned here, such a text would be delivered via some kind of computer. In the future, this computer would be a variation of the laptop, with wireless access to a 'library' containing any number of 'books' available for downloading. Such technology is not generally available yet and there are serious challenges to overcome. One of these is the fact that with the present technology the average person takes in computer text 25% slower than text on a page. Likewise, reading from a screen seems to cause more eyestrain.

There is a further, perhaps more important issue. If one accepts the notion that "the media is the message" and its implication that each type of media makes it easier to present certain 'truths' and harder to present others, will the hypermedia text change the very nature of what material is presented and how it is presented? To explore these questions, the author of this paper has written a set of web-based documents to teach C++. The materials include a 'narrative' on C++, reference materials, programming patterns, and examples. He is presently working on tutorials on key topics. All of this is available on the web at the following address: http://cs.nmhu.edu/personal/curtis/cs1htmlfiles/Cplusintro.htm

The Fall of 1998 represents the third semester that this material has been used in the classroom. Results so far indicate both the promise and the problems with such material. The next section describes the text and the third section describes some of the preliminary results.

II. Teaching C++ in the Late Age of Print

Students come to a text with different goals. Some already know at least part of the material and want to start in the middle. Others are looking for a reference document, especially if they have studied the material before. Some know that they learn best from examples and prefer to start with such and move to more detailed explanations later. Still others need a carefully crafted guide with plenty of 'story' and metaphor.

This last group is really many groups. A 'guidebook' can be written in many different ways, with each way preferred by a different type of student. To what extent should pictures and diagrams be included? How should the topics be ordered? At what point should key abstractions be introduced and how thoroughly? What level of mathematics should be included in the discussion? What types of metaphors and analogies should be used? What learning styles (visual, tactile, or auditory) should be emphasized and how? No single print-oriented text can possibly meet the needs or expectations of all its readers. It does seem, however, that attempts have been made to do just that, and elsewhere (http://cs.nmhu.edu/personal/curtis/txtconcp.htm), the author has argued that the cumbersome length of some C++ texts can be explained by attempts to meet all these needs and expectations.

It is important to understand that what is being advocated here is not a specific pedagogy. The point is not to follow, for example, a problem- or case-based approach. Nor is this a discussion about the importance of rigor, about which programming language to teach, or about whether to present an object-based or functional approach to programming. Rather, it concerns the need to sort out the various demands of a textbook and give each aspect its due.

To that end, the material to teach C++ described here is really a set of distinct documents, connected internally and externally via links. The first of these has the working title "The Story of C++." At present, this is the longest of the documents. It acts as a narrative description of the material in C++ and has the flavor of a traditional textbook except that its chapters and sections are connected via web links. Such links also connect this material to the other documents in this set.

A second document goes under the working title "The Essentials of C++." This represents an easy to read manual of the basic constructs of the language. Again, each section contains links to other sections and other documents.

A third key document is a set of examples that one could read through as a text. Many of the examples include just enough explanation that a reader with good programming skills and a knack for learning from examples could use this material as the primary learning tool.

This last document is not complete at this writing. However, even as it presently stands, it represents one of the many potential routes being developed for student exploration. Other examples include:

- a set of on-line tutorials using an off the shelf computer-based training (CBT) development tool, Asymetrix
- animations and game-based approaches
- audio explanations.

While some documents are more finished than others, it is the nature of hypertext that none of the documents are truly completed. For example, a complete re-write of one of the chapters of "The Story of C++" is being completed now. It is envisioned not as a replacement for the present chapter but as an alternative reading. At present, students can either read one or both of the versions. Later, after it has been determined which approach works better with which type of student, the two variations could be preceded by a description that allows students to choose which approach they want to start with.

III. Preliminary Results

Students seem to like the web-based approach described here but there is a learning curve to its effective use. Many students seem to end up reading "The Story of C++" while ignoring the rest of the material. This is similar to reading a regular text while ignoring all the appendices and other supporting materials. To counter this practice, this semester the author will include discussion of how to use the material in the lab sessions.

At this point, most students still buy a printed copy of the materials. In the first versions of the material there was little difference in content between the on-line and printed versions; the main difference was the links. Now, however, as more material has been added that is not being printed and as the web of links has grown, there is a significant difference in the two products. Students need to understand what the on-line version provides and, again, education is the answer. In addition, to accommodate students who do not have web access at home or wherever they use a computer, a CD-ROM version of the complete set of documents is being made available.

Because the on-line version is free while the printed version costs, the Computer Science department has been forced to make a rule prohibiting printing of the text in the lab. Most students respect this and don't complain. A few, however, have simply gone to a computer lab outside the Computer Science department and printed as much of the text as they wanted.

HTML is a limited form of hypertext and as such does not allow for complete exploration of the medium.

For example, it has proven difficult to link in quality CBT modules and high quality graphics. Likewise, one does not have sophisticated control over the presentation of links. On the reader's side, it is not easy get an overview of the document web. Student's traversing the space often desire such a 'map'. Other hypertext products, such as "StorySpace," (http://www.eastgate.com/Storyspace.html), provide these capabilities and are actively being considered for future iterations of this material.

Advantages for the on-line version include the following:

- The student can cut and paste any piece of code found in the material directly into a program editor. This encourages students to borrow and explore code as opposed to simply reading it.
- The same cut-and-paste capability allows students to create their own set of notes by cutting out key material and mixing it with their own rephrasings. One way to encourage this rephrasing is by requiring that students submit electronic journal entries involving the rephrasing of the material. This can be seen as a logical extension of the notion of a book without boundaries.
- The material is available anywhere one has access to a networked computer. Students in the lab can access what they are looking for even if they have forgotten their text.
- Since web browsers include document search capabilities, it is possible to locate references to specific concepts whether or not they are included in an index.

IV. Summary

No quantitative studies have been completed yet on how well students perform using this material. It is not complete enough yet to do so. The author is personally focusing on adding tutorial modules and on designing high-quality graphics as explanations of abstract and conceptually difficult material. He is also actively recruiting other instructors of C++ to participate in this effort. Anyone interested should contact Curtis Sollohub at curtis@cs.nmhu.edu. To explore the material described here, go to: "http://cs.nmhu.edu/personal/curtis/cs1htmlfiles/cs1text.htm".

References

1. Bolter, David Jay (1991). *Writing Space*. Hillsdale, N.J.: Lawrence Erlbaum.
2. Sollohub, Curtis (1997). The Computer Science I Textbook as a Web Document. *The Journal of Computing in Small Colleges* (13)2: 179-184.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY *(Leave blank)*

2. REPORT DATE
April 1999

3. REPORT TYPE AND DATES COVERED
Conference Report

4. TITLE AND SUBTITLE
Materials Presented at the MU-SPIN Eighth Annual Users' Conference

5. FUNDING NUMBERS
933

6. AUTHOR(S)
Harrington, James Jr., Shukla, P., Brown, R.

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS (ES)
Science Communications and Technology Branch
Earth and Space Data Computing Division
Goddard Space Flight Center
Greenbelt, Maryland 20771

8. PEFORMING ORGANIZATION REPORT NUMBER
99B00035

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS (ES)
National Aeronautics and Space Administration
Washington, DC 20546-0001

10. SPONSORING / MONITORING AGENCY REPORT NUMBER
CP—1999–209204

11. SUPPLEMENTARY NOTES
Shukla, P., and Brown, R., ADNET Systems, Inc

12a. DISTRIBUTION / AVAILABILITY STATEMENT
Unclassified–Unlimited
Subject Category: 80
Report available from the NASA Center for AeroSpace Information, 7121 Standard Drive, Hanover, MD 21076-1320. (301) 621-0390.

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

The goal of NASA's many outreach programs is to promote to the general public an understanding of how NASA makes significant contributions to American education systems and to institutions dedicated to improving science literacy. This newsletter provides one vehicle for reporting how applications and hardware used for space science and other NASA research and development can be adapted for use by teachers and their students and by non-NASA organizations.

14. SUBJECT TERMS
MU-SPIN; outreach; teacher education.

15. NUMBER OF PAGES
298

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	UL