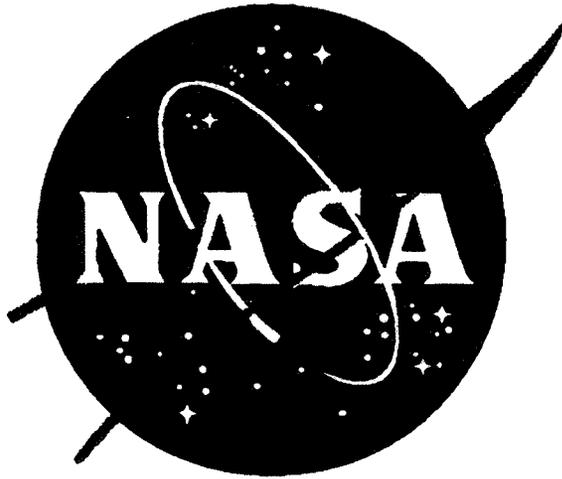


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National Aeronautics and
Space Administration



INFORMATION INFRASTRUCTURE TECHNOLOGY AND APPLICATIONS (IITA) PROGRAM

ANNUAL K-12 WORKSHOP

APRIL 11-13, 1995

Program Manager: Paul Hunter
Project Manager: William Likens
Deputy Project Manager: Mark León

Preface
IITA K-12 Third Annual Workshop
April 1995

Mark León, IITA Deputy Project Manager

The purpose of the K-12 Workshop is to stimulate a cross pollination of inter-center activity and introduce the regional centers to cutting edge K-12 activities. The format of the workshop consists of project presentations, working groups, and working group reports, all contained in a three day period. The agenda is aggressive and demanding.

The K-12 Education Project is a multi-center activity managed by the IITA/K-12 Project Office at the NASA Ames Research Center (ARC). This workshop is conducted in support of executing the K-12 Education element of the Information Infrastructure Technology and Applications (IITA) project.

The IITA K-12 Project funds activities that use the National Information Infrastructure, (e.g., the Internet), to foster reform and restructuring in mathematics, science, computing, engineering, and technical education.

Two approaches have been undertaken to execute the K-12 Project: NASA Cooperative Agreement Notices that fund worthwhile proposals submitted to NASA, and K-12 Outreach activities that are based at seven NASA field centers. This workshop has focused on the multi-center outreach efforts and the progress of these projects is enclosed herein.

Preface

Mark León
IITA Deputy Project Manager

Agenda

IITA K-12 Educational Workshop April 1995

April 11 - 13, 1995
NASA Ames Research Center
ARC Visitor Center, Building N223, Conference Room (SER)

Day One

Information Infrastructure Technology and Applications K-12 Program /Education

8:00 **Welcome and Introductions**
 Paul Hunter/Malcom Phelps/Mark León

NASA Field Centers Educational Outreach Projects

8:30 **Jet Propulsion Laboratory**
 "JPL IITA K-12 Projects Update; Telescopes in Education"
 Barba & Clark/Alvidrez

9:00 **Goddard Space Flight Center**
 "GSFC IITA K-12 Project Update; The Maryland Initiative Project"
 Latham

9:30 **Ames Research Center**
 "ARC IITA K-12; Internet Initiative"
 Traicoff & Jones/Hull

10:00 **Johnson Space Center**
 "JSC IITA K-12 Project Update"
 Mark Rorvig

10:30 **Break**

10:45 **Langley Research Center**
 "LaRC IITA K-12 Projects Update"
 Warren

11:15 **Lewis Research Center**
 "LeRC IITA K-12 Projects Update"
 Mackson

11:45 **Dryden Flight Research Center**
 "DFRC IITA K-12 Projects Update"
 Duke

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IITA K-12 Educational Workshop

April 1995

12:15 Lunch will be provided by ARC in conjunction with Demonstrations
Note: if you have dietary constraints please contact
Linnie Brunn @ 415-604-1995
There will be an internet and video connection with an overhead projector for demonstrations. Demonstrations from individual projects (computer software under development or available, videos, etc.).

Education and Outreach programs initiated under the CAN "Public Access Earth Space Science Data"

- 1:15 **NASA Classroom of the Future (35min)**
- Exploring the Environment
- Astronomy Village
- Open Houses
Wheeling Jesuit College - Bob Myers
- 1:50 **Windows to the Universe - An Earth and Space Science Internet-based Active Learning System (25min)**
U. Michigan - Roberta Johnson
- 2:15 **Overview of Project Globe (25min)**
Dale Dickerson, ARC
- 2:40 **Passport to Knowledge: Electronic Field Trips to Scientific Frontiers via Interactive TV and Internet (e.g. Live From series of videos) (25min)**
Childhood Project Inc. - Geoff Haines-Stiles
- 3:05 **Earth System Science Curriculum Testbed (25min)**
ECOlogic - Michael Keeler
- 3:30 **Creating the Public Connection: Interactive experiences with Real Time Earth and Space Science Data (25min)**
Rice Univ.-Pat Reiff
- 3:55 **A Science Infrastructure for Access to Earth and Space Data through the Nation's Science Museums (25min)**
University of Berkeley - Bob Semper
- 4:20 **Break (15min)**
- 4:35 **Stanford Research Institute, (25min)**
Bob Kosma
- 5:00 **National Research and Educational Network evolution "Educational Network Planning for the future" (25min)**
Milo Medin, ARC

IITA K-12 Educational Workshop April 1995

- 5:25 Spacelink (25min)
Rick Smith, HQ
- 5:50 NASA Code U (25min) [Pending]
Rose Grymes, PhD
- 6:15 Department of Education, John Cradler and Staff (25min)
Regional Farwest Labs
- 6:40 Dinner provided by ARC
Dinner will be buffet style and will be done in conjunction with project demonstrations. There will be an internet and video connection with an overhead projector for demonstrations. Demonstrations from individual projects (computer software under development or available, videos, etc.).
- 7:40 Adjourn for Evening

IITA K-12 Educational Workshop April 1995

Day Two

ARC Visitor Center, Building N223, Conference Room (SER)

8:00 Overview of Day Two
Paul Hunter/Malcom Phelps/Mark León

The objective of these sessions is to develop recommendations and guidelines for present and future project development in the IITA K-12 program. Each chairperson will be asked to facilitate group discussions and coordinate group output.

Track A: N258, Room 127
Track B: Building N223, Conference Room (SER)
Track C: N262, Room 284
Shuttles will be available from N223

8:30 Breakout Sessions

Track A: School Selection Criteria;
Chairperson Gynelle Mackson
Track B: Coordination of Environmental Education Projects;
Chairperson Michael Keeler, Co-Chairperson Farzad Mahootian, Ph.D
Track C: Indicators and Evaluation for NASA IITA K-12 Programs;
Chairperson Shelley Canright, Co-Chairperson Barbara Grabowski, Ph.D

10:30 Break

10:45 Breakout Sessions

Track A: Home Page Coordination
Chairperson Steven Hodas
Track B: Coordination of Environmental Education Projects (cont'd.)
Chairperson Michael Keeler, Co-Chairperson Farzad Mahootian, Ph.D
Track C: Indicators and Evaluation for NASA IITA K-12 Programs(cont'd.)
Chairperson Shelley Canright, Co-Chairperson Barbara Grabowski, Ph.D

12:45 Lunch (On own - ARC Cafeteria on-site)

1:45 Breakout Sessions

Track A: Home Page Coordination(cont'd.)
Chairperson Steven Hodas
Track B: Coordination of Environmental Education Projects (cont'd.)

POC: Mark León, IITA Deputy Project Manager 415-604-6498

IITA K-12 Educational Workshop April 1995

Chairperson Michael Keeler, Co-Chairperson Farzad Mahootian, Ph.D
Track C: Indicators and Evaluation for NASA IITA K-12 Programs(cont'd.)
Chairperson Shelley Canright, Co-Chairperson Barbara Grabowski, Ph.D

3:45 Break

4:00 Breakout Sessions

Track A: Facilitating Inter-Center Collaborations;
Chairperson Jennifer Sellers

Track B: Publications and Communications Strategy;
Chairperson Sandy Dueck

Track C: 800 Accounts and AUP;
Chairperson Mike DeFrenza

6:00 Group Dinner (TBA)

The Group Dinner is optional however we will be having a group activity in Mt. View involving Flight Simulators. Civil Servants of the US Government are expected to pay for this activity. Dinner and activity will be provided at no cost to all others provided they have registered with our conference coordinator, Linnie Brunn 415-604-1995

IITA K-12 Educational Workshop April 1995

Day Three

ARC Visitor Center, Building N223, Conference Room (SER)

**8:00 Overview of Day Three Events
Paul Hunter/Malcom Phelps/Mark León**

Session Reports:

8:20 Coordination of Environmental Education Projects Report

8:50 Indicators and Evaluation for NASA IITA K-12 Programs Chairperson Report

9:20 Publications and Communications Strategy Chairperson Report

10:00 Break

10:20 800 Account and Acceptable Use Policy Chairperson Report

10:40 Home Page Coordination Chairperson Report

11:00 Facilitating Inter-Center Collaborations Chairperson Report

11:20 School Selection Criteria Chairperson

11:40 Discussion and Follow-up

12:30 Adjourn

IITA K-12 Educational Workshop April 1995

ABSTRACTS FOR IITA K-12 PROJECT UPDATES

ARC

The Ames Internet Initiative intends to raise the bar a little higher. Given the tremendous explosion in K-12 activity over the past year, the installed base of knowledge and equipment in schools has grown, as have expectations. There are more providers of services, connectivity, and technical assistance available to schools from both the private and public sectors. The role of IITA K-12 Internet, therefore, should shift away from delivering services that can originate locally and toward a higher-level coordinating function, while at the same time continuing to deliver directly to end-users those products and services for which we remain uniquely qualified.

This evolution will ensure that our constituents have access to the broadest range of high-quality offerings from numerous providers, that our project continues to build expertise and infrastructure on the local level, and that the IITA K-12 Project remains securely in the vanguard of educational networking.

K-12 Project Manager: Karen Traicoff

DFRC

The Electronic Busing (EB) project addresses these three issues by using computer technology, Internet, and the World Wide Web to connect schools serving diverse student groups in widely separated school districts. The goals of this project are: a.) To provide a multi-cultural environment in which students from different ethnic and socio-economic backgrounds can meet and interact as equals, b.) To develop a wider sense of community among students by, first, connecting them with other students within the state of California and, second, by using World Wide Web to connect them to the world. c.) To promote the development of curricula in science and mathematics for a "virtual high school" d.) To introduce students and faculty to state-of-the-art computer hardware and information science technology

The concept for this program was developed by participants at the "Virtual Reality and the Physically Handicapped" Conference held in March of 1994 in San Francisco. The conference was sponsored by the Center for Disabilities at the California State University at Northridge. Representatives from the NASA Dryden Flight Research Center, Ericson Center, Hollister High School and DeAnza College attended this conference, and it was there, that the outlines of this project were formulated.

K-12 Project Manager: Lee Duke

GSFC

"The Maryland/Goddard Earth and Environmental Science Teacher Ambassador Program aims to enhance Earth and environmental science education in Maryland. Twenty-four secondary school Earth science teacher ambassadors are selected each year (one from each school district in Maryland) to receive computer equipment, an Internet connection, and extensive training in Earth science education and use of the Internet. These teachers then serve as ambassadors in their respective school districts to pass on this training. Now 3/4 of

IITA K-12 Educational Workshop April 1995

the way through year-1 of this program, GSFC will present status, problems encountered and lessons learned."

K-12 Project Manager: James Fischer

JSC

"The Internet Library Information Assembly Database (ILIAD) Project will focus on Texas teachers who send email to the intelligent agent ILIAD to request information from the Internet. Teachers will receive objects that meet user preferences via email. Classrooms can take advantage of the maze of Internet materials using simple, low end equipment. The ILIAD Knowbot is a smart system of Internet services that focus on 3-8 grade curriculum. Teachers activate ILIAD from all types of existing classroom computers by sending email to a server computer.

K-12 Project Manager: Mark Rorvig

JPL

Formerly referred to as "Mission Possible", this effort has made new educational and curriculum materials available on networks accessible through the TRC for dissemination to educators and students. Internet connectivity has been established, and a World Wide Web Mosaic Home Page developed which direct users through the expanded TRC electronic library. A curriculum materials catalog is also available on-line. Educational materials which have been available by walk-in, mail, or phone requests are now accessible through computer access from remote sites. Project S.P.A.C.E. and the on-line library are viewed program-wide as catalysts for creation of new and exciting methods for teaching science and for disseminating interactive curriculum products. TRC in-service teacher workshops incorporating a hands-on and team learning approach are being used to familiarize teachers with the basics of the Internet, to integrate these new curricula into classrooms and to prepare students and teachers for a JPL center visit. Beginning in FY '95, we plan to disseminate Project S.P.A.C.E. to all NASA centers to enhance site visits. Too, a comprehensive, independent review and report of the educational effectiveness of Project S.P.A.C.E. and the online curriculum library will occur in the second quarter of FY '95. Pre-exposure and post-exposure testing of students is planned.

K-12 Project Manager: Steve Barba

LaRC

The NASA Langley IITA K-12 Program has networked 5 local area high schools on the internet and provided in depth training to each school. Each of the schools was supplied with a computer lab of approximately 12 computers of which one of those was a general purpose UNIX based computer. This presentation addresses additional items that would greatly enhance this pilot program and would supply additional information that is being requested by school systems that are currently duplicating this model. There are approximately 141 schools on the Virginia Peninsula that are currently planning on the duplication of this model within the next 2 years. The project here would allow the investigation of methods to increase the performance and define the limits of the Network-to-Network PPP model currently employed as well as scale up the training program to include a much larger group of teachers.

K-12 Project Manager: Gary Warren

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LeRC

The Lewis Research Center has initiated an IITA K-12 program. The goal of the program is to introduce into the K-12 School system IITA technology that will benefit Math and Science studies. By incorporating IITA technology in Parallel Computing and advances in Software development into the K-12 school curriculums, a new generation of computer literate math and science students can be produced. We hope to realize a benefit both with the number of students who are more proficient in math and science as well as the level of proficiency of those students. We hope to see an increase in the number of students choosing math or science as majors when they choose a university.

K-12 Project Manager: Greg Follen

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ABSTRACTS FOR WORKING SESSIONS:

"Indicators and Evaluation for NASA IITA K-12 Programs" Chairperson, Shelley Canright, LaRC

An indicator is a measure that conveys a general impression of the condition or nature of an underlying system being examined. In the IITA K-12 realm, "indicators" are statistics and other information to be collected to determine whether the IITA K-12 projects are meeting their goals and objectives. Evaluation is the process of *interpreting* the evidence and making judgments and decisions based on it. If the indicators are not sound, the evaluation will not be sound.

In this session, participants will examine alternative formative and summative evaluation methods. As an outcome of this session, participants will create an indicator system for their specific projects. The indicator system will consist of input indicators, process indicators, and outcome indicators. Such a system will be useful as we develop metrics for each IITA K-12 effort.

The indicator system will become useful in the development of a master IITA K-12 evaluation plan. A system of indicators supports -- but doesn't substitute for -- periodic in-depth program evaluation. Program evaluation goes beyond indicators by introducing the additional elements of judging the merit or worth of the program, understanding how the program operates to bring about particular values, and making policy decisions about the program.

"Coordination of Environmental Education Projects" Chairperson, Michael Keeler & Farzad Mahootian, Ph.D, Gonzaga College High School

The Cooperative Agreement Notice awarded a number of grants to projects related to environmental fields with and emphasis on education. As these projects mature and products become available it would be useful for the existing groups to collaborate and share information.

In this session we will address four fundamental questions: What are the goals, objectives and practical opportunities for coordinating our projects? How can we improve awareness of, interest in, access to, and support the products of our work? How can we build relationships between projects for scientific, educational, technical and programmatic benefit? How can we evaluate the effectiveness of coordination efforts?

This working session will produce answers to these questions and propose a structure for future collaboration.

"Home Page Coordination" Chairperson Steven Hodas, ARC

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Purpose: To explore issues applicable to the greater coordination of NASA IITA/ed. WWW services. We will start by looking at the basic questions--why and whether--and if appropriate proceed to discussions of how and when.

Objectives:

To clarify the degrees of independence, interdependence, and coordination for which we strive, and to design procedures and/or frameworks to support those goals. Working groups and timelines will be developed as needed.

Products:

A White Paper outlining the group discussion and recommendations will be generated by the chairperson.

"Publications and Communications Strategy"

Chairperson Sandy Dueck, ARC

The IITA K-12 Program produces a wide range of internet related products and services that are distributed and tested across the board. Currently only 3% of the classrooms and 40% of the schools are connected to the internet according to recent studies. For this reason teachers, students and administrators still rely on published hard copy information for the majority of their new material.

The purpose of this session is to investigate two fields of interest what hard copy publications does IITA K-12 want to target for distribution of its networking approaches, curriculum products and internet services. The second area is to identify what we have learned that can best serve those in the user community.

Two deliverables will come out of this working session: one is a list of the periodicals that we intend to submit articles, and two is a list of subjects and lessons learned that we intend to publish.

"Facilitating Inter-Center Collaborations"

Chairperson Jennifer Sellers, ARC

Inter-center collaborations can be defined as a project which has meaningful participation from individuals at more than one NASA center. The purpose of this session will be to facilitate the formation of these multi-center projects.

The following objectives have been identified:

1) Increase awareness of potential inter-center collaborations. Identify existing or proposed activities which might benefit from a multi-center effort. Individuals will be given some time to present potential projects. Others will consider how these projects might fit

IITA K-12 Educational Workshop

April 1995

into their own center objectives and plans.

2) Define a process for actualizing these projects. The following topics might be considered for discussion: how should these projects be proposed to IITA K-12 Program Management, funding strategies, lines of authority and accountability, methods of follow-up after the workshop ends

Two products will result from this working session. A general policy will be generated for how centers will organize intercenter collaborations. A list of potential future projects will be identified.

"800 Account and Acceptable Use Policy" **Chairperson Michael DeFrenza, ARC**

800 # and server accounts

Historically the Project has given out free access and server accounts to NASA machines for selected individuals. In light of changes in the availability of commercial accounts and accounts from other organizations in NASA and from other government agencies, should this role continue? What criteria should be used to establish a need for an account and/or free access? What level of technology should be offered in the dialup environment? Terminal only? SLIP or PPP? ISDN?

The goal will be to establish a Project-wide position for accounts and the criteria to be used if account are to continue to be given out. What should be asked of the recipients? Alternate account and access providers will be identified.

Acceptable Use Policy

At least three Center have established acceptable use policies for the users that they support with either equipment or connectivity. In order to move toward a single Project-wide AUP, we will present the policies from each Center and develop the criteria from which a single Project-wide policy can be developed. Issues regarding government regulations and legal concerns will be discussed. In addition we will ask the participants for first hand experiences.

We will assign a team and set a schedule to develop a Project-wide AUP for the various circumstances the Project has encountered.

"School Selection Criteria" **Chairperson Gynelle Mackson, LeRC**

Why: As the NASA IITA K-12 program is being faced with reduced resources, it is important that we have criteria to determine which schools to add directly to the program and under what agreements they are added.

What: Define the criteria for schools to be added to the NASA IITA K-12 program and distributed to all IITA school projects.

Introductory Presentation

Mark León
IITA Deputy Project Manager

NASA IITA K-12 Education Project



K-12 Education Project

Information Infrastructure Technology & Applications (IITA) Project

**High Performance Computing & Communications Program, Office of Aeronautics
National Aeronautics and Space Administration**



February 1995

**Kindergarten through 12th Grade (K-12) Education Project
Information Infrastructure Technology and Applications**



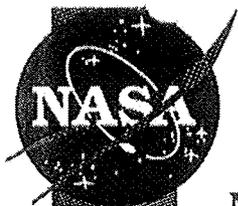
NASA IITA K-12 Education Project

GOAL

To enable a revolution in teaching and learning methods through use of computer internetworking.

OBJECTIVE

To use examples from NASA's unique mission, experiences, and ideals to provide an enhanced learning experience that is universally accessible.

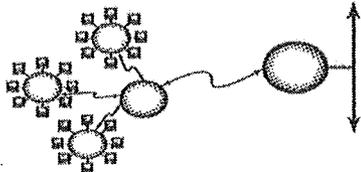


SCOPE

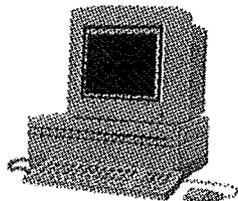
NASA IITA K-12 Education Project

Technology

Infrastructure Alternatives



Search Tools

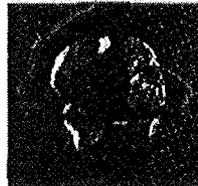


Instructional Materials

Aeronautics



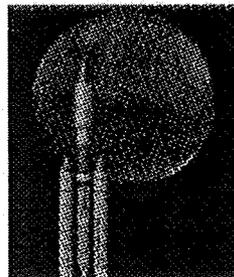
Environment



Internet Use



Space



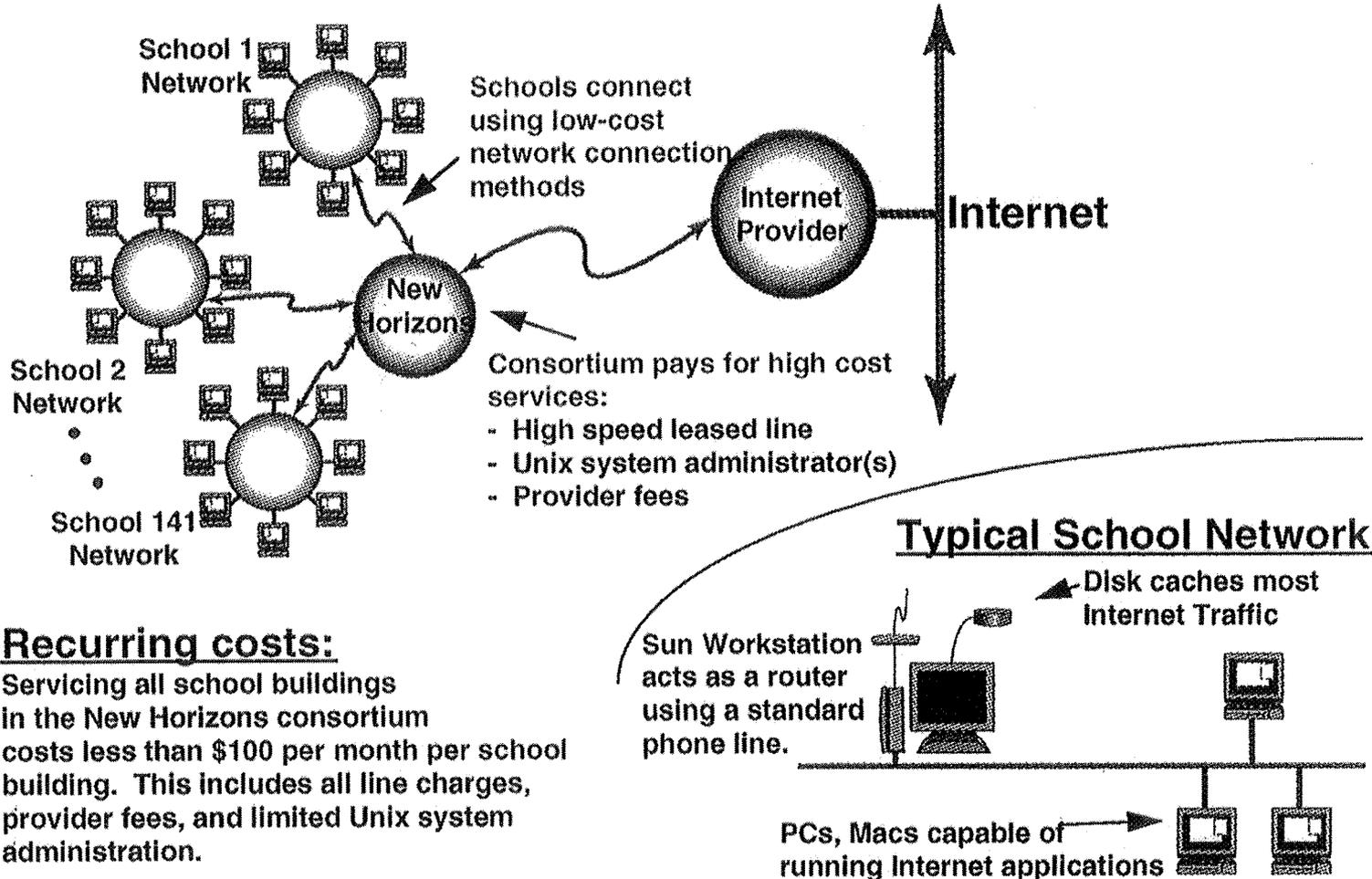
Sharing NASA
Career Experiences

Kindergarten through 12th Grade (K-12) Education Project
Information Infrastructure Technology and Applications



Technology Assessment Infrastructure Alternatives

NASA Langley's IITA K-12 Low-Cost Network Connection and Support Model



Recurring costs:

Servicing all school buildings in the New Horizons consortium costs less than \$100 per month per school building. This includes all line charges, provider fees, and limited Unix system administration.

Kindergarten through 12th Grade (K-12) Education Project
Information Infrastructure Technology and Applications

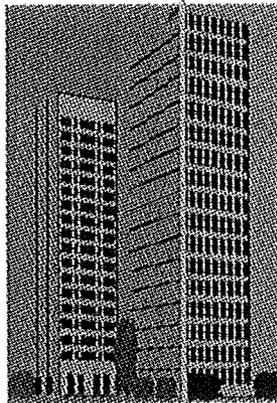


Technology Assessment

Infrastructure Alternatives

NASA Lewis Research Center IITA K-12 RF Connectivity for K-12 Schools

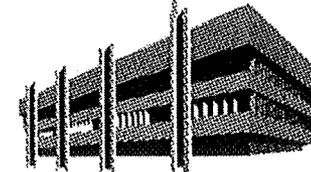
Cleveland State University



Rhodes Tower

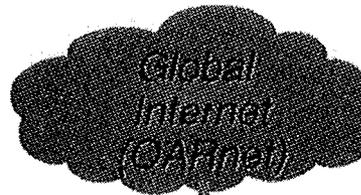
- 2 Mbps Radio Link
- Spread Spectrum
- Unlicensed FCC Frequency
- 908Mhz - 928Mhz
- T1 Data Throughput
- No recurring charges
- 3-5 Mi radius

East Technical High School



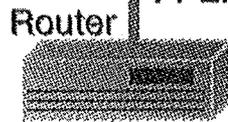
RF/Ethernet Bridge

RF/Ethernet Bridge



Global Internet (GAINet)

T1 Link



137.148.xx.xx
CSU Ethernet Backbone

East Tech Ethernet

137.148.205.xx



Server



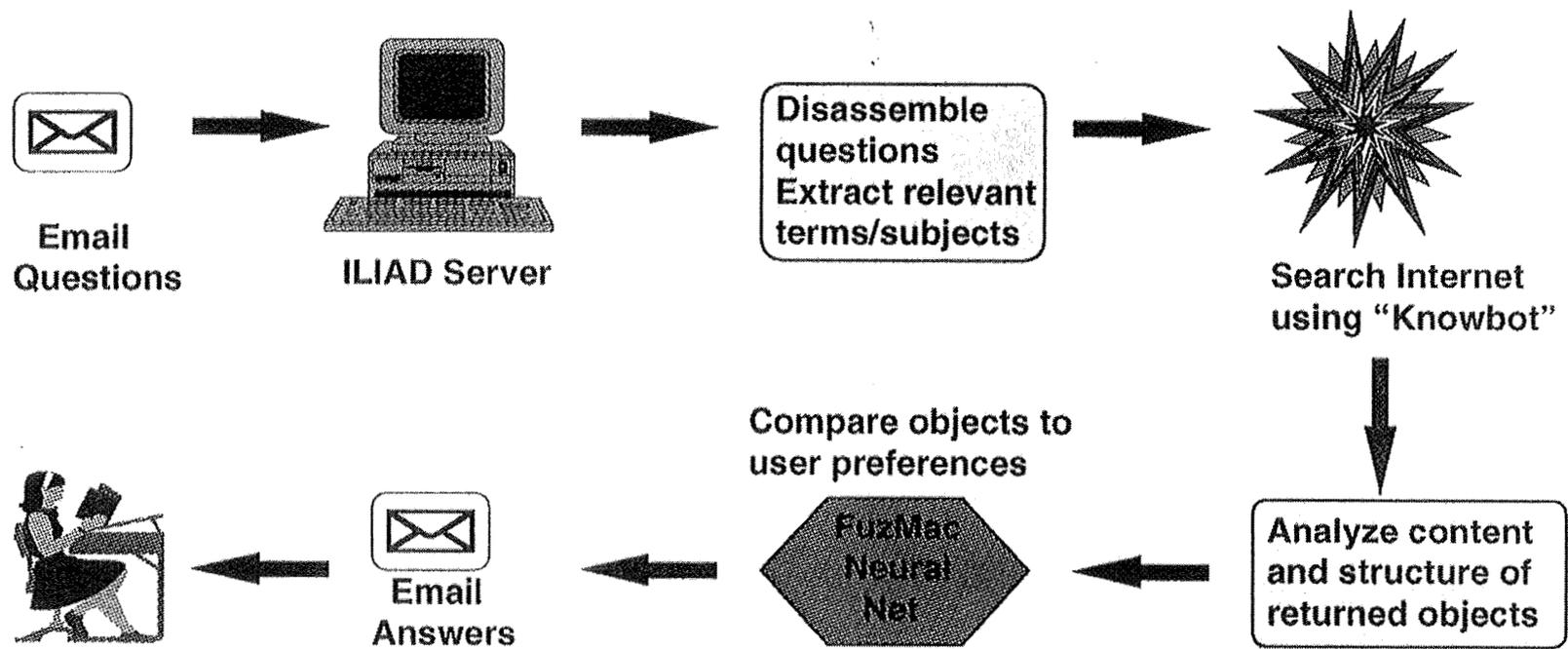
Workstation

Kindergarten through 12th Grade (K-12) Education Project
Information Infrastructure Technology and Applications



Technology Development
Search Tools

**NASA Johnson Space Center IITA K-12
Internet Library Information Assembly Database (ILIAD)**



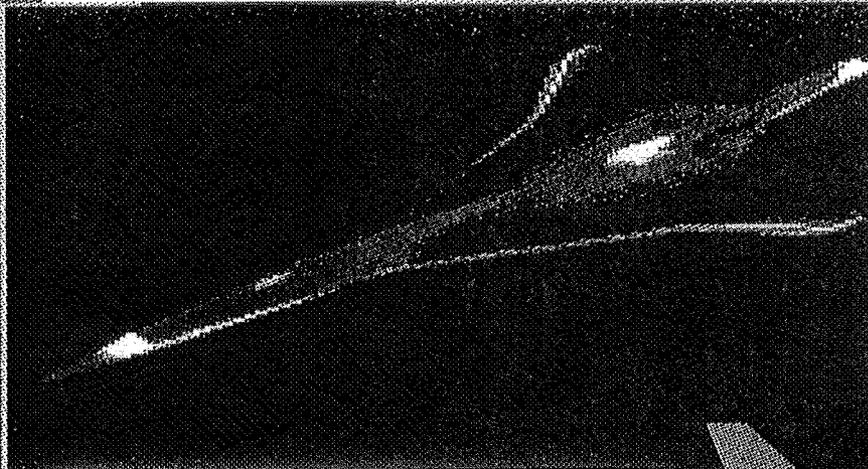
- The ILIAD Knowbot is a smart system of Internet services
- ILIAD augments 3-8 grade curriculum
- Teachers activate ILIAD from all types of existing classroom computers by sending email to a server computer

Kindergarten through 12th Grade (K-12) Education Project
Information Infrastructure Technology and Applications



Instructional Materials
Aeronautics

**NASA Ames Research Center IITA K-12
Education, Training and Lifelong Learning in Aeronautics
Cooperative Agreement Notice**



Soliciting projects that make innovative use of the Internet to teach math, science, engineering and technology using examples drawn from aeronautics.



- Solicitation Released Nov. 18, 1994.
- Proposals Received Feb. 15, 1995.
- Initial Awards planned for June 1995.

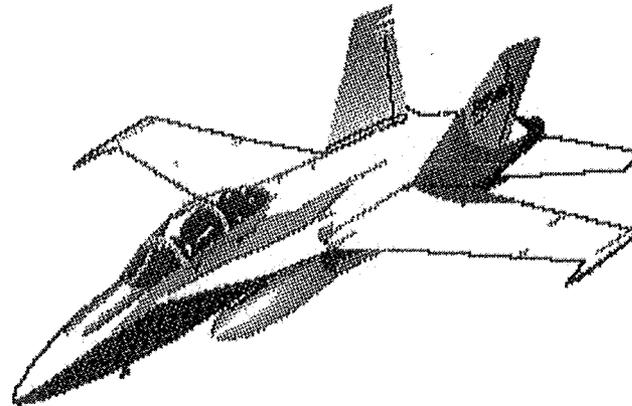
Kindergarten through 12th Grade (K-12) Education Project
Information Infrastructure Technology and Applications



Instructional Materials

Aeronautics

**NASA Dryden Flight Research Center IITA K-12
Flight Opportunities for Science Teacher EnRichment (Foster)**



On-line with the F-18 Systems Research Aircraft.

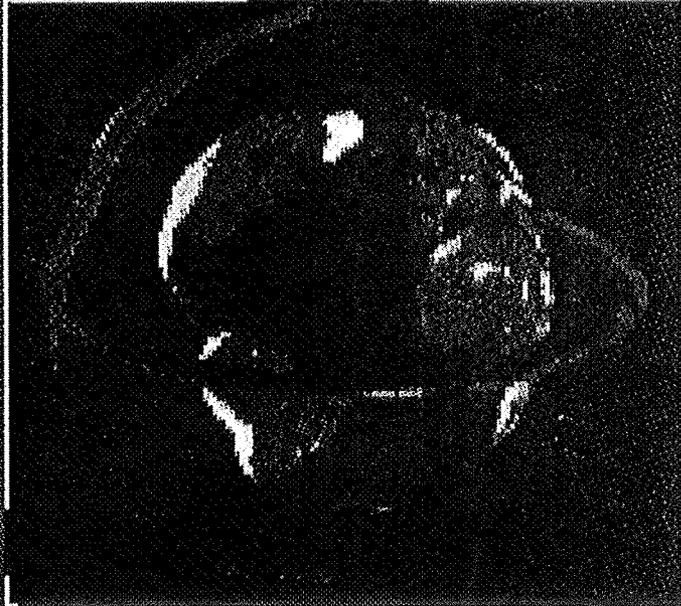
- Enable students to use Email to ask questions of NASA test pilots.

Kindergarten through 12th Grade (K-12) Education Project
Information Infrastructure Technology and Applications



Instructional Materials
Environment

**NASA Goddard Space Flight Center (GSFC) IITA K-12
Environmental Science**



A partnership has been formed between GSFC and the State of Maryland to use the Internet as a medium for revamping Maryland's environmental science instruction.

- Environmental science instruction has been identified as a strategic focus for Maryland schools.
- Environmental science instruction is a critical part of the State of Maryland's curriculum at the 6th & 7th, and the 10th & 11th grade levels.
- Concerns about the environmental health of the Chesapeake Bay drives Maryland's interest in the environment.

Additionally, the IITA Public Use of Remote Sensing Cooperative Agreement Notice from GSFC has funded 10 education projects dispersed throughout the United States.

Kindergarten through 12th Grade (K-12) Education Project
Information Infrastructure Technology and Applications



Instructional Materials Environment

NASA Goddard Space Flight Center (GSFC) IITA K-12 Environmental Science

“Ecologica”

a two semester research course in Earth system science for high school students.

*F. Mahootian, PI
M. Keeler, PI*

Working collaboratively in teams, students at **Gonzaga High School in Washington, DC** investigate the Earth system by conducting extensive background research and modeling the Earth system using remotely sensed data.



Data sources:
GISS, GSFC, JPL, LaRC,
National Geophysical Data
Center, ORNL

Internet

on MOSAIC
<http://www.circles.org/>

Ecologica is a computer-mediated, network-based, and uses NASA data and computational resources.

Each Ecological project publishes a hypermedia final report on the World Wide Web using Mosaic.

**Kindergarten through 12th Grade (K-12) Education Project
Information Infrastructure Technology and Applications**

The Earth System

Project Areas

Modeling and Simulation



STELLA model of the ozone cycle

Biosphere

- Biosphere/Atmosphere Interaction*
- Biosphere/Hydrosphere Interaction*
- Biodiversity*



CZCS Global Ocean Chlorophyll from GSFC DAAC

Atmosphere

- Energy Budget*
- Ozone Distribution*



SAGE II from LaRC DAAC



AVHRR Sea Surface Temperature from JPL PO DAAC

Hydrosphere

- El Niño*
- Ocean pH*
- Ocean Salinity*



Instructional Materials Internet Use

NASA Ames Research Center IITA K-12 Videos for the K-12 Community

Past

Present

Future

Produced two inspirational videos in FY94

- *Global Quest: The Internet In The Classroom*
 - » Educates the K-12 community on the benefits of the Internet in the classroom
 - » All-time most requested NASA educational video

- *Connecting to the Future: Building Educational Networks*

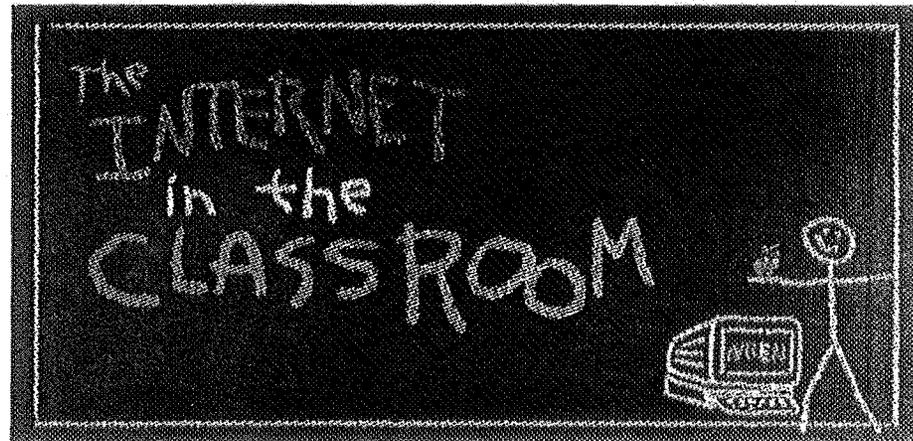
- » Assists community in making effective decisions about network implementation
- » Co-produced with the U.S. Dept. Educ
- » Accompanied by a detailed handbook

Producing innovative training video in FY95

- *Destination Everywhere*
 - » Trains in using the Internet to foster active learning
 - » Covers major Internet tools: email, mail lists, news, Gopher, Telnet, FTP, and World Wide Web

Future plans

- *videos on the benefits of the Internet for K-12 education*
- *videos that help educators integrate Internet resources into classrooms and curricula*

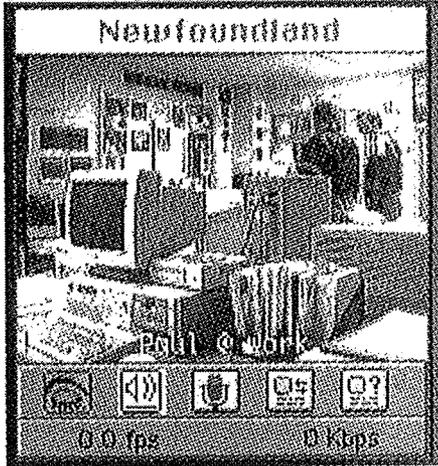
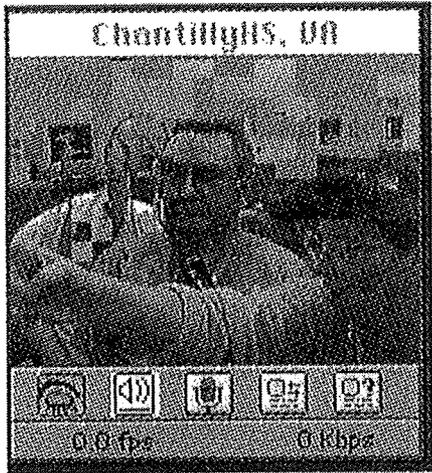


Kindergarten through 12th Grade (K-12) Education Project
Information Infrastructure Technology and Applications



Instructional Materials Internet Use

NASA Lewis Research Center IITA K-12 Desktop Video Conferencing using the Internet





NASA Ames Research Center IITA K-12 Quest Information Server

Instructional Materials Internet Use

Gopher, FTP and World Wide Web (WWW)
access for all Internet users

Targeted to K-12 teachers involved in
classroom restructuring, Goals 2000
(federal/ state/ local reform initiative)

Hosts interactive online science projects like
Live From Antarctica

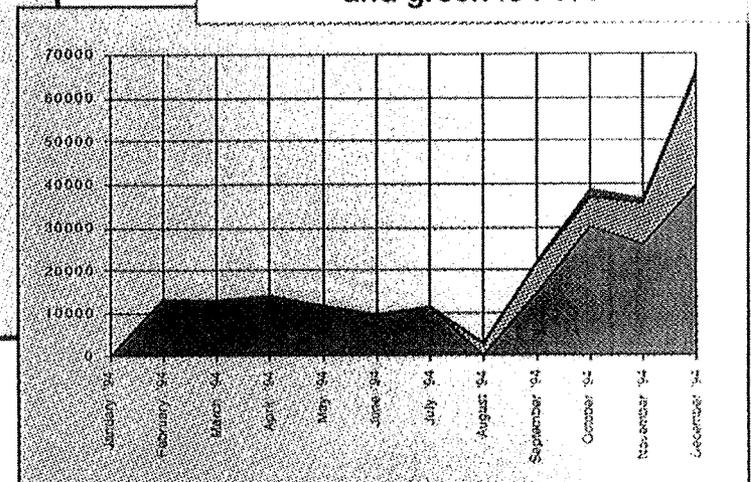
Hosts email accounts and email lists for K-12
educator community

Library of professional development resources

Pointers to NASA and non-NASA educational
resources

Internet Address:
quest.arc.nasa.gov

Number of files transferred from
Quest in calendar year 1994.
Blue area is Gopher, red is WWW,
and green is FTP.

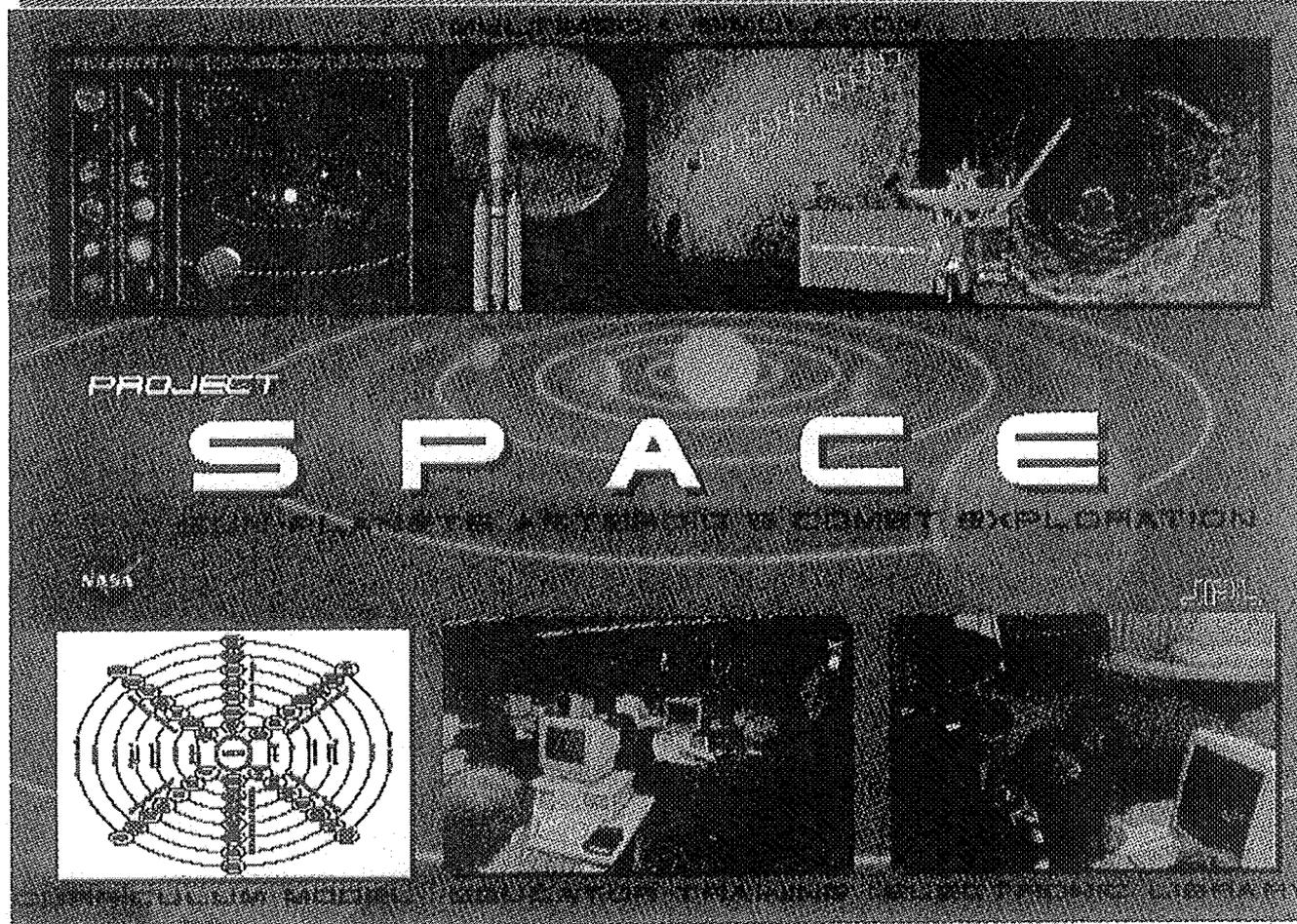




Instructional Materials

Space

NASA Jet Propulsion Laboratory IITA K-12 Project Sun, Planets, Asteroid & Comet Exploration





Sharing NASA Career Experiences

NASA Ames Research Center IITA K-12 Sharing NASA with the Classroom

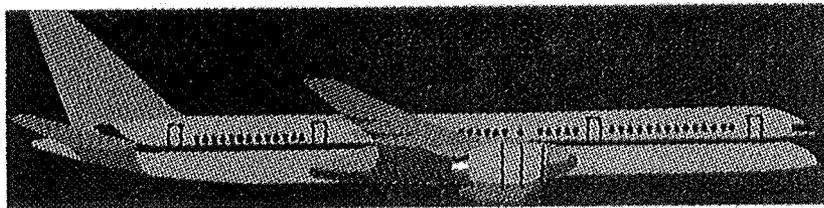
Produce interactive projects in which students can work with scientists and support personnel via the Internet



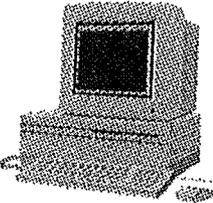
- *Live From ... Other Worlds*, with virtual reality researchers in Antarctica, incorporated television, on-line, and print media.

- *Live From Antarctica* used volunteers to process email; demonstrated scalable model for future projects. More than 700 teachers participated.

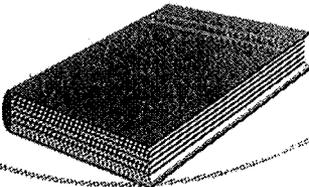
- *FOSTER On-line*, with airborne astronomers, served several hundred classrooms via email.



Develop tools, software and methods to make future projects easier to implement, thus allowing others to organize similar projects



Published white paper on lessons learned:
[gopher://quest.arc.nasa.gov:70/11/projects/white paper](mailto:gopher://quest.arc.nasa.gov:70/11/projects/white%20paper)



Kindergarten through 12th Grade (K-12) Education Project
Information Infrastructure Technology and Applications



FY 94 ACCOMPLISHMENTS

Technology

Developed, tested, and evaluated an internet connection model using 20 computers linked by high speed modems over a single voice phone line. This approach is now being used by the New Horizons consortium to connect 130 school buildings in eastern Virginia. (Langley Research Center)

Implemented a pilot demonstration using radio frequency spread spectrum technology to connect Cleveland East Technical High School with the Internet. (Lewis Research Center)

Designed a knowledge robot, an automated information search tool, and released it to 100 schools linked to the Texas Education Network. (Johnson Space Center)

Information Servers

Implemented and updated the Quest information server, providing Internet accessible education information (especially on how to use the Internet), special interest mail lists, and toll free access accounts for 200 educators across the country. Over 400 toll free access accounts are now in service (Feb. 1995), including 100 accounts offered through the Native Indian Education Association. (Ames Research Center)

Implemented an on-line electronic library of Teacher Resource Center materials. (Jet Propulsion Laboratory)

Published educational training and testing materials, including a 9th grade proficiency test, on the Internet using Mosaic. (Lewis Research Center)



FY 94 ACCOMPLISHMENTS

Curriculum Materials

Supported the Mendocino Unified School District in the creation of 20 educational modules on a variety of subjects. (Ames Research Center)

Implemented an earth science course, "Ecologica," at Gonzaga College High School in Washington, D.C. (Goddard Space Flight Center)

Developed and demonstrated Project Sun, Planets, and Comet Exploration (SPACE), a multi-media planetary mission design and analysis learning experience for students. (Jet Propulsion Laboratory)

Implemented a supercomputing course at Barberton High School in Akron, Ohio. (Lewis Research Center)

Implemented a Geographical Information System (GIS) training course at Bugoneshigee School in Cass Lake, Minnesota. (Lewis Research Center)

Sharing NASA Career Experiences

Conducted FOSTER On-Line, where students conducted email interactions with NASA airborne astronomers. (Ames Research Center)

Conducted "Live from Antarctica," where students conducted email interactions with NASA virtual reality researchers in Antarctica. (Ames Research Center)

Kindergarten through 12th Grade (K-12) Education Project
Information Infrastructure Technology and Applications





FY 94 ACCOMPLISHMENTS

Teacher Training

Worked with the Monta Vista High School, Cupertino, California, to develop and release the publications "Teacher's Resource Guide" and "Teaching a Class on the Internet." (Ames Research Center)

Conducted a four week Internet and earth science training course for 24 teachers (1 representative from each school district in Maryland). (Goddard Space Flight Center)

Provided Internet training to 13 teachers, who in turn have trained over 300 teachers in their districts. (Langley Research Center)

Trained 12 teachers in a 2 week Internet course. (Lewis Research Center)

Internet Training Videos

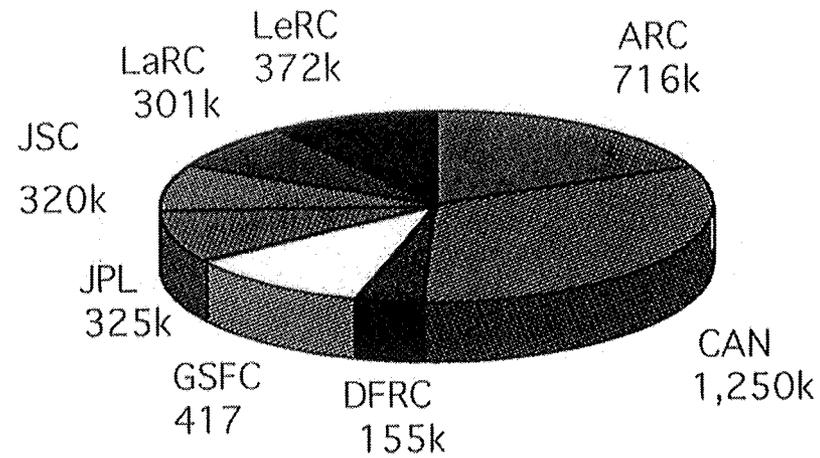
Produced the video "Global Quest: The Internet in the Classroom," NASA's most requested education video. It has played on PBS stations throughout the country. (Ames Research Center)

Produced the video "Connecting to the Future," a step-by-step guide to implementing instructional networks. (Ames Research Center)



IITA K-12 Education Project Budget (\$3.8M in FY 1995)

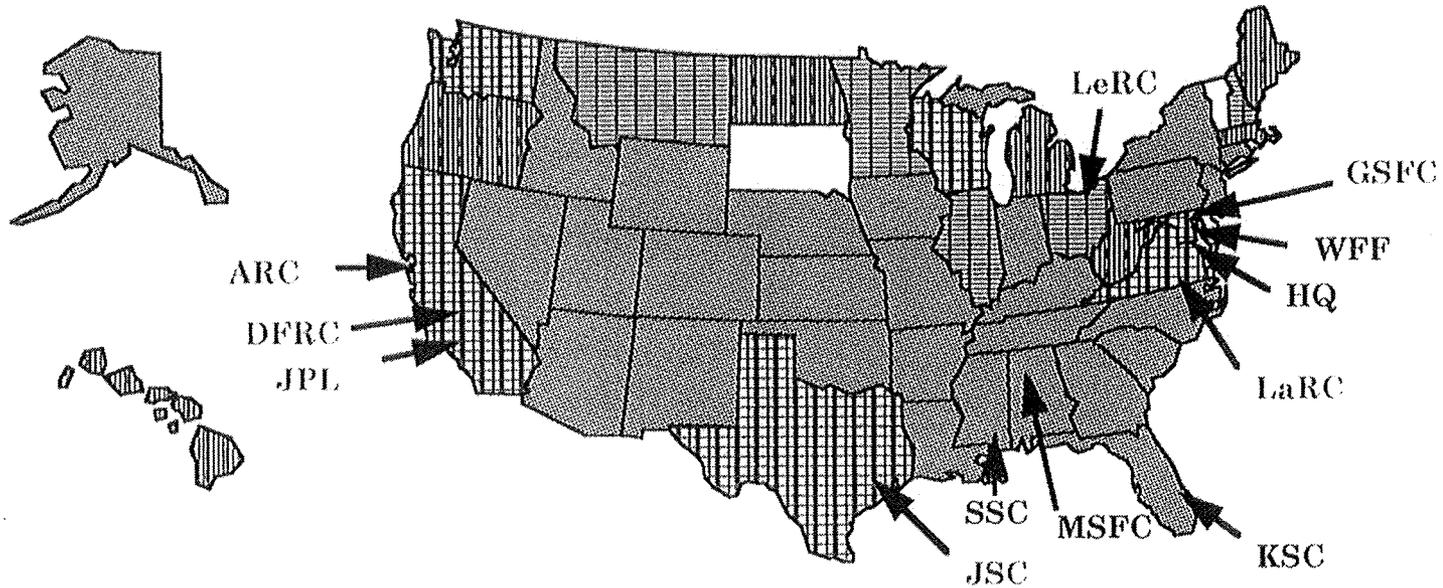
Budget by Center



Kindergarten through 12th Grade (K-12) Education Project
Information Infrastructure Technology and Applications



OUTREACH IN NASA'S IITA K-12 PROJECT



-  IITA K-12 Project Partner Schools & Education Activities funded through IITA Remote Sensing Database CAN
-  IITA K-12 Project Partner Schools
-  Education Activities funded through IITA Remote Sensing Database CAN
-  IITA K-12 Affiliated Projects and Internet 800 Dial Up Accounts

NASA Centers with IITA K-12 Tasks are in red

Kindergarten through 12th Grade (K-12) Education Project
Information Infrastructure Technology and Applications

Internet Videotapes

The NASA K-12 Internet Initiative produces public-domain videos about the Internet. These videos may be freely duplicated for education. Further information about these and future titles is available by sending E-Mail to info-video@quest.arc.nasa.gov

"Global Quest: The Internet in the Classroom"

This first video describes why the Internet is an amazing school resource. The 12-minute format is designed as a tool for Internet advocates to help convince their colleagues to invest time in the technology. Since its release in October 1993, *Global Quest* has aired on numerous PBS stations and has become NASA's all-time most popular educational video.

"Connecting To The Future"

The second video provides guidance for schools considering Internet connectivity. The video discusses the different issues and options that will be faced by a school seeking access to the Internet. The video recognizes the complexity involved in connecting to the network and assists technology planners in making effective decisions.

The 22-minute video was co-produced by NASA and the U.S. Department of Education. *Connecting to the Future* is also accompanied by a handbook providing more details and background information.

These products are available from three sources:

NASA's Central Operation of Resources for Educators (CORE) will mail these videos to you for a fee that covers costs for duplication, shipping and handling. *Global Quest* costs \$19.50 and *Connecting to the Future* costs \$26.50. To contact CORE:

NASA CORE, Lorain County Joint Vocational School
15181 Route 58 South, Oberlin, OH 44074
Phone: (216) 774-1051, x293/294

Free duplication from high-quality masters is available at your nearest NASA Teacher Resource Center (TRC) or Regional TRC. To locate these facilities, contact the Education Office of the nearest NASA center.

NASA Television broadcasts these videos occasionally during their Educational programming. A program schedule can be found on Spacelink (see below). NASA Television is available via satellite; it also may be available on local cable or educational TV systems.

Online Science and Math Resources

NASA computers are filled with information targeted for teachers interested in science, math, Internet and NASA topics. Use Gopher or the Web to access the information on these computers.

quest.arc.nasa.gov

This is the online home for the NASA K-12 Internet Initiative. This computer houses curriculum supplements for teachers, original Internet-related documents, information about educational reform and archives of interactive projects. Quest is also rich in pointers to other NASA and education resources and is a good starting point for online NASA explorations. For Gopher use quest.arc.nasa.gov; for Web use <http://quest.arc.nasa.gov>

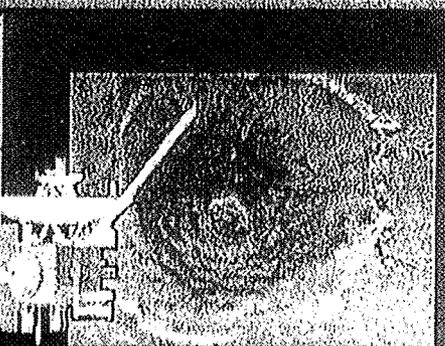
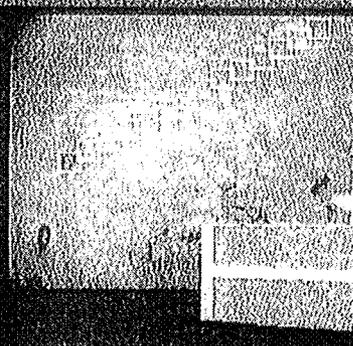
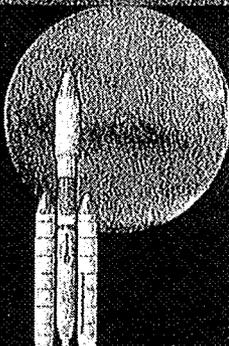
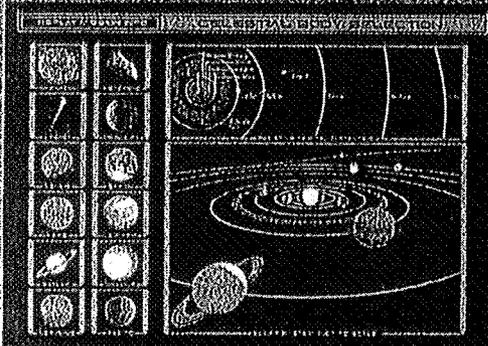
spacelink.msfc.nasa.gov

This is another excellent resource for K-12. It houses a tremendous collection of current (updated daily) and historical information about NASA's projects and missions, including the shuttle. It also contains information about NASA educational programs, images and other goodies. For Gopher use spacelink.msfc.nasa.gov; for Web use <http://spacelink.msfc.nasa.gov>

Jet Propulsion Laboratory

Steve Barba, Gil Clark
& Rich Alvidrez

SPACE
Sun Planets Asteroid Comet
Exploration



MULTIMEDIA SIMULATION

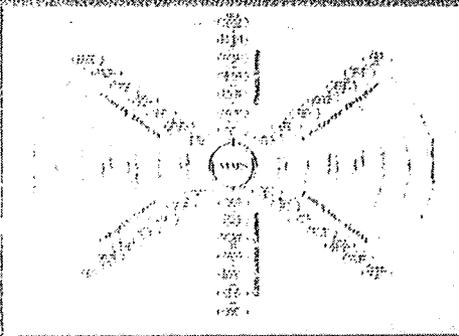
PROJECT

SPACE

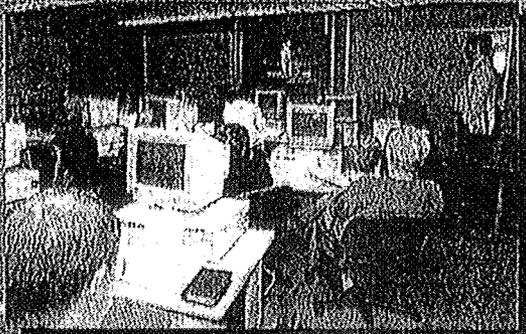
SUN PLANETS ASTEROID COMET EXPLORATION

NASA

JPL



CURRICULUM MODEL



EDUCATOR TRAINING



ELECTRONIC LIBRARY

Project S P A C E
Sun Planets Asteroids Comets Exploration

Goal

To use advanced educational technology and methods that provide teachers and students with an enriched opportunity to learn how NASA solar system exploration projects are planned, developed, and carried out.

Philosophy

“Don’t give fish, give fishing pole.”

Project SPACE

Objectives

- **Develop methods which integrate science concepts and NASA mission objectives into a curriculum model, which is consistent with California state frameworks and national standards.**
- **Educate teachers how to use current technologies and NASA mission data to teach basic science.**
- **Provide teachers and students with high-end computer simulations that use current multimedia technology to demonstrate science concepts.**
- **Maintain an electronic curriculum products library that integrates data from NASA missions. Make curriculum products that are accessible and easy to update.**

Project SPACE

SPACE Components:

Curriculum Support

Curriculum drives learning. Teachers use before, during, and after simulation ("Web" curriculum model).

Teacher Enhancement

TRC in-service training (Model technology classroom), demonstration and development of new curriculum models.

Simulation - Multimedia

High-end computer application (Interactive space exploration) is an extension of the curriculum.

Electronic Library

Curricula made available via the Internet (Web - home page interface), data integrated from every NASA mission.

Project SPACE NASA's Educational Programs Categories

Teacher Faculty Preparation and Enhancement

**In-service Program, Follow-up Curriculum Products,
Educator Workshops & Conferences**

Curriculum Support

"WEB" Curriculum Model, Electronic Curriculum Library, CD-ROM's

Systemic Change

**Partnerships, New curriculum Models, technology applications to
curriculum, model technology classrooms, teacher education &
in-service programs**

Student Support

**Project Space Simulation, Student Hands-On Products, Electronic
Library, CD-ROM's**

Educational Technology

**Project Space, model technology assisted classrooms,
Electronic Library, CD-ROM's, teacher education & inservice programs**

Project SPACE - Internal Partnerships

- **High Performance Computing & Communications (HPCC)**
Simulation & Multimedia
Model Technology Classroom Networking
Electronic Curriculum Library
- **Management & Technical User Applications (ICIS)**
Simulation & Multimedia, Telecomputing, and
Model Technology Classrooms
- **Imaging & Spectrometry Systems Section**
Imaging, Mapping, and Design Tools
- **Planetary Data System**
Image & Data Content
CD-ROM Design
- **Advanced Lab for Parallel High Performance Applications
(ALPHA Project)**
3D Visualization
- **Mission Design Section**
Systems Engineering Design (Project QUICK)
- **NSCAT**
Model Curriculum

Project SPACE

Announces

New Home Page Name and Address

**JPL Learning Link
<http://learn.jpl.nasa.gov>**

**For more info:
seaberry@jpl.nasa.gov**

Project SPACE

Status:

- **Curriculum Products Library (on line)**
Curriculum "WEB" model Products, June, '95
JPL Learning Link, <http://learn.jpl.nasa.gov>
- **SPACE Simulation**
Alpha Testing & Evaluation, June, '95
Mars Phase On-line, Fall, '95
- **Curriculum Products**
Curriculum "WEB" model products, June, '95
- **SPACE Training**
Teacher In-service program, August, '95
Model Technology Classroom, August, '95

Telescopes In Education
- TIE -

AN EDUCATIONAL OUTREACH PROGRAM

SPONSORED BY

NASA IITA

JPL SUPERCOMPUTING PROJECT

NASA CODE "S"

AND

MOUNT WILSON INSTITUTE

Telescopes In Education
- TIE -

Founded and Directed
by
Gil Clark
of

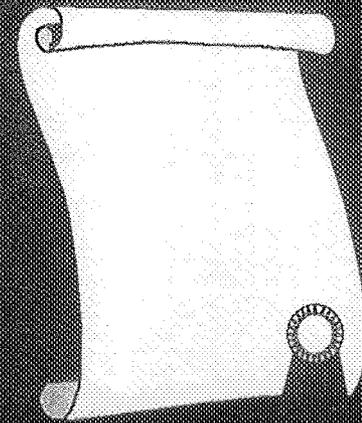
Telescopes In Education

- TIE -

The TIE program is designed to make research grade telescopes and the data they produce available to schools and amateur astronomers across the country

Telescopes In Education - TIE -

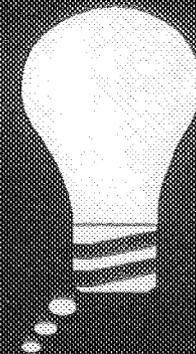
We invite you to become part of a unique program that is bringing an exciting, hands-on educational experience in science, mathematics, and computing to classrooms across the United States.



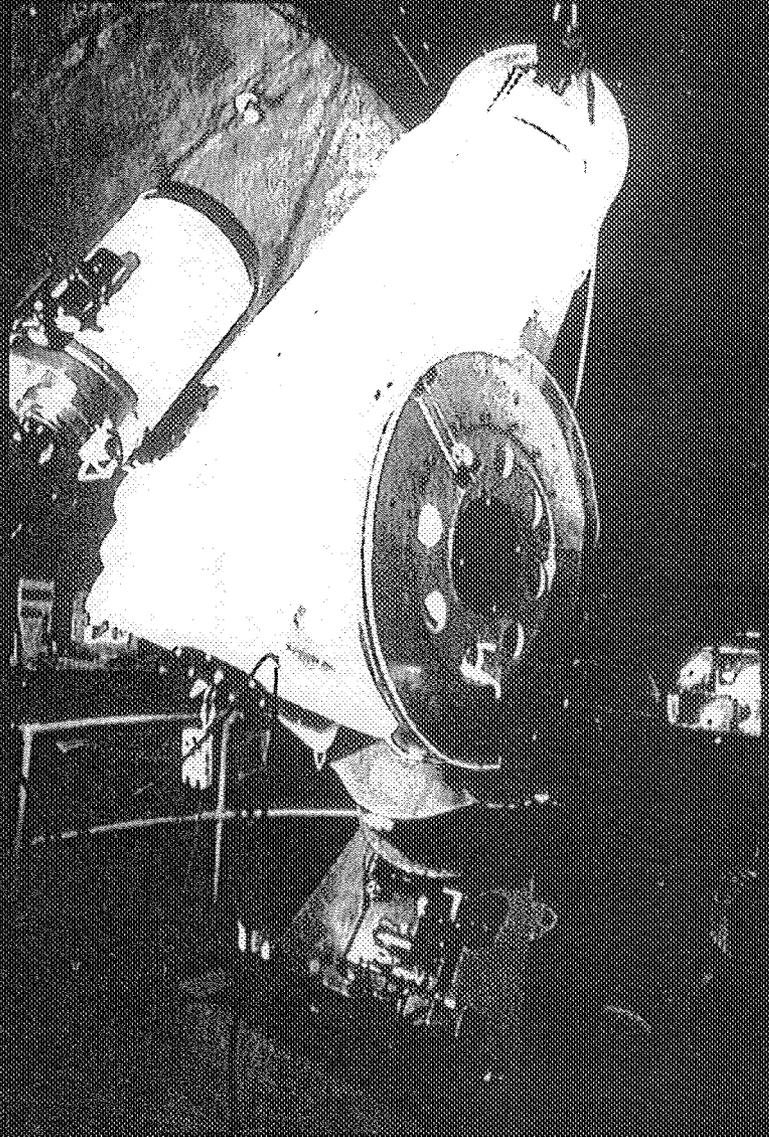
Telescopes In Education - TIE -

**Imagine . . . your students
controlling a 24" research-
grade telescope, located at
Mount Wilson, California . .**

. . . . from your classroom.



**The
Mount
Wilson
24"
Telescope**



M-1 The Crab Nebula

The result of a massive supernova



M-101 Galaxy

(All images taken with the Mt Wilson 24" telescope)



What is needed?

HARDWARE

IBM 386/486 or PC compatible

Modem: 9600 baud or faster

Phone line

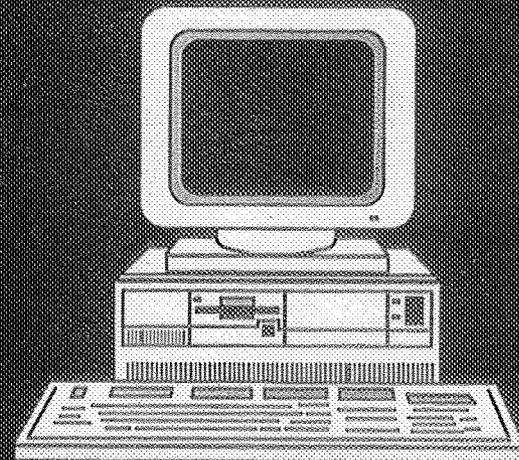
SVGA monitor and driver card

4 Megabyte RAM

SOFTWARE

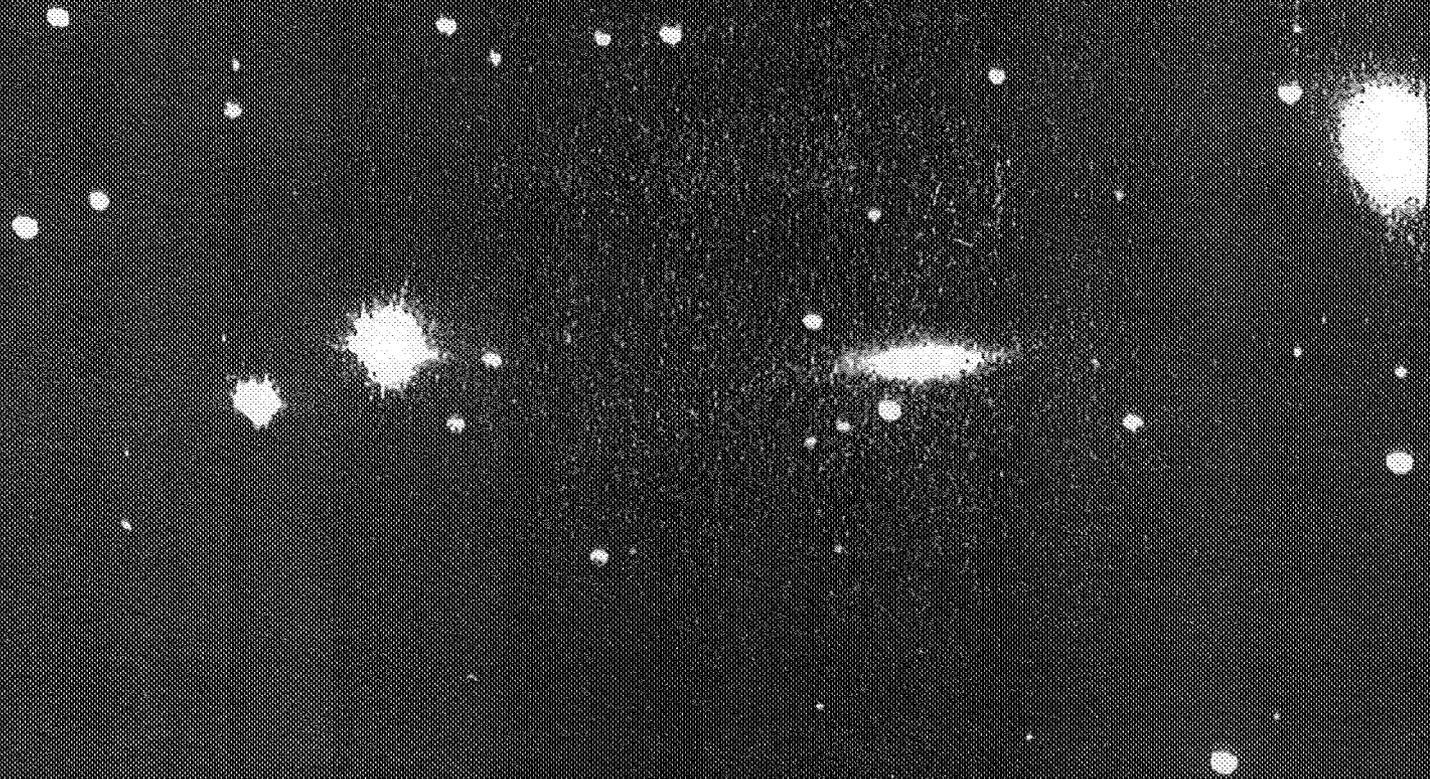
TheSky & SkyPro

Windows 3.1



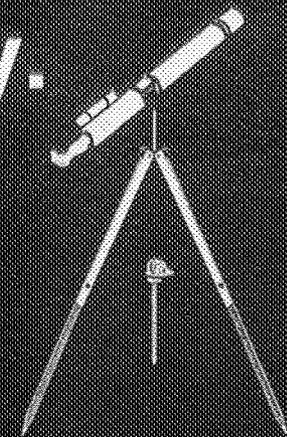
NGC 5560

Another distant galaxy



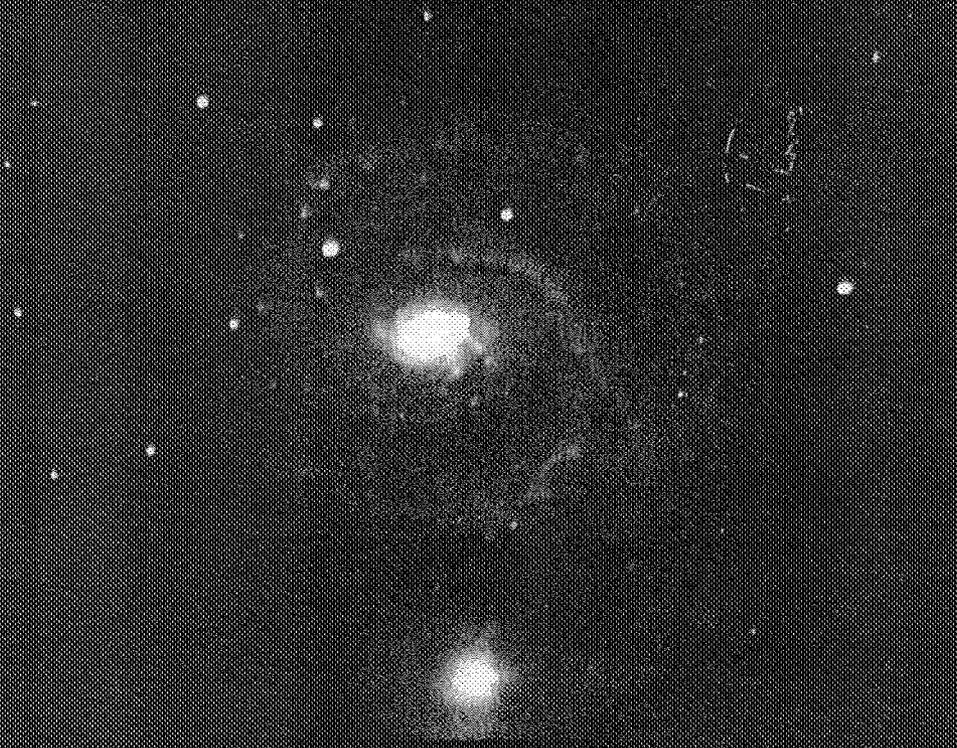
Teacher Workshops

**Mt Wilson Institute's
Telescopes In Education (TIE)
program wants to welcome
you to the exciting world of
observational astronomy.**



M51 - WHIRLPOOL GALAXY

An example of interacting galaxies



Teacher Workshops

Who can attend?

Educators and teachers interested in learning more about the TIE program

What do you bring?

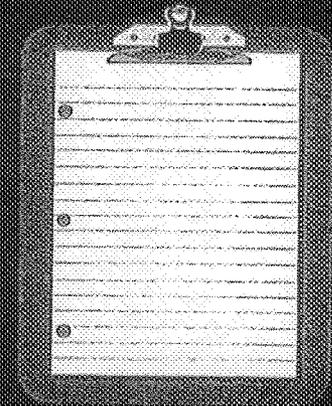
An interest in astronomy, a notebook and pencil to take notes, and a camera (optional)

Where are the workshops held

Workshops are held at the Mount Wilson Observatory

Cost of Attendance?

No cost to educators



M-81 Spiral Galaxy in Ursa
Major



Teacher Workshops

- May 6
- May 20
- June 3
- June 24
- July 8
- July 22

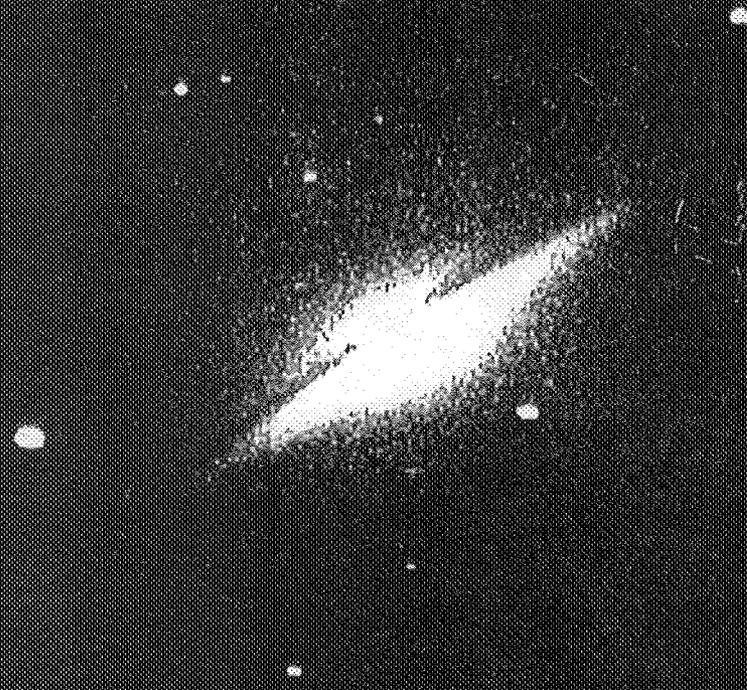


2:00 p.m. - 5:00 p.m.

Mount Wilson Observatory

NGC-4594 Sombrero Galaxy

Notice the dust lanes across this edge-on galaxy



Telescopes In Education
- TIE -

Contact:

Telescopes In Education

Box 24

Mt. Wilson, CA 91023

Phone # (818) 793-3100

Fax # (818) 793-4570

email: tie@mtwilson.edu

Telescopes In Education
- TIE -

<http://www.mtwilson.edu/tie>

Teacher BBS: (818) 354-0617

Amateur BBS: (818) 354-0629

NSA

51-80

92989

250672

13P.

Goddard Space Flight Center

Jim Latham

*1994 Maryland/GSFC Earth &
Environmental Science Teacher
Ambassador Program*

1994 MARYLAND/GSFC EARTH
AND ENVIRONMENTAL SCIENCE
TEACHER AMBASSADOR
PROGRAM

NOVEMBER 15, 1994

Richard Crone
Project Director

James W. Latham
Principal Investigator

ABSTRACT

This Maryland/GSFC Earth and Environmental Science Teacher Ambassador Program was designed to enhance classroom instruction in the earth and environmental science programs in the secondary schools of the state of Maryland.

In October 1992 more than 100 school system administrators from the twenty four local Maryland school systems, the Maryland State Department of Education, and the University of Maryland met with NASA Goddard Space Flight Center Scientists and Education Officers to propose a cooperative state wide secondary school science teaching enhancement initiative. State level goals for earth and environmental science as well as student outcomes for these areas had recently been enacted into law in Maryland. A testing program to determine student performance was being developed. At the same time science programs for teaching these earth science concepts in the secondary schools of the state were either not present or were not well defined.

The Goddard Space Flight Center had a well established history of providing high quality resources and programs to enhance the education of both teachers and students. They also because of their role in the NASA program, MISSION TO PLANET EARTH, had many outstanding scientists and engineers working in the earth and environmental sciences who could contribute to this educational endeavor.

The University of Maryland had for more than twenty years been recognized for their work in curriculum development and teacher education in the earth sciences.

It was the belief of those assembled that by working together the teaching of the earth and environmental sciences in the secondary schools of Maryland could be enhanced. This program was an outgrowth of that meeting.

A four week summer residential institute was held at the GSFC and the University of Maryland. Students were enrolled in a graduate level geology course at the university and earned six credits for successfully completing the program. Participants learned how earth systems are studied both from

the ground and from space. They designed and conducted ground station earth monitoring projects at the institute and are continuing those projects during the school year with their students. They learned about the Maryland environment and how to use High Performance Computing and Communications equipment to gather and share information. In their school they have access to this equipment and to electronic networks and bulletin boards. Each teacher has a connection to the Internet. One GSFC Scientist is assigned to each teacher as a advisor. Each worked with the teacher during the institute and continues to assist them during the school year. Eight one day seminars are being held for the participants during the school year.

Each teacher is serving as an ambassador for earth science teaching enhancement in their respective school and local school system.

THE MARYLAND/GSFC EARTH AND ENVIRONMENTAL SCIENCE TEACHER AMBASSADOR PROGRAM

OVERVIEW

In October 1992 more than 100 school system administrators from the twenty four local Maryland school systems, the Maryland State Department of Education, and the University of Maryland met with NASA Goddard Space Flight Center Scientists and Education Officers to propose a cooperative state wide secondary school science teaching enhancement initiative. State level goals for earth and environmental science as well as student outcomes for these areas had recently been enacted into law in Maryland. A testing program to determine student performance was being developed.

The educators present recognized that earth science programs were not well established in the state and that many teachers lacked the current knowledge and skills needed to help students achieve the state outcomes. It was hoped by the educators assembled that the GSFC science resources in the Mission to Planet Earth Program (the Earth Science Directorate), the High Performance Computing and Communications Program, and the Educational Programs Office might join forces with them to enhance instruction in these areas of science.

A state steering committee was formed to plan an initiative. An institute which would train in the summer of 1994 one earth science teacher from each of the 24 local school systems in a four week program at GSFC and the University of Maryland was proposed. Following the 1994 summer program the teachers would return to their schools and use the knowledge from the institute and new technologies to improve instruction in their respective classes. Each teacher would serve as an ambassador or resource to other teachers in their school and school system for earth science teaching enhancement. In the summers of 1995 and 1996 forty eight additional teachers would receive similar training.

This Maryland/GSFC Earth And Environmental Science Teacher Ambassador Program is an outgrowth of that conference and the work of the steering committee.

INSTITUTE DESIGN

This is a four week summer residential institute which was held at the GSFC and the University of Maryland. Students were enrolled in a graduate level geology course at the university and earned six credits for successfully completing the program. Participants learned how earth systems are studied both from the ground and from space. They designed and conducted a ground station earth monitoring project at the institute and continue it during the school year with their students. They learned about the Maryland environment and how to use High Performance Computing and Communications equipment to gather and share information. In their school they have access to this equipment and to electronic networks and bulletin boards. Each teacher has a connection to the Internet. One GSFC Scientist is assigned to each teacher as an advisor. Each worked with the teacher during the institute and is assisting them during the school year. Eight one day seminars will be held for the ambassadors during the current school year.

GOALS AND OBJECTIVES

Goal:

To enhance the classroom instruction in the earth and environmental science programs in the secondary schools of the state of Maryland.

Objectives:

As a result of this program each teacher participant will be expected to:

- Understand how earth systems can be studied from space and how data gathered in this manner can be used to enhance earth and environmental science teaching. They will learn how to gather and use ground station environmental data and how to access and use satellite data.
- Identify how to use computers and computer networks to enhance earth and environmental science teaching.

investigator. Each was a two day program held in Washington, DC. The institutes were conducted by the National Center For Improving Science Education. The first was held in the spring of 1994. It focused on the use of a planning template to be used in planning the summer program for teachers. The second was held in September of 1994. It provided assistance in strategies for evaluating the program. These institutes were helpful. However they were a bit out of sequence with the work of this program. Much of the planning for the program had been completed by the time the first leadership training was provided. Also the evaluation strategies for this program had been designed and implemented by the time the evaluation training was provided.

Pilot Project:

A pilot project was conducted in three local schools prior to the institute. In it the computer equipment to be used by the institute participants was used by classroom teachers. Training models were tested and problems encountered relating to teacher skill levels were identified. The training provided to the summer participants was modified in accordance with the findings from the pilot project.

Planning Template:

A planning template was provided by the National Center For Improving Science Education. It was used as one of the planning tools. In the template are identified components of effective practice. For each component we identified our intended program activity and after the program was conducted described what actually was done. The template was helpful but some of the component areas identified in it seemed to overlap with others. Instruction about how to fill out the actual program column needed more clarification. A copy of the project planning template is provided as Attachment B.

FUNDING

Funding for this program was a cooperative venture involving NASA, The University of Maryland, The U. S. Department of

candidates were to include male, female, and minority representation.

The applications were returned to the Maryland State Department of Education. The Department followed-up to see that the applications were received on time and that the necessary information was provided with each application.

The selection of teacher ambassadors was made by a team of local assistant superintendents. Each school system was allowed one participant. This selection process was used to assure a balance of minority, male, and female representation in the program.

Because of funding approval delays the recruiting process was started late. Some of the teachers identified as good candidates for this program had made other commitments for the summer and thus were not available. Some of the school systems were not able to identify three candidates. Four school systems did not identify any candidates. Therefore, four school systems were granted permission to have two teachers participate in the program. Some of the teachers identified did not have the minimum skill level specified in the requirements of the application packet.

The recruiting materials are provided as Attachment A.

These Teacher Ambassadors were secondary school teachers of earth and environmental science. They represented 20 of the 24 local school systems in the state of Maryland. Seventy five percent of them taught at the high school level and the remaining 25 percent taught at the middle school level. The schools in which they teach are described as 61% rural, 2% urban but not inner city, 1 % urban inner city, and 36% suburban. The ethnic composition of the schools they represented was Asian 4%, Hispanic 2%, Black 33%, and White 61%.

SUMMER PROGRAM

This was a four week residential institute for Maryland secondary school earth and environmental science teachers. It was conducted in June and July of 1994. The participants

Each participant received a Power Macintosh AV Computer with a CD ROM Disk Drive, Geoport, and Laser Printer, related software, and a number of CD ROM science images disks. They also received a TV/Video Monitor and a Laser Disk Player. Laser disks and operating software for using them were also provided. Two computer related handbooks were provided.

Some basic equipment for conducting the water budget profile and ozone monitoring experiments is being provided.

A telephone connection was provided each teacher's classroom. Funds to pay phone charges for one year were made available, as were four hours of commercial Internet access time each day.

Funds were provided to permit substitutes to be hired to free the teacher ambassadors to work with other teachers or to attend seminars held on school days. Reimbursement for travel costs related to seminar participation was provided.

Each school system assistant superintendent has worked closely with the local teacher ambassador to get their phones installed, to facilitate the implementation of the new strategies and technologies into their classroom instruction, and to provide opportunities for them to serve as an ambassador to other schools.

FISCAL MANAGEMENT

The Cecil County Public Schools served as the fiscal manager for this project. Dr. Wayne Carmean, the Assistant Superintendent for Instruction for the Cecil County Public Schools directed this activity. He was assisted by Mr. Steven Repole the school system's business officer.

All moneys related to this project were granted to this school system. The system made all of the purchases of goods and services and payments for the same.

This was all done without cost to the project and represented a substantial local school system contribution to a state-wide educational endeavor.

Help Desk:

A help desk has been established in the HPCC Program Branch at GSFC. The ambassadors can phone or contact this person by E-mail and get many of their computer related questions answered.

Principal Investigator:

The principal investigator maintains continuing contact with each ambassador. Site visits are made to the schools. Teacher plans and monthly reports are reviewed and suggestions made to each teacher ambassador. Monthly information mailings are sent to each teacher. The seminars are modified to address ideas and concerns gained through this continuing contact.

Teacher Resource Center:

The GSFC maintains a teacher resource center. The ambassadors were introduced to the resources of this facility during the summer institute. The director of the center attends the seminar sessions and introduces new materials available through the center. The center is available for teacher use during the school year.

EVALUATION AND FINDINGS

Several evaluation strategies were used with this program. They included a pre and post program survey provided by the National Center For Improving Science Teaching, weekly surveys designed by the principal investigator, a content survey designed by the University of Maryland Geology Department Representative, informal interviews with the participants, monthly reports from each ambassador, and seminar surveys designed by the principal investigator. Samples of these instrument are presented in ATTACHMENT E.

The Pre and Post Surveys

These instruments tried to provide a reading on the teacher's attitudes toward science teaching practices and to determine if there was a change in attitude between the start and end of

which their grade would be based. Even though it was explained as an instrument to see how effective we had been in delivering this portion of the institute it was not generally accepted as such.

Principal Investigator Observations:

The pace was fast and intense. Teachers appeared to maintain a high level of enthusiasm, dedication, and interest. This was demonstrated by their early arrival to the site, working through the lunch hour, being at sessions on time, questions asked of instructors and suggestions made, and remaining at the site long after the day's program had officially ended. You could see some exhaustion beginning to set in during the last two days of the program.

The enthusiasm has been high in the first two fall seminars. The monthly reports indicate that many of the content ideas are being implemented, the technology is being used extensively, and the teachers are making presentations to teachers in their schools, and teachers and administrators in their school systems. The local school assistant superintendents have reported that they are pleased with the present impact of the program and have established a task force to plan another institute for 1995.

ISSUES AND RECOMMENDATIONS

Issue: Late Receipt of the Funding

Some of the funding for this program was not available until early June. This made it very difficult to secure the materials and consultants needed to support the program.

Recommendation:

Funding should be awarded to the fiscal management unit by no later than mid February.

Issue: Leadership Training Institute

The training cycle was out of line with the program timeline. The instruction about the use of the planning template as it

Issue: Program Delivery Coordination

Although both GSFC and The University of Maryland were members of the planning committee there were some differences in the programs each presented which made them at times appear to be two separate programs rather than components of one institute.

Recommendation:

More pre program planning would result in the program objectives being addressed by the two program components in a more complimentary manner.

The learning environment at the University made that program look like six hours of instruction in the same classroom. It is difficult to maintain a high level of interest and enthusiasm in that environment. Interspersing some learning in places other than that one site would help break this up. The field trips did this. However there should be some daily variety.

Issue: Internet Access

Providing access to the Internet for the teachers has been a problem. None were connected prior to November. Some will not be connected until the first of next year. Three schools have not been provided with Internet access in the present model.

Recommendation:

The system now being designed should resolve the problem of access for most of the future school sites.

Contracting for commercial accounts in 1995 should be done in time for these accounts to be available to the teachers by 15 August 1995.

A conference of Maryland local and state level school administrators with representatives of NASA with expertise in Internet access should be held. The issue of providing schools Internet access in a cost effective manner needs to be addressed.

Maryland/Goddard Earth and Environmental Science Teacher Ambassadors Program

To enhance Earth and Environmental Science Education in the secondary schools of Maryland

Training and support

Internet access

Each school district receives a Macintosh AV computer system



Point to Point Protocol (PPP) software makes each Macintosh a fully functional Internet node via a 'local-call' dial-up

Earth Science Teacher Ambassadors from each of Maryland's 24 school districts



8 trips back to Goddard and U. of Maryland for supplementary training



Annual 4 week summer intensive Earth Science curriculum training sessions at Goddard and the University of Maryland

Maryland

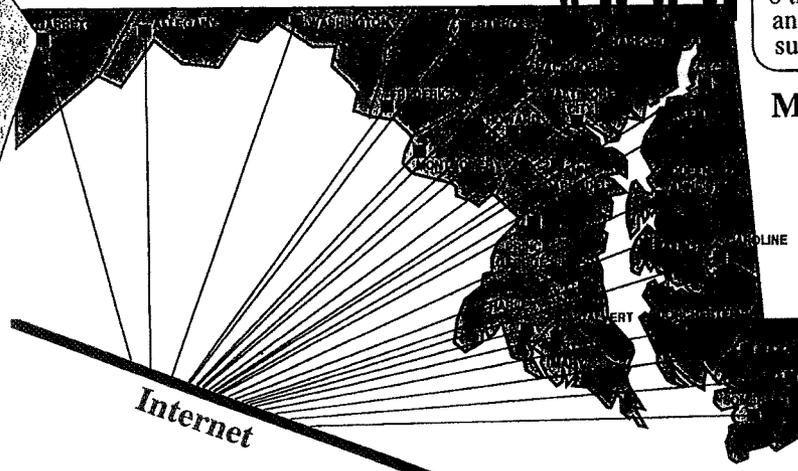


Trained in Internet and CD-ROM navigation, data access, and data interpretation techniques

Teacher Ambassadors train other teachers in their school district

Trained to conduct experiments during the year at their schools and share the results via Internet

2 years of electronic interaction and visits with assigned NASA scientist mentors



"Catalog of Internet Accessible Resources in the Earth and Environmental Sciences" Version 1.0

Partners:

- NASA Goddard Education Programs Office
- NASA/HPCC IITA Program
- NASA Goddard Earth Science Directorate
- All 24 Maryland local school districts
- Maryland State Department of Education
- University of Maryland
- Department of Energy
- Educational Programs Division, NASA HQ

100-70
P45

Ames Research Center

**Karen Traicoff, Kevin Jones
& Garth Hull**

*NASA Ames IITA K-12 Internet
Initiative*

***NASA Ames IITA K-12 Internet
Initiative***

**Karen Traicoff
Ames K-12 Products & Services
Group Leader
April 11, 1995
415-604-4066**

Ames K-12 Internet Initiative

- **Products and Services Group**
 - Sharing NASA with our Schools
 - Curriculum
 - Videos and Handbooks
 - Quest
- **Pilot Projects and Demonstrations Group**

Sharing NASA with our Schools

- **Interactive Projects serving schools**
- **Development to improve interactivity of projects**

What are Interactive Projects?

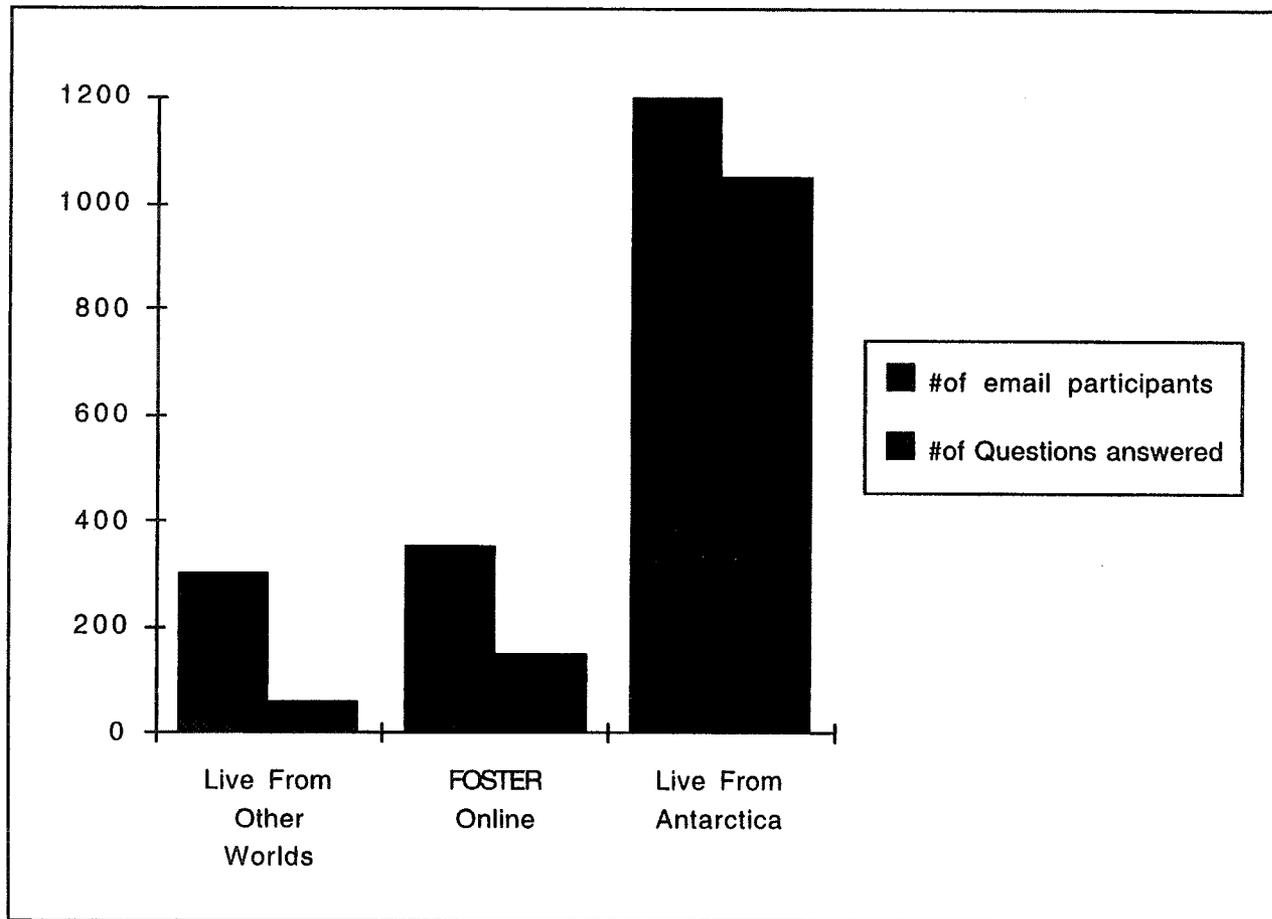
- **NASA science/technology projects become accessible to students**
- **Focus on people; capture enthusiasm**
- **Frequent updates from project**
- **Opportunities to send Email questions**
- **Background about project online**
- **Sometimes includes live TV**



Past Projects

- **Live From...Other Worlds**
 - Telepresence researchers in Antarctica
 - October '93 - February '94
 - Live Television
- **FOSTER Online**
 - Airborne astronomers
 - May-June, '94
- **Live From Antarctica**

Project Growth



Current Projects

- **TOPEX/Poseidon Online**
 - Ocean observing satellite
 - Opportunities to analyze data
- **F-18 SRA Online**
 - Systems Research Aircraft
 - Testing fly-by-light, advanced computer controls, etc.

Projects for Next Year

- **Live From the Stratosphere**
 - Airborne infrared astronomy
 - Early October '95
 - Friday evening flight covered on live television
- **Live From the Hubble Space Telescope**
 - Competition for HST observing time
 - Live television component

Development to improve projects

- **Serve larger audiences**
- **More efficient**
- **Easier on participants**
 - **Experts**
 - **Students/Teachers**
 - **Smart Filters**
- **Publish results**

Curriculum Development

- **Helps teachers to integrate resources available through the Internet into science and math learning**
- **Developed in-house and by partner schools**

Mendocino High School Curriculum

- **20 units - range of subjects**
- **Fits into California framework**
- **Online since September '94**

Watsonville CAD/CAM Curriculum

- **5 units of CAD/CAM curriculum for September '95**
- **5 units of aeronautics CAD/CAM curriculum for January '96**
- **Involve colleges and aeronautics industry**

Interactive Aeronautics Design Software

- **Software to design an aircraft**
- **Developed at Ames**
- **Tested in Ames Aerospace Encounter**

Videos and Handbooks

- ***Global Quest* video**
 - Promotes the use of the Internet in the classroom
- ***Connecting to the Future* video**
 - Assists in the development of a plan for the placement of the Internet in the classroom
- ***Connecting to the Future* handbook**
 - accompanies video to provide organizational structure
- ***Destination Everywhere* series**
 - Training videos for email, gopher, telnet, FTP, etc.

Quest

- **On-ramp to the information highway for:**
 - NASA IITA K-12 Program
 - NASA K-12 Internet Initiative (Ames)

What is Quest?

- **Server**
- **Information and resource distribution point (Web and text)**
 - How to use the net
 - Curriculum Supplements
 - About the K-12 Internet Initiative
 - CAN Information
- **Hub for online interactive projects**
- **Pointer to other resources**

Plans for the Future: Design

- **New Search Functions!**
 - Search Quest Easily
 - Search the Entire Web from Quest
- **New Interactive Functions!**
 - Features Customized for Each User
 - Authentication of User Access
- **New Graphical Interface!**
 - “Clickable” Map of Quest
 - New Icons and Exciting Graphics

Plans for the Future: Content

- **Education Reform**
 - More On-line Curriculum
 - More Internet Teaching Methods
- **On-line Flight Community**
 - On-line Flight Education Homepage
 - On-line Flight Curriculum
- **New NASA Education Resources**
 - New Pointers Within NASA
 - New NASA Education Documents on Quest

K-12 Internet Initiative Ames Research Center Pilot Projects and Demonstrations Group

Kevin L. Jones
Group Leader
415-804-2006
4/11/95

Network and Communications Branch, IDH

K-12 Internet Initiative Workshop pg.1

K-12 Pilot Projects and Demonstrations Group Overview

- Pilot Projects
- Alternative Access
- Targeted Outreach
- Community Networking

Network and Communications Branch, IDH

K-12 Internet Initiative Workshop pg.2

Pilot Projects

- **Watsonville High School**
 - Ribbon Cutting Ceremony for getting T1 up and running
 - Able to transfer CAD/CAM files
- **Mendocino High School**
 - Site Visit to meet key participants
 - Transition from 56Kbps to Frame Relay T1 access
- **Monta Vista High School**
 - Meet to discuss transition plan
 - Requested new System Administrator Support

Network and Communications Branch, IDH

K-12 Internet Initiative Workshop pg.3

Alternative Access

- **Wireless Bridge Test bed**
 - Improved connectivity from wireless bridge
 - Expanded access to schools in 1.5 mile radius of the Adult Education Center.
- **Frame Relay Test Bed** (Mendocino High School)
- **ISDN Test Bed** (Ronald McNair Middle School)
 - Dan Goldin Demonstration

Network and Communications Branch, IDH

K-12 Internet Initiative Workshop pg.4

Targeted Outreach

- Offer of 100 Quest accounts to Native Americans.
- Providing Data Communications Equipment to Salish-Kootenai College so that they can access to the University of Montana in Missoula's Internet Connectivity.
- **National Society of Black Engineers**
 - Internet Workshop at National Conference
 - Scholarship, Educational, and Career Opportunities Panel Workshop at National Conference

Network and Communications Branch, IDH

K-12 Internet Initiative Workshop pg.5

Community Networking

- **Crittenden Middle School**
 - Publicize and support their Open Computer Facility Wednesday nights.
 - Enlist support teachers at other schools.

Network and Communications Branch, IDH

K-12 Internet Initiative Workshop pg.6

Johnson Space Center

Mark Rorvig

*An Intelligent Agent for the
K-12 Educational Community*

NASA

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An Intelligent Agent for the K-12 Educational Community *

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Abstract - Nearly every professional would like to have a personal assistant to perform the physical and mental work of searching libraries for needed information. This paper describes a tool which performs this function using commonly available Internet services. The promises and difficulties of developing such a tool are described.

* This paper describes a NASA owned invention, Case No. MSC-22551-1. Inquiries for use may be made to Mr. Hardie Barr, Patent Counsel, Lyndon B. Johnson Space Center, NASA, Houston, TX 77058-0000, telephone 713-483-1003.

This work was funded under WBS 509-40 as part of the Information Infrastructure Technology Applications program of the High Performance Computing and Communications Division, Code RC, of the National Aeronautics and Space Administration.

In order to be considered an intelligent agent, it is proposed that such a device must possess at least two characteristics. First, it must be selective, that is, capable of discriminating knowledge sources, and evaluating them according to the wishes of its owners. Second, it must be resource efficient, that is, act in a manner which does not jeopardize the functions of its host. In this last case, the host environment, or body in which the agent resides, is the Internet. Such a device has been constructed for use by primary and secondary educators and it has been deployed through the Texas Education Agency's Texas Education Network (TENET) facilities at the University of Texas at Austin beginning in December, 1994 (1).

Though the technology of intelligent agents is in its infancy, a number of such tools now exist on the Internet. Others have been commercially announced. Existing, non-commercial agents on the Internet as of January, 1995 numbered about ten (2). Various referred to as robots, web wanderers, and spiders, these devices perform a wide range of functions: counting server sites; retrieving documents on specific subjects; and gathering and reorganizing server site listings for better retrieval. At least one of these, called InfoSeek (3) by its authors, has evolved to search a compiled catalog (4) of the net with a complex query.

Commercial knowledge robots are mostly in the prototype stage of development. Entries to the marketplace include AT&T's Personalink--a product designed to assist users in shopping and organizing electronic mail. Another firm, General Magic has announced a product called Telescript. The structure of the networks which support these agents and a description of many agent functions has appeared in the formal literature within the last year. (5, 6)

The general approach to our agent, referred to as ILIAD (Internet Library Information Assembly Database), consists of five steps: First, conversion of a user's natural language query into the structured terms of the Dewey Decimal Classification (DDC); second, generation of a server list previously mapped to the DDC by either automated or manual methods; third, retrieval of the documents from the individual servers by passing the query to the server and obtaining the results; fourth, linguistic filtering of the retrieved documents using a partial match vector formula (7, 8); fifth, a neural net preference filter operating on style and readability characteristics of the retrieved documents (9, 10, 11, 12, 13). Retrieved documents which survive the linguistic and preference filters are simply mailed back by electronic mail to the person who

originally submitted the query. A chart displaying the overall system design is presented in Figure 1.

The agent which we have constructed, though generalizable to many domains, has been oriented toward elementary and secondary education (14, 15). In this regard, we attempted to take advantage of the large scale electronic library infrastructure created by government (Federal, State, and local) during the preceding several years (16).

Specifically we concentrated on the more than 500 WAIS servers on the Internet, since (a little over a year ago) these servers represented almost all areas of knowledge and permitted ranking by relevance to the query of their content objects (18). The distribution of these servers among the schedules of the Dewey Decimal Classification (DDC) (the classification system used in most K-12 American educational institutions) is shown in Figure 2.

We do not hesitate to note that the simple growth of the Internet has made this approach insufficient to service many of the requests which have been put to the agent, and our initial reliance on WAIS has been expanded to include use of the catalog of Uniform Resource Locators as collected by the Lycos application at Carnegie Mellon University. (17)

The specifications for our agent were drawn from conversations with the managers and participants in the Texas Education Network. The agent was to address text data alone. Above all, educators stressed the need for the agent to be highly selective, noting that an abundance of poor material was already easily available to teaching communities. Finally, the interface to the agent was to be entirely comprised by email, since network resources for graphical interfaces could not be assumed to be available at the vast majority of Texas schools.

The specificity of the educators' remarks give rise to difficulty in assessing the system, since traditional measures for assessments of information retrieval systems, i.e., precision and recall, do not actually fit this situation. The potential recall of the system may be estimated from multiplying the number of servers contacted for any query by ten, since only the top ten scoring items were retrieved from each WAIS server. However, since we were unable through our charter to be sufficiently intrusive with the client

population to obtain human judgments of the relevance of the final documents, precision cannot effectively be estimated.

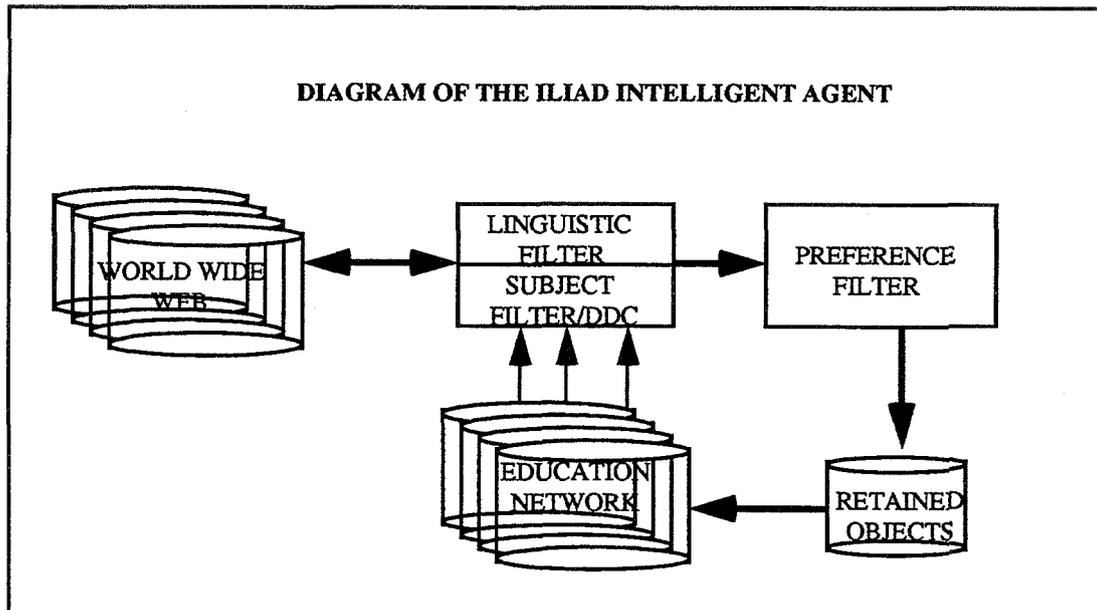


Fig. 1: The intelligent agent is composed of several interacting software components: A subject filter which converts a natural language user query into the controlled vocabulary of the Dewey Decimal System; a linguistic filter which qualifies retrieved documents; and a neural net preference filter, trained to reflect style characteristics of preferred documents. The subject filter receives requests from networks, identifies the Internet resources which could meet the request, and sends requests and receives material from these sources. The linguistic filter uses a partial match formula to eliminate unnecessary material and then passes its received source material to the preference filter, which decomposes the received objects into signature patterns. These patterns are then matched against the preferred patterns for a user or class of users, and the resulting material returned over networks to the requestor.

Although operational data for the agent are limited, it is clear that WAIS sources alone are insufficient to meet many queries. Indeed, out of 160 queries processed in 45 days, more than one in five were returned with no relevant documents selected. Gopher sources and http sites are required to service educator needs for learning resources from the Internet environment in the future. Figure 3 and Table 1 below summarize the existing data on the agent performance in its first weeks of operation.

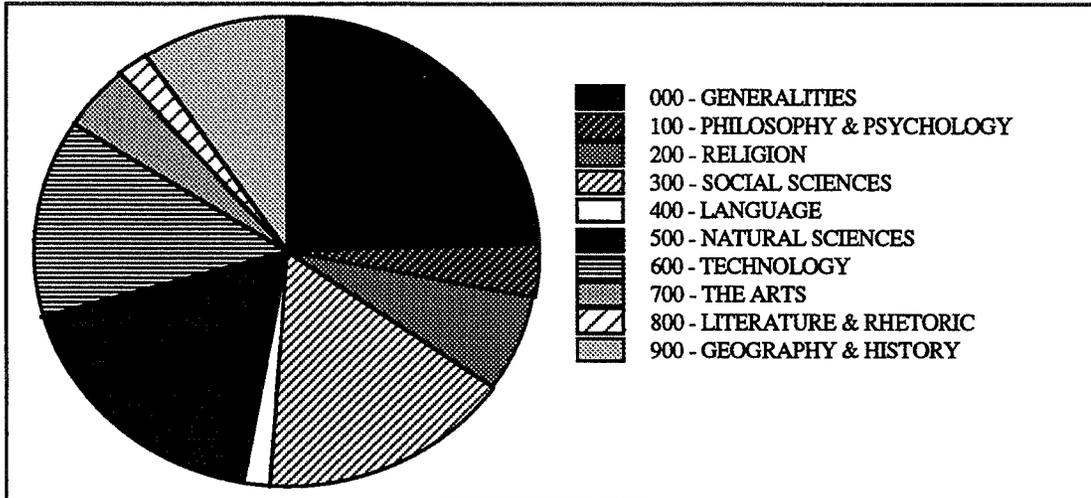
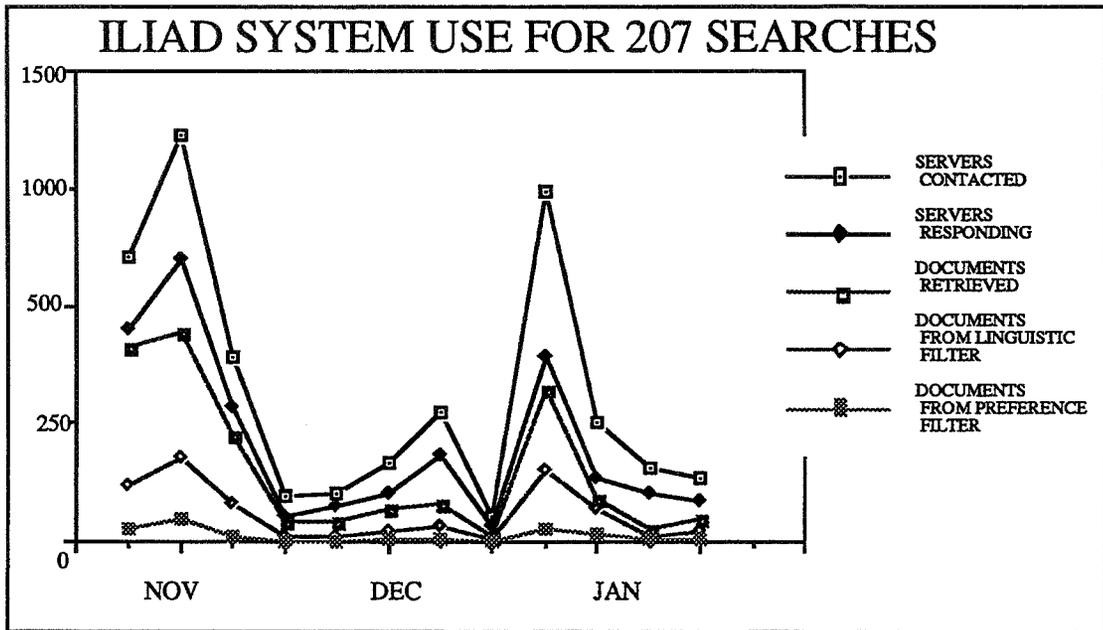


Fig. 2: The relative subject distribution of 905 servers (some are duplicated among subject categories) which follow the Wide Area Information Server (WAIS) index structure and communication protocol is displayed as a pie graph. The large number of servers (222) listed under the subject heading "Generalities," reflects the origins and development of the Internet, since the 004-007 classes contain the headings for computer science, software, and methods. The Dewey Decimal System, first devised by Melvil Dewey in 1894 is now in its 20th edition and is thought to be the most widely used classification schedule in the world.

More seriously, after January, a large number of WAIS sources discontinued responses at their former logical port server addresses. It is thus speculated that many servers are now accessible only through the logical port addresses formerly associated with uniform resource locators, or URL's. The agent response was discontinued in late February until new server resources from the Lycos data file could be used in place of the former WAIS associated structure. The new system returned to service in mid-April.



^{3/} Fig. 2: Operational data for the agent during its first 90 days of operation.

	(1) SERVERS CONTACTED	(2) SERVERS RESPONDING	(3) DOCUMENTS RETRIEVED	(4) DOCUMENTS SURVIVING THE LINGUISTIC FILTER	(5) DOCUMENTS SURVIVING THE PREFERENCE FILTER
WEEK 1	909	677	617	175	43
↓	1290	903	668	262	71
↓	583	426	338	122	17
↓	147	84	65	15	4
↓	155	112	61	13	1
↓	252	150	104	31	8
↓	406	270	120	49	9
↓	82	47	19	9	2
↓	1117	587	480	222	44
↓	381	201	134	104	23
↓	235	149	43	17	8
WEEK 12	200	127	76	29	8

Table 1: Operations of the agent during its test and open periods in the Fall and early Winter of 1994. The table reflects the happenstance nature of the Internet, in that, at any given moment in time, a large number of servers do not respond. The actions of the linguistic and preference filters tend to screen out these discrepancies, however, with the average ratio of documents surviving to servers contacted at 30 to 1. Although recall and precision figures could be calculated for the agent, it is not clear that such figures would reflect its performance, since the server response rate tends strongly to condition the subsequent processes.

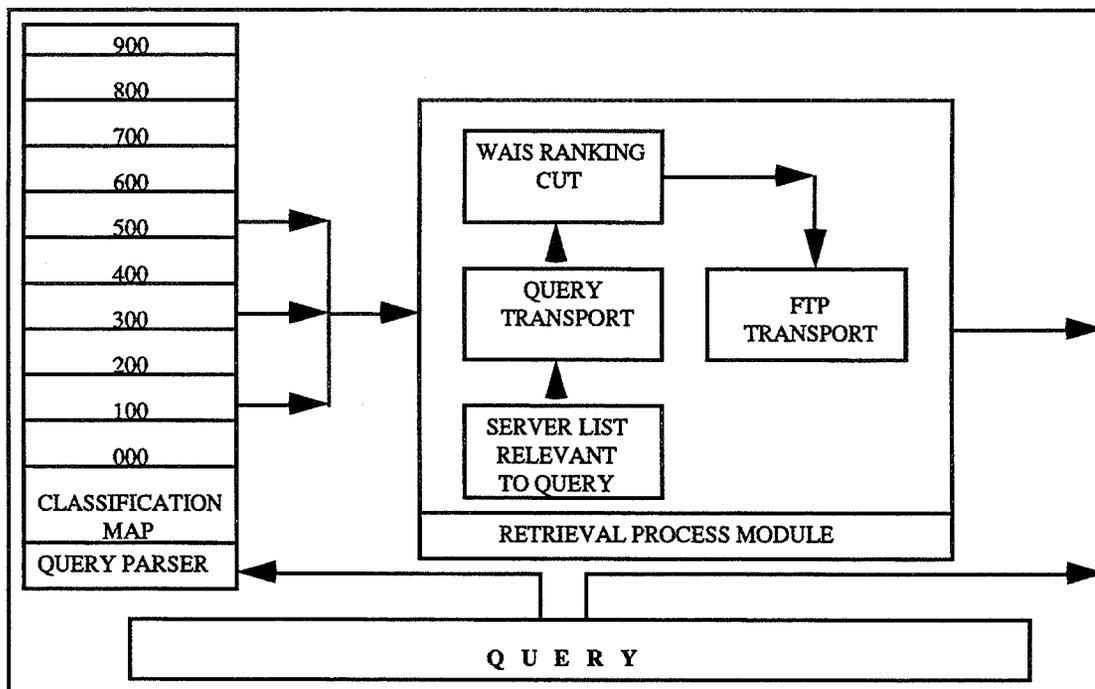


Fig. 4: The information flow and component layout of the subject filter is diagrammed. Queries, i.e., user requests for information, are received and parsed into search strings. These strings in turn are matched against the classification descriptions of the Dewey Decimal System, 20th Edition by means of the Salton cosine-vector formula. Assuming an appropriate matching threshold, the original query is forwarded to the topically relevant server sources. The top ten objects are then requested by means of the file transport protocol (FTP) and passed, together with the original user request, to the linguistic and preference filters.

The subject filter was created by searching the catalogs of WAIS servers with queries composed of the words associated with each decal division of the DDC. Manual methods of classification are very difficult to perform and it should be noted that the assignment of WAIS sources to decal divisions of the DDC required a trained librarian more than three months effort. Future work will employ automatic methods of classification using techniques originally evaluated with respect to online public access library catalogs. (19)

Returned responses from WAIS sites were limited to only the top scoring objects. The performance of the agent is thus constrained by the quality of linguistic descriptions at the server sites and the effectiveness of the ranking algorithms at each site. During the first year of operation of ILIAD within the TENET system, only text files will be retrieved on an operational basis. On a selective basis, a small number of institutions

may be permitted multimedia access in the specialized area of earth observing images.. A diagram of the subject filter components are shown in Figure 4.

The most complex component of ILIAD is its preference filter. To begin with, such preferences must be recorded by non-verbal means, since it is usually quite difficult for individuals to explicate preferences for specific information content styles and formats. Further, though the operation of the subject and linguistic filters ensure, through matching formulas and cutoff thresholds, that received objects will be at least topically relevant to a query, topical relevance alone is insufficient. The preference filter must thus ensure that retrieved objects, meet the indirectly expressed preference responses of its users.

These objectives are accomplished with a series of operations. First, the preference profile is constructed for a randomized sample of materials retrieved from each DDC schedule division where the schedule description itself is used as a query. A Thurstonian scaling technique is used (a description of this method is available in (9)) to elicit preference judgments on pairs of text stimuli, (but which could also include mixed pairs of images and text, text and text, and sound and text, or any pair combination.) The result is an ordering of objects according to the probability that each would be chosen over the others in the choice set (20). This ordering may be rendered by representative groups (as performed in this application by stratified samples of K-12 educators), or by an individual. Those objects with the highest probability of choice are then analyzed to obtain a series of feature "signature" scores. These scores are then normalized by converting the various measures to common unit normal deviates of the normal curve, according to procedures developed earlier for NASA (21, 22). The overall structure of the preference filter is displayed in the diagram of Figure 5.

Once the object feature signature scores of preferred objects have been obtained and stored by DDC class, they may be invoked whenever a new query is serviced. As new objects are received by DDC class from the subject filter in response to a query, they are decomposed by the same object features used to establish the signatures of the preferred objects, normalized, and matched, class by class, against the stored object feature signatures of preferred objects. Those new objects failing to fall within the boundaries of the signature of preferred objects as determined by a new form of neural net (13), are deleted from the retrieved set. Those objects within the boundaries are retained and forwarded to the requesting educator or educational institution.

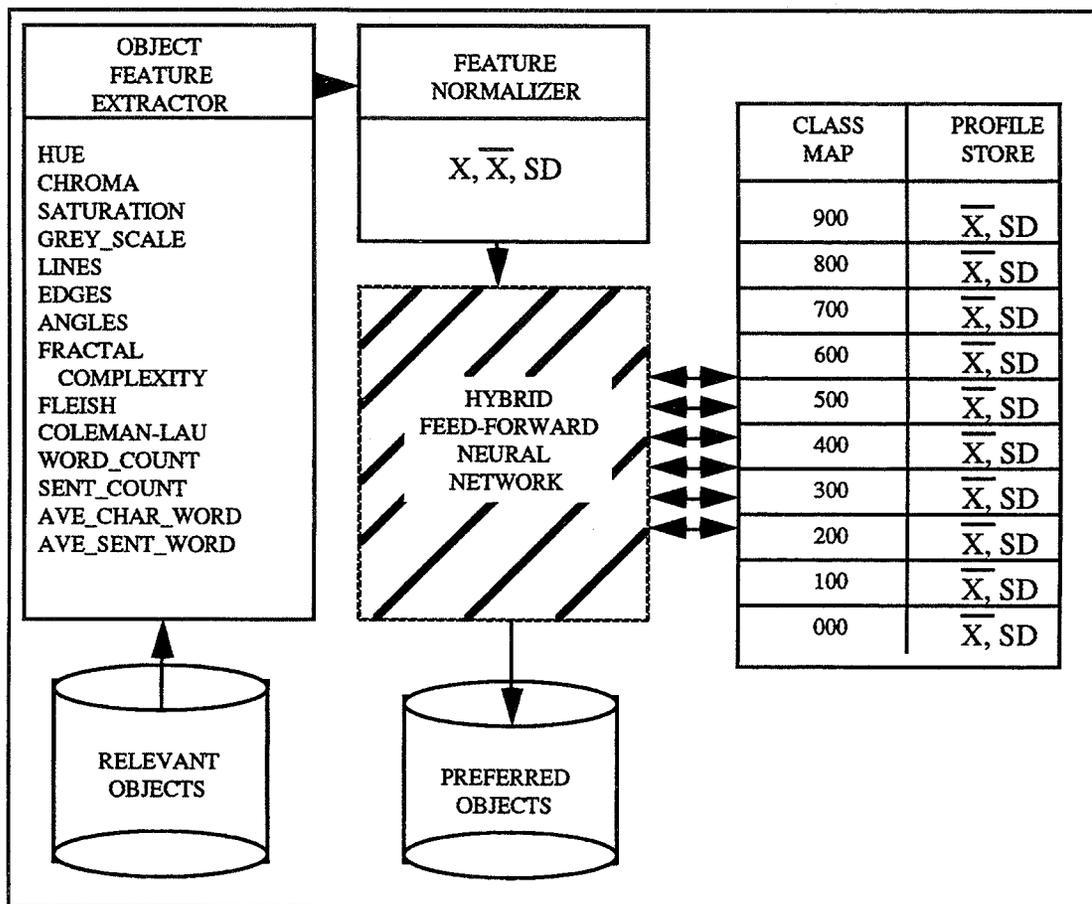


Fig. 4: The information flow and component layout of the preference filter is diagrammed. Objects are passed to the preference filter by the linguistic filter for decomposition into feature signatures or patterns. Some of the features presently used by the intelligent agent are listed. The measures hue, chroma, saturation, grey scale, lines edges, angles and fractal complexity refer to image processing measures which were used experimentally. The production measures used in the text only system were the Fleish, Colman-Lau, and various word frequency counts for text preference detection. The measures as a whole reflect the multimedia capabilities of the system of software components. Since features are quite dissimilar, they are normalized as standard units under the normal probability curve for all items received. These patterns are in turn matched by a neural network to the preferred signatures stored for a user or user class. Those objects meeting the preference standards are retained and mailed to the requestor's point of origin. The precision, or ratio of preferred items to less preferred items correctly matched during testing, appears to lie in the 55-70% range for a small group of practicing teachers. There is some evidence that preference signatures for engineers would be easier to match.

The feed-forward neural net was invented (13) to perform electrical signal matching from Space Shuttle telemetry. As electrical devices are used, their identification is required in order to monitor total power consumption during spaceflight.

Automation of this function by the new hybrid feed-forward neural net is expected to lead to reduced ground crew expenses during Space Shuttle missions.

The agent, ILIAD, and other similar devices represent an important addition to Internet searching technology. However, this advance also raises a number of unique social issues over the availability and cost of information. Although a good deal of government information is available presently on Internet at no cost, such information is neither as uniformly described nor quality controlled as those from commercial sources. The technology of intelligent agents may put the equivalent of a personal library clerk at the disposal of many persons, but its performance will be only as refined as the information sources from which it draws.

Acknowledgements

The authors gratefully acknowledge the contributions of the following persons: Mr. Robert T. Savely, Chief Scientist for Software Technology (of NASA); Dr. Timothy Cleghorn (of NASA) for his advice on the application of fractels to image understanding; and Ms. Linda Blount, Executive Director of the Partnership Center for Education Enhancement for her organization's assistance in locating educators for construction of our test and validation data sets.

References and Notes

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- (18) There may be technical reasons which would prohibit inclusion of all Internet services into this knowledge base. The Lycos server from Carnegie Mellon University, for example, now contains records of over 1.5 million pages, necessitating considerable human and machine resources if complete classification were to be performed. Lycos is available at <http://lycos.cs.cmu.edu/>
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APPENDIX A - EXAMPLE OF QUESTION AND ANSWER RESPONSES FROM
NOVEMBER AND APRIL

NOVEMBER FIRST QUESTION AS OF 11-4-94:

?*Q1 : How far is the earth from the sun and the moon from the earth? I would like to know the distances between planets in the Solar system and the distances between galaxies and our own galaxy.

Research and Visiting Appointment - MAX-PLANCK-INSTITUT FUER
ASTROPHYSIK

% Session 71 -- Galaxy and CBR Distribution

AUSTRALIAN NATIONAL UNIVERSITY -
DOCTORAL, MASTER'S & BACHELOR'S THESES ABSTRACTS

:source
:version 3
:ip-name "Hypatia.gsfc.nasa.gov"
:tcp-port 210
:database-name "HST_data"

HTML Version of AstroWeb Database

Subject: Re: ASTRONOMERS DISCOVER NEARBY SPIRAL GALAXY HIDDEN
BEHIND THE MILKY

APRIL LATEST QUESTION AS OF 4-10-95:

?Q1: Tell me about the Hubble Space Telescope?

TALE OF TWO CLUSTERS YIELDS SECRETS
OF STAR BIRTH IN THE EARLY UNIVERSE

<H1>
NASA Hubble Space Telescope</H1>

<title>STScI Documentation </title>
<h1>STScI On-line Documentation </h1>

<Title>HST Data Handbook</Title>
<HR>
<H1>HST Data Handbook</H1>

SEARCH FOR RED DWARF STARS IN GLOBULAR CLUSTER NGC 6397

GALAXY M100 RESOLUTION COMPARISON

Frequently Asked Questions about
the Collision of Comet Shoemaker-Levy 9 with Jupiter

<Title>STScI/HST Pictures</Title>

<H1>Hubble Space Telescope Public Pictures</H1>

<H1>The HST Archive</H1>

HST OBSERVES THE SUPERNOVA IN THE WHIRLPOOL GALAXY

Langley Research Center

Gary P. Warren

*Overview of the NASA Langley
HPCC/IITA K-12 Program*

Overview of the NASA Langley HPCC/IITA K-12 Program

Gary P. Warren
Jeff Seaton

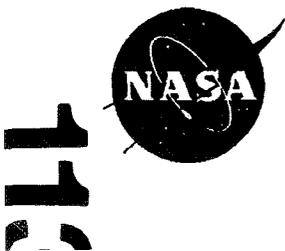
112



2/18/00
7/1/00
00/1/00

Goals of the HPCC/IITA K-12 Program

- **The primary goal of the program is to enhance science and math curricula by integrating computational science and Internet connectivity into the K-12 classroom. This includes:**
 - **An affordable computer infrastructure with direct Internet access that can be funded and supported by a school consortium**
 - **A high quality staff development program that targets teachers within the school consortium**
 - **An environment to develop curriculum materials related to computational science and the Internet**



Pilot Sites

Original Participation



Common Questions

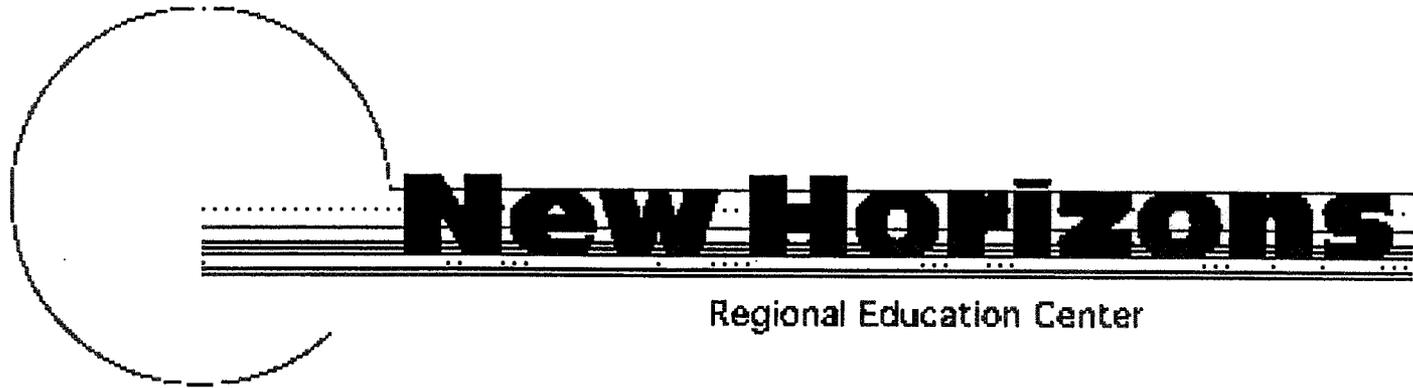
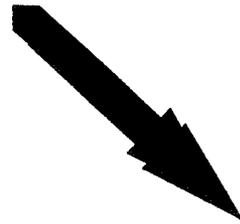
- How can 'my' school connect to NASA?!
- How can 'I' participate in the training?!
- How can my school get a computer lab?!
- Should I write my congressman?!
- Who is your boss?!



Transfer Program



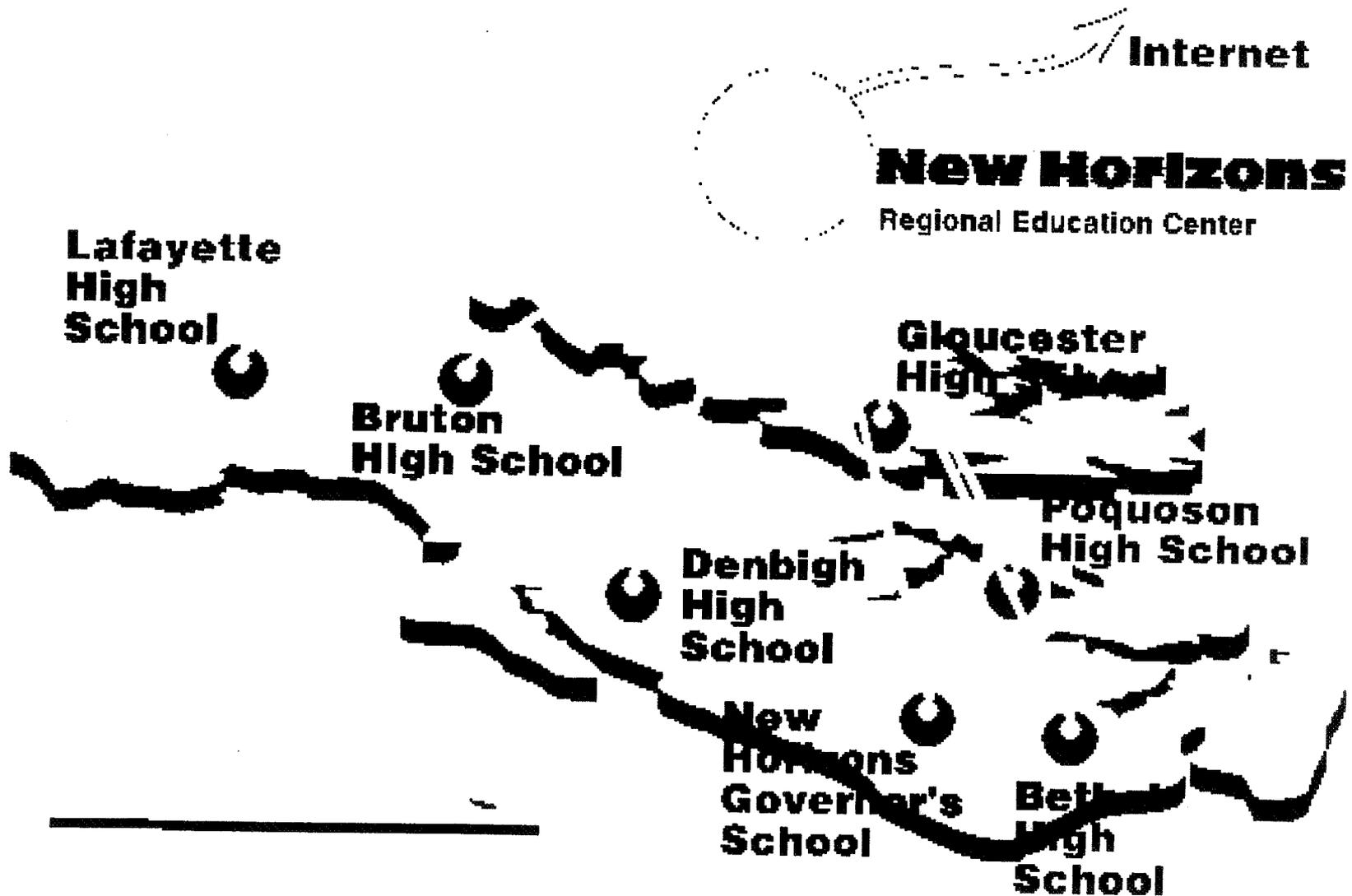
Work on low-cost network technologies, staff development programs, and computational science curricula that is relevant and capable of being duplicated without outside funding sources.



Regional Education Center

Pilot Sites

Consortium Connectivity



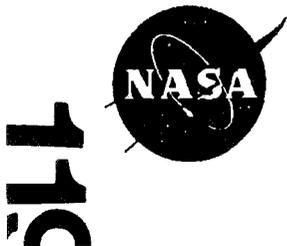
Development of Affordable Internet Connectivity

- **“Internet” connection can mean many different things.**
- **Internet connectivity models.**
 - Dial-up service with terminal emulation.
 - Machine-to-Network TCP/IP connection.
 - Network-to-Network connection.
- **Must include training and support.**
 - Training for using connection model with students.
 - Training for support of connection model.



Development of Affordable Internet Connectivity

- **Build a proper foundation**
 - Routing of TCP/IP (for an entire network)
 - Proper Domain Names (*.k12.*)
 - Domain Name Service
 - SMTP based email
- **Incorporate School Needs**
 - Support structure
 - Filtering of specific sites
 - Reporting of sites visited
 - cheap.... real cheap...
- **Plumb it up based on use and demand**



The Three Models

How they build a proper foundation for future growth

- **Dial-up service with terminal emulation.**
 - No foundation
- **Machine-to-Network TCP/IP connection.**
 - No foundation (usually)
- **Network-to-Network connection.**
 - Need a foundation (although everyone is trying to cheat)



Dial-up with Terminal Emulation

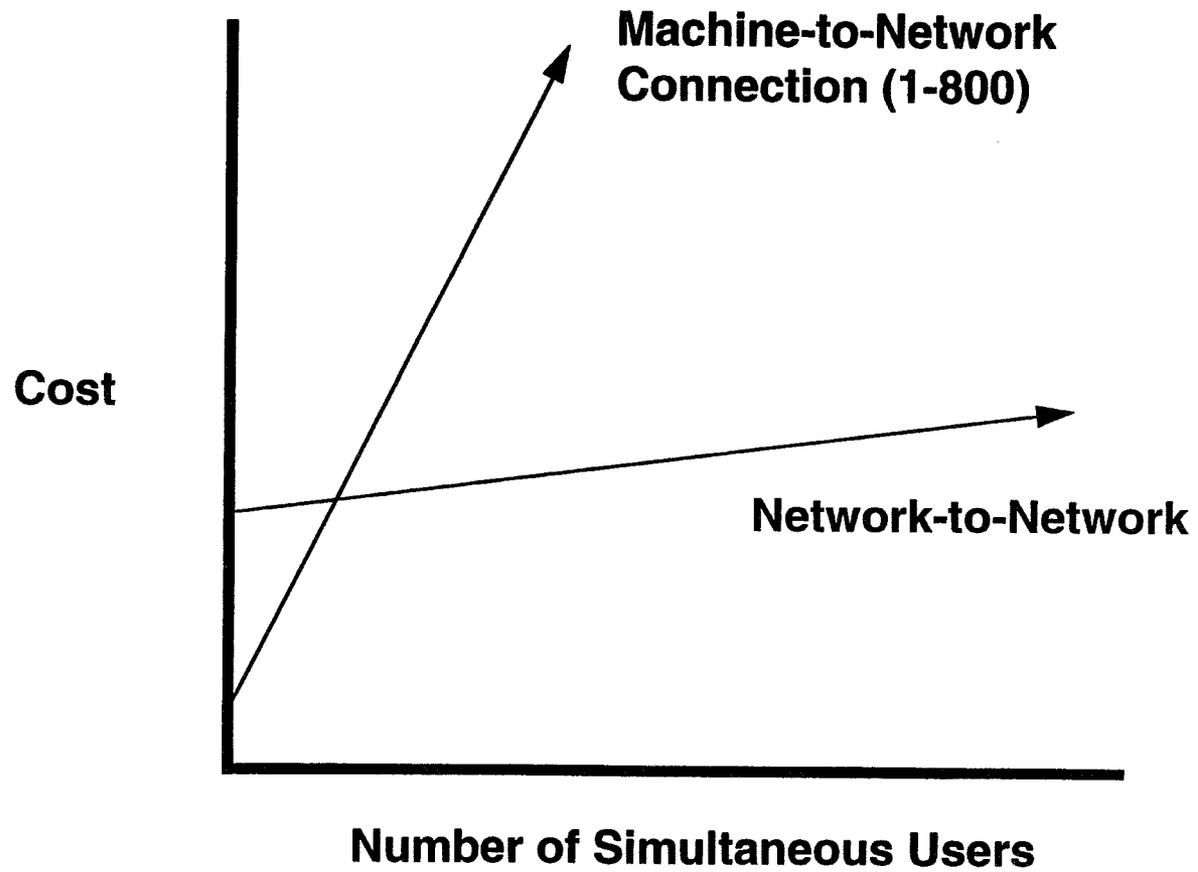
- **Allows one machine to use one phone line.**
- **Usually text-only interface.**
- **Usually requires learning Unix commands.**
- **Students typically become “observers” and not “participants”.**
- **Does not scale for large coverage.**
- **Difficult to teach in non-computer science courses.**



Machine-to-Network IP Connection

- **Allows one machine to use one phone line**
- **TCP/IP connection (via SLIP or PPP) allows graphical interface for FTP, HTTP (WWW), WAIS**
- **Students typically become “observers” and not “participants”.**
- **Does not scale for large coverage.**
- **Difficult to teach/assign Internet projects for entire class**

Let's Spend Some \$\$



Network-to-Network Internet Connection

- All machines on Local Area Network can use graphical interface for Internet resources
- Requires intensive staff development program for all administrators and teachers to understand functionality and issues related to the Internet (Security and Ethics)
- Requires Unix system administration and TCP/IP routing support (you can try to hide it... but it will not go away).



General Guidelines on Providing Network-to-Network Connectivity

- **School districts can not afford leased lines for all school buildings.**
- **Recurring costs are less acceptable than capital costs.**
- **School districts can not afford and do not understand Unix system administration and support.**
- **School districts can not afford the quality of training required for all teachers and administrators.**



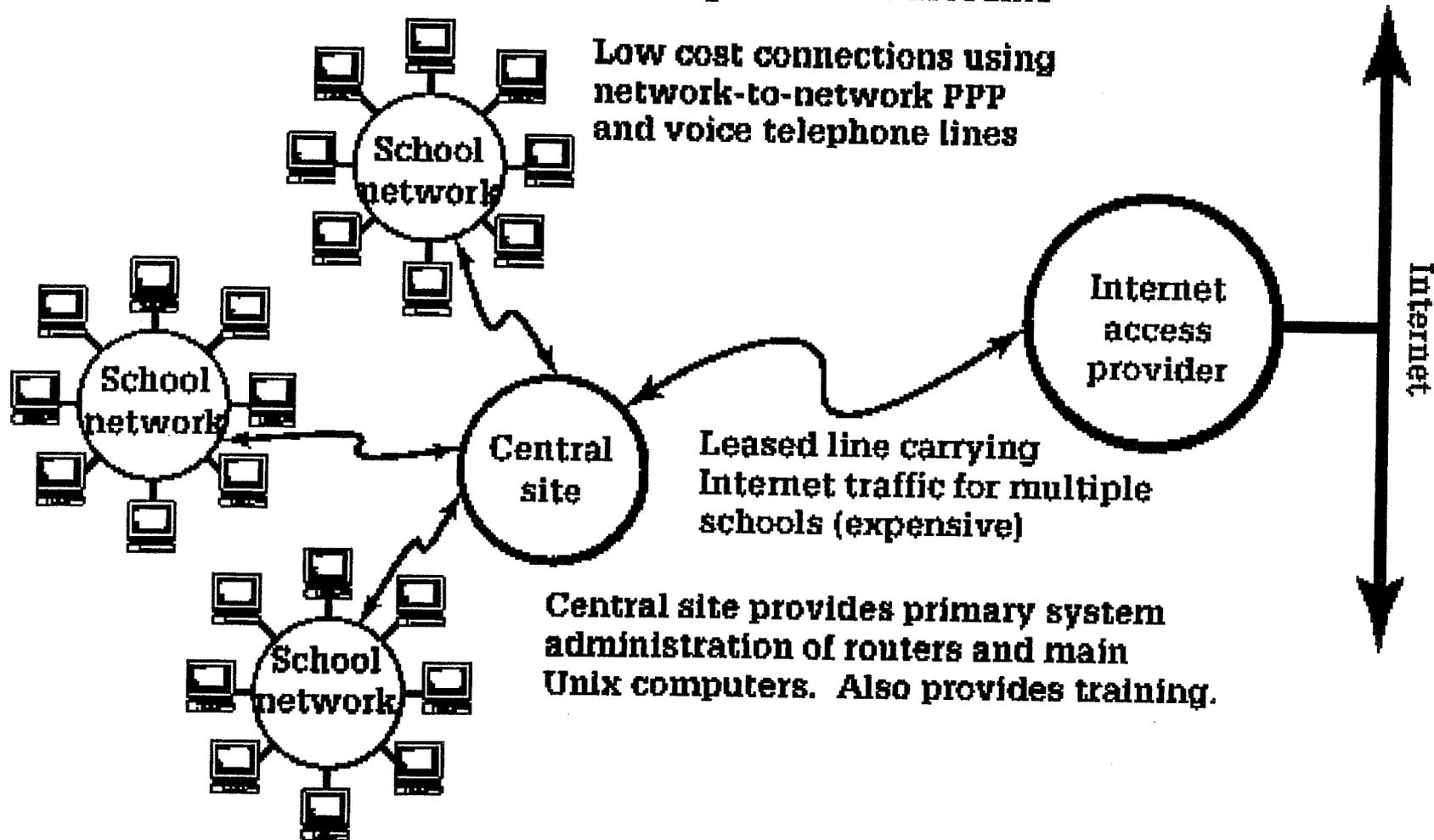
Using a Consortium to Reduce Costs and Support a Proper Foundation

- **Consolidate required high-cost items at a central site (not remove them by using NASA or a university)**
 - routing support
 - Basic Unix support
 - Internet Provider fees
 - High-speed leased line (T1 or better)
- **Share costs between members of the consortium**

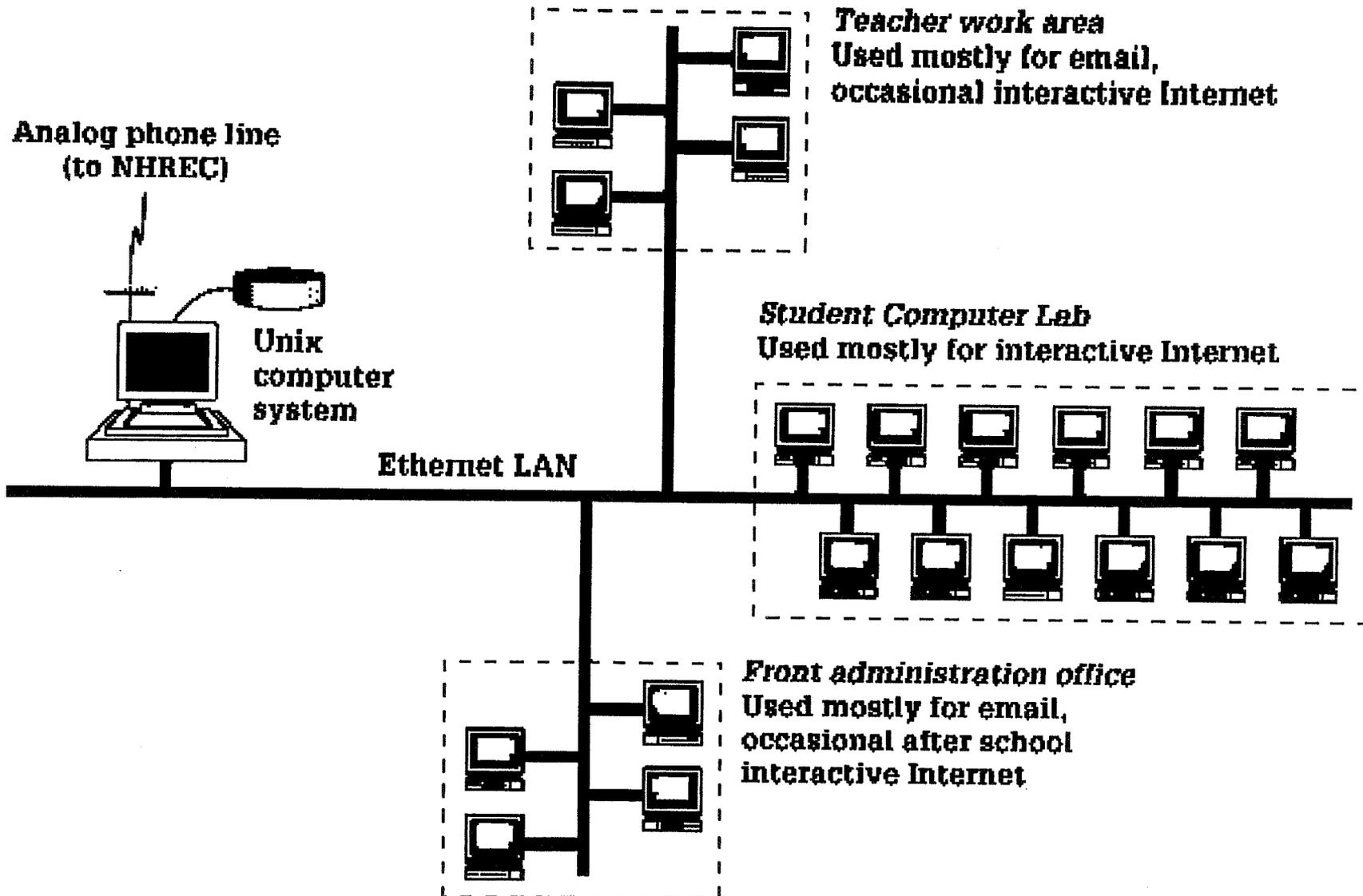


Consortium Overview

School provides secondary system administrator for assisting primary administrator and establishing local user accounts

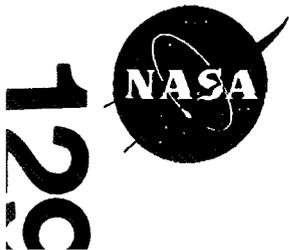


Typical School Network



Network-to-Network Internet Connectivity Solution (Low-end)

- **Use analog phone lines instead of leased line**
 - Point-to-Point Protocol (PPP) using Sun workstations as routers for entire network.
 - 28.8 kbs modems provide 30 - 70 kbs for entire network (based on actual established networks in the schools)
 - modem technology has caught up with low-end leased line performance
 - 56 kbs leased line
 - 19.2 - 56 kbs Frame Relay
- **Must have connection hub to support network-to-network PPP and routing.**
 - NASA Langley Pilot for FY 93 and FY 94
 - New Horizons for FY 95 and beyond



Why the Sun Workstation?

- **Sun workstation performs the following functions:**
 - Router for TCP/IP traffic (upgradeable to T1)
 - Domain Name Server
 - SMTP/POP email server
 - proxy cache server (filter)
 - Apple file server
 - HTTP server
 - Compute server (X-windows)
- **Stability**
- **Network performance**

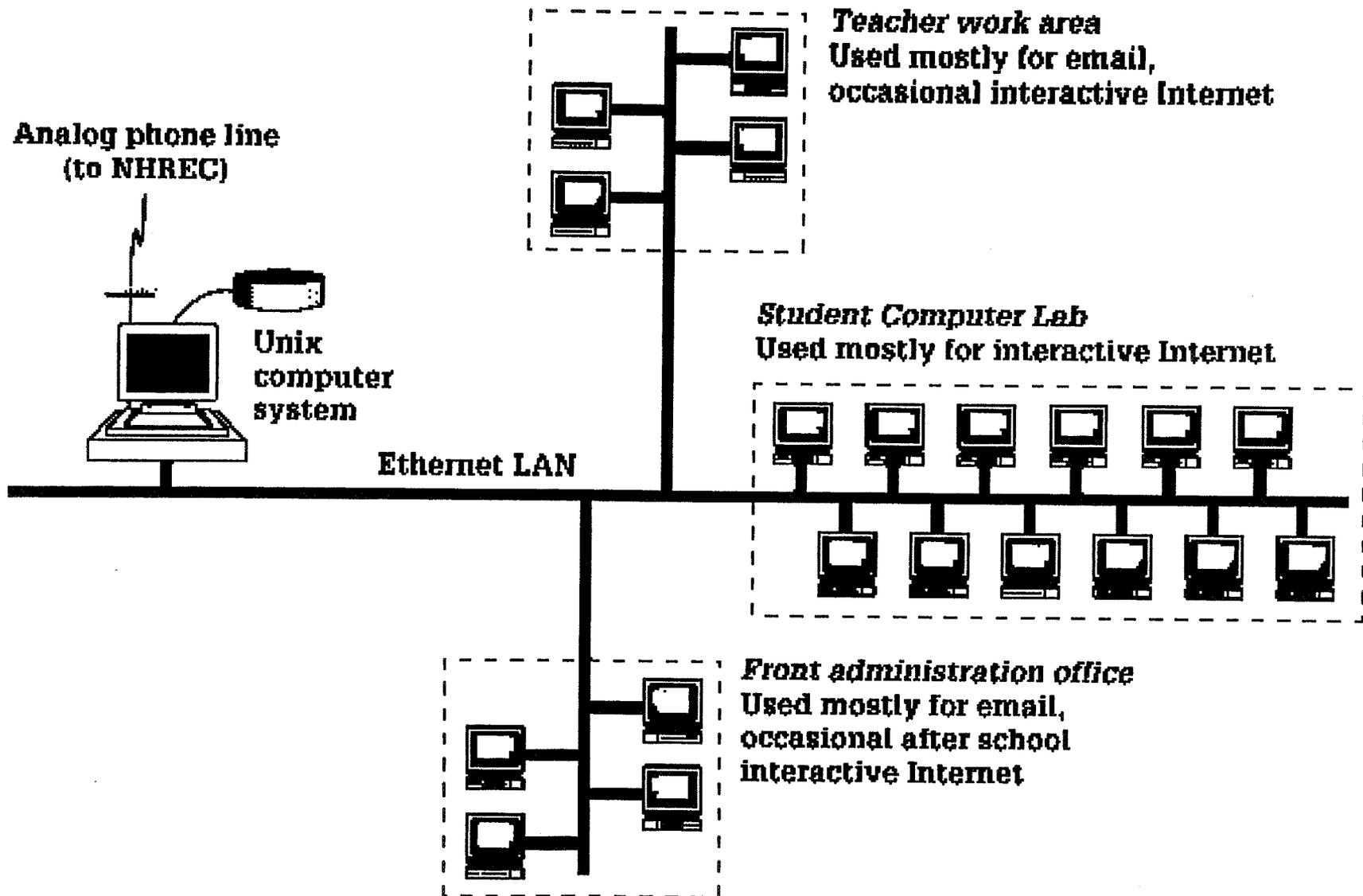
Caching Internet Traffic

or

Why we should be happy the
telecommunications industry did not
develop our water system

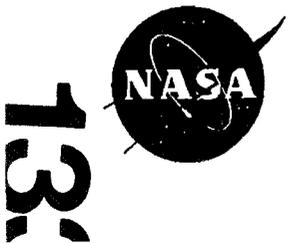


Typical School Network



Caching

- **Allows filtering of certain URLs.**
 - Some things on Yahoo.
 - www.playboy.com, www.penthousemag.com, www.adult.com.....
 - Allows a reporting mechanism.
- **Can eliminate > 70% of http traffic.**
- **Some cache software exists**
 - CERN (does not work well on low-speed links)
 - Ichtus (Perl Script... needs work)



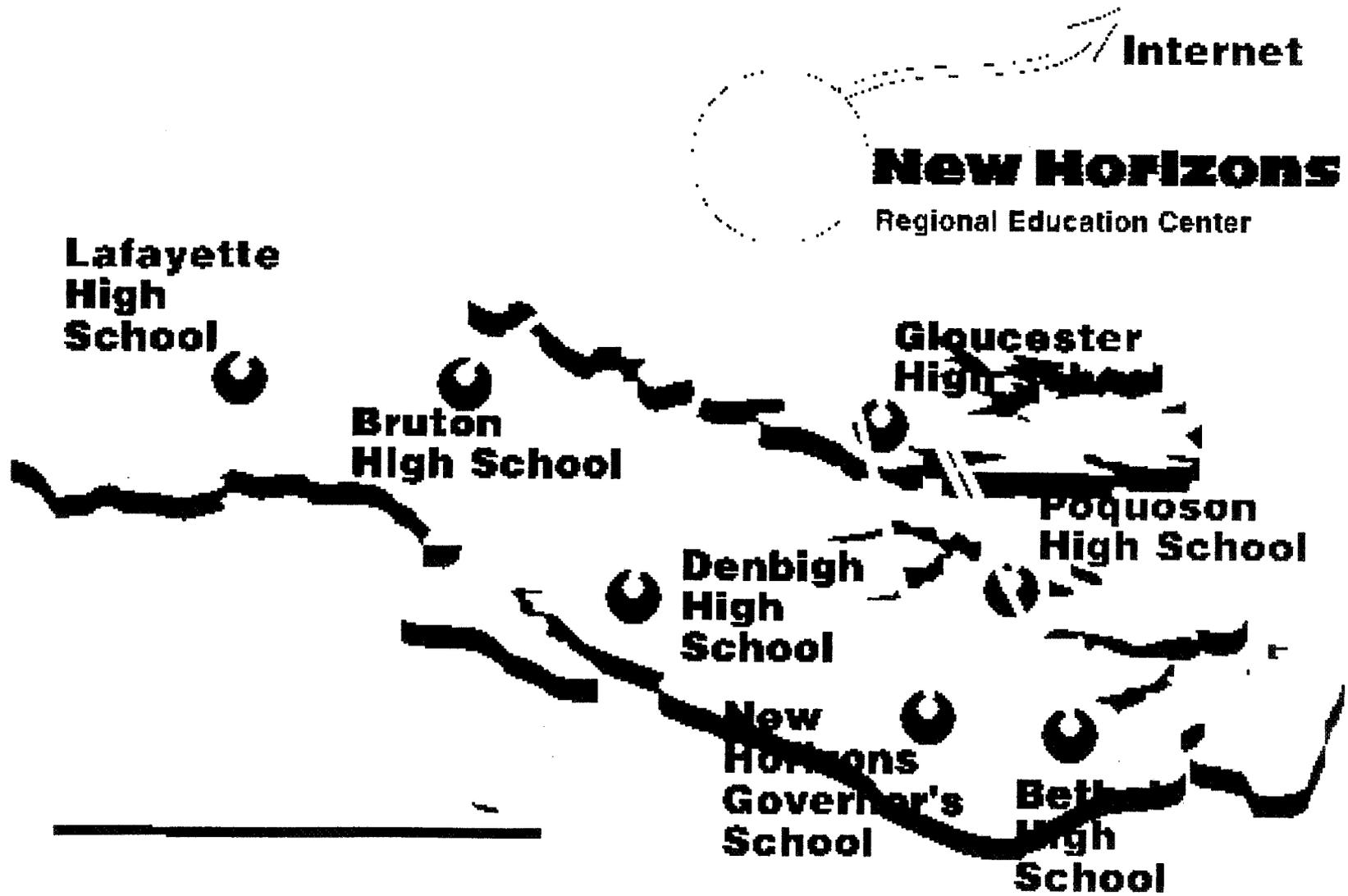
Common Questions

- **How can 'my' school connect to NASA?!**
- **How can 'I' participate in the training?!**
- **How can my school get a computer lab?!**
- **Should I write my congressman?!**
- **Who is your boss?!**



Pilot Sites

Consortium Connectivity



Requirements for School to Connect to NHREC

- **Must belong to consortium.**
- **\$8600 for Sun Workstation and peripheral equipment.**
 - Sun and First Step Computing have bundled the package together for a single PR.
 - Sun providing discount maintenance for software and hardware
- **Provide teacher for training at NHREC for secondary system administration.**
- **Provide teacher(s) for training at NHREC on Internet use and issues.**



Unix System Administration

(A Two Tier Approach)

- **Primary Administrator**

- Located at New Horizons Regional Education Center
- Responsible for TCP/IP routing (not establishing user accounts)
- Responsible for main configuration of all Unix systems
- Global system security.
- Development of software utilities.
- Training.

- **Secondary Administrator**

- Located at connecting school (1 per school)
- Responsible for establishing user accounts.
- Responsible for training users on computer security and ethics.
- Coordinates with Primary Administrator on assigning IP addresses to machines on LAN.
- Typically gets extra time and/or stipend.



Expansion

- **Working with South West Virginia Governor's School Consortium**
 - 50K from NASA, 25K from Va DOE, balance from members.
 - Travelling road show
- **Demonstration network using ~10 machines and a standard phone line travels the region extensively**
- **Council on Information Management, Office of the Governor**
- **State-wide Network Connectivity training program sponsored by NASA, DOE, DIT with ~360 participants (June, 95).**



Teacher Training Program

- **Moved to the consortium (Summer '95) and will include about 50 teachers.**
- **Teachers meet at the consortium periodically to work on curriculum materials and share ideas.**
- **Working with Technology Directors and Curriculum Specialists on program.**



Peninsula Schools Internet Working Group

- **Technology Directors from all 6 school divisions meet at New Horizons every 1st and 3rd Thursday.**
- **Training**
- **Gives them ownership of expansion**



Curriculum Alignment Materials

- **There is an active program with the 7 initially connected schools to develop material that will align computational science with their existing curriculums. The projects currently being implemented involve developing these materials using the following items**
 - **Using *Mathematica* in a High School Physics curriculum**
 - **Using Interactive Physics in a High School Physics curriculum**
 - **Using computerized data acquisition methods (LabView) in a Biology curriculum.**
 - **Using the Internet for High School research projects.**
- **These materials are being developed by teams of teachers and will be available in August '95.**



NASA Langley Teacher Resource Center (TRC)



- **Located ~5 miles from LaRC @ the Virginia Air and Space Center (VASC).**
- **TRC provides services to educators, students, and visitors in a multi-state region.**
- **VASC is also the official NASA LaRC Visitor's Center.**
- **Current Activity:**
 - TRC connected to Internet using LaRC networking model.
 - Sun and 6 Macs provided by NASA for use in TRC.
 - Beginning staff training in networking, Internet, security and ethics, and system administration.

Ongoing Effort with TRC/VASC



- **Future work: Aviation Research Library**
 - Add NASA-provided SGI Indy and VASC Macs to network for use by staff and visitors conducting research.
 - Installation of T1 line to allow high-capacity access to on-line library resources, museum exhibits, and LaRC information, using infrastructure which is now in place.
- **Future work: Internet Exhibit**
 - Explain basic concepts of Internet and WWW to general public.
 - Allow visitors to explore the Internet using a graphical WWW browser.



Lewis Research Center

Gynelle Mackson

*High Performance Computing &
Communications*



NASA Lewis Research Center

High Performance Computing and Communications

K-12 Program

**Beth Lewandowski, ITO
Gynelle Mackson, CSD
Greg Follen, ITO**

April 11, 1995

Lewis Research Center



AGENDA

- **Background of Program**
- **Teacher Resource Center**
- **Teacher Training**
- **Curriculum Activities**
- **Infrastructure Support**
- **Future Activities**

Lewis Research Center



BACKGROUND

- **Tiered Approach**
 - Distributed Infrastructure and network applications
 - Centralized Facilities
- **Support Coverage**
 - 11 schools
 - 9 school districts in Ohio, 1 school district in Minnesota
 - RTRC's
- **Impact on Education**
 - Broad and consistent
 - Direct activities w/ teachers and students
 - serving as advocates and enablers.

Lewis Research Center



BACKGROUND, CONT.

- **Personnel**

- **Interdisciplinary Technology Office**
 - » **Greg Follen, Program Mgr.**
 - » **Beth Lewandowski, Detailee**
- **Computer Services Division**
 - » **Gynelle Mackson**
- **Education Programs Office**
 - » **Jonathan Boyd**

Lewis Research Center



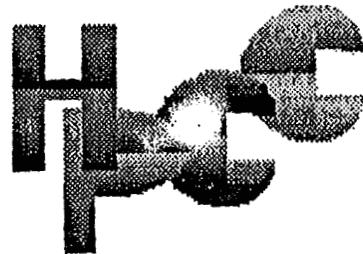
Teacher Resource Center

- Maintain Regularly Scheduled Visitations with Teachers in the Program
- Provide Guidance to Teachers on Macintosh Hardware and Software Applications
- Expand and Maintain the NASA Lewis HPCC K-12 Mosaic Homepage

Lewis Research Center

NASA Lewis Research Center IITA K-12 Program

K-12 Mosaic homepage



NASA LeRC

K-12 Program

**HIGH PERFORMANCE
COMPUTING &
COMMUNICATIONS**

Welcome to the NASA Lewis Research Center's High Performance Computing and Communications K-12 Homepage.

Some General Information

- [NASA World Wide Web Server](#)
- [NASA Home Page](#)
- [NASA Starting Points](#)
- [On line tutorial for the Internet](#)
- [NASA What's New Page](#)



Teacher Training

- An Intensive, Two Week, Hands-on Summer Workshop Held at Lewis
- Approximately 25 Teachers have been Trained Over the Past Two Summers
- Teachers Part of Nine Different School Districts, Reaching Students of Diverse Backgrounds

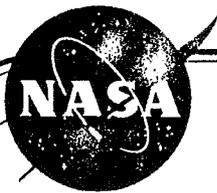
Lewis Research Center



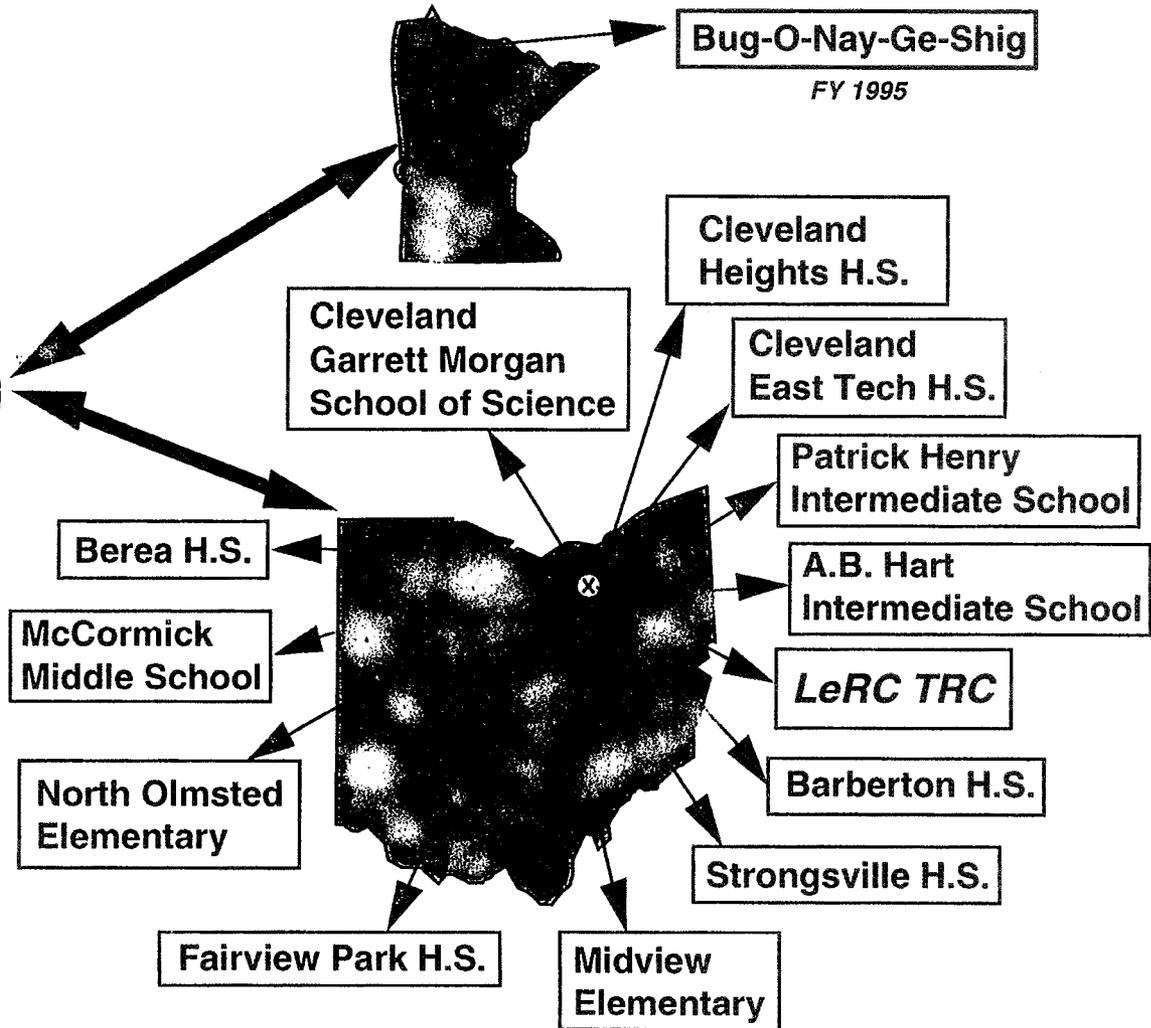
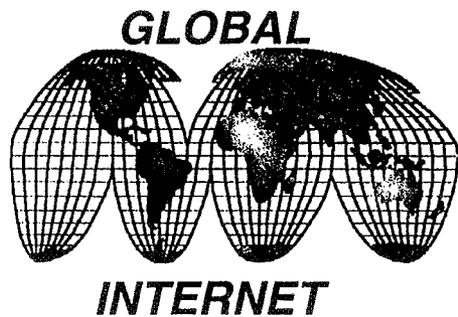
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Lewis Research Center



LeRC K-12 Program



OTHER TRC COVERAGE AREAS
ILLINOIS, INDIANA, WISCONSIN, MICHIGAN



Teacher Training

- Topics of the Workshop Include Use and Application of HPCC Hardware and Software
 - Macintosh Software Applications
 - Mathematical and Scientific Software
 - Internet Navigation
- Teachers Develop Curriculum and Classroom Projects Utilizing Equipment

Lewis Research Center



Teacher Training

- This Summer Training will be in the LeRC Classroom of Excellence
- Physically Challenged Initiative Added to Program, Talking Interface Software Added to Workshop Topics
- Summer Camp Provided to Schools as a Concluding Activity for Technical Projects

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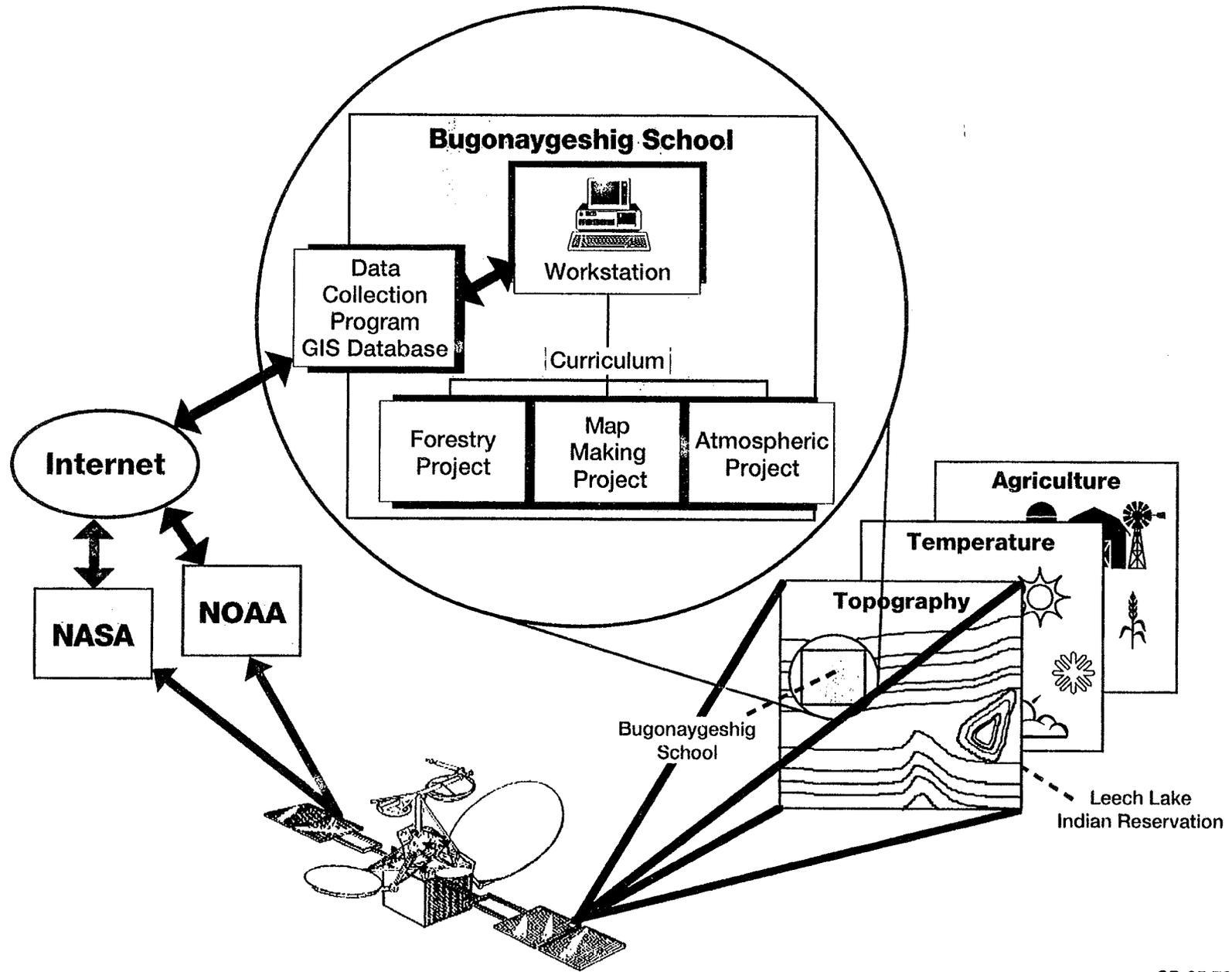


Curriculum Activities

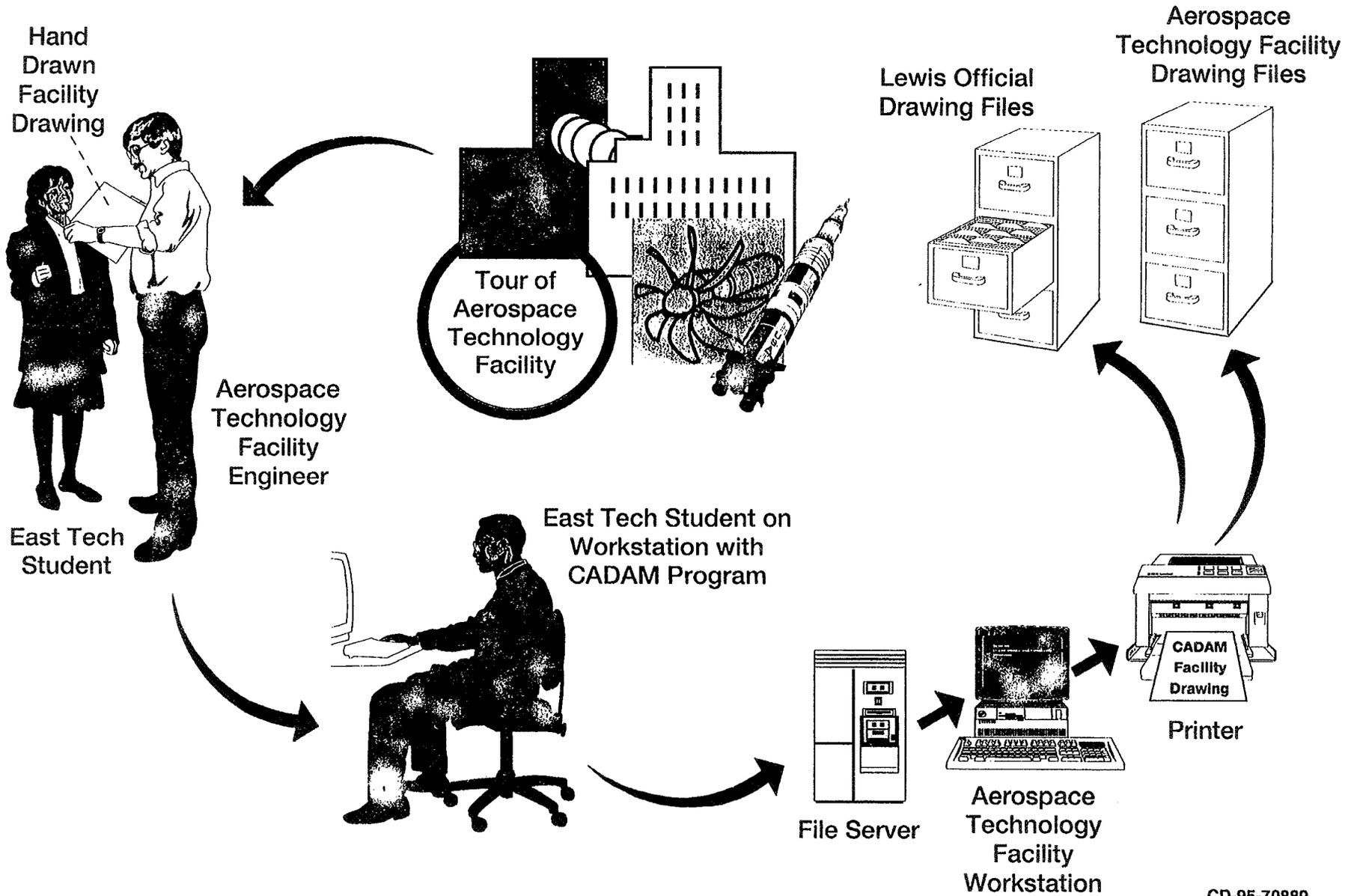
- Bug School is Developing a Geographical Information System (GIS) Course
- East Technical High School in Collaboration with NASA Aerospace Facility Division has Students Updating Facility Drawings on CADAM
- Barberton High School Working with NASA Researcher on Wind Tunnel Project which Exposes Students to Aeronautic Sciences
- Regional Classroom Projects to be a Reality with CUSEEME, a MAC-Based Desktop Conferencing Application

Lewis Research Center

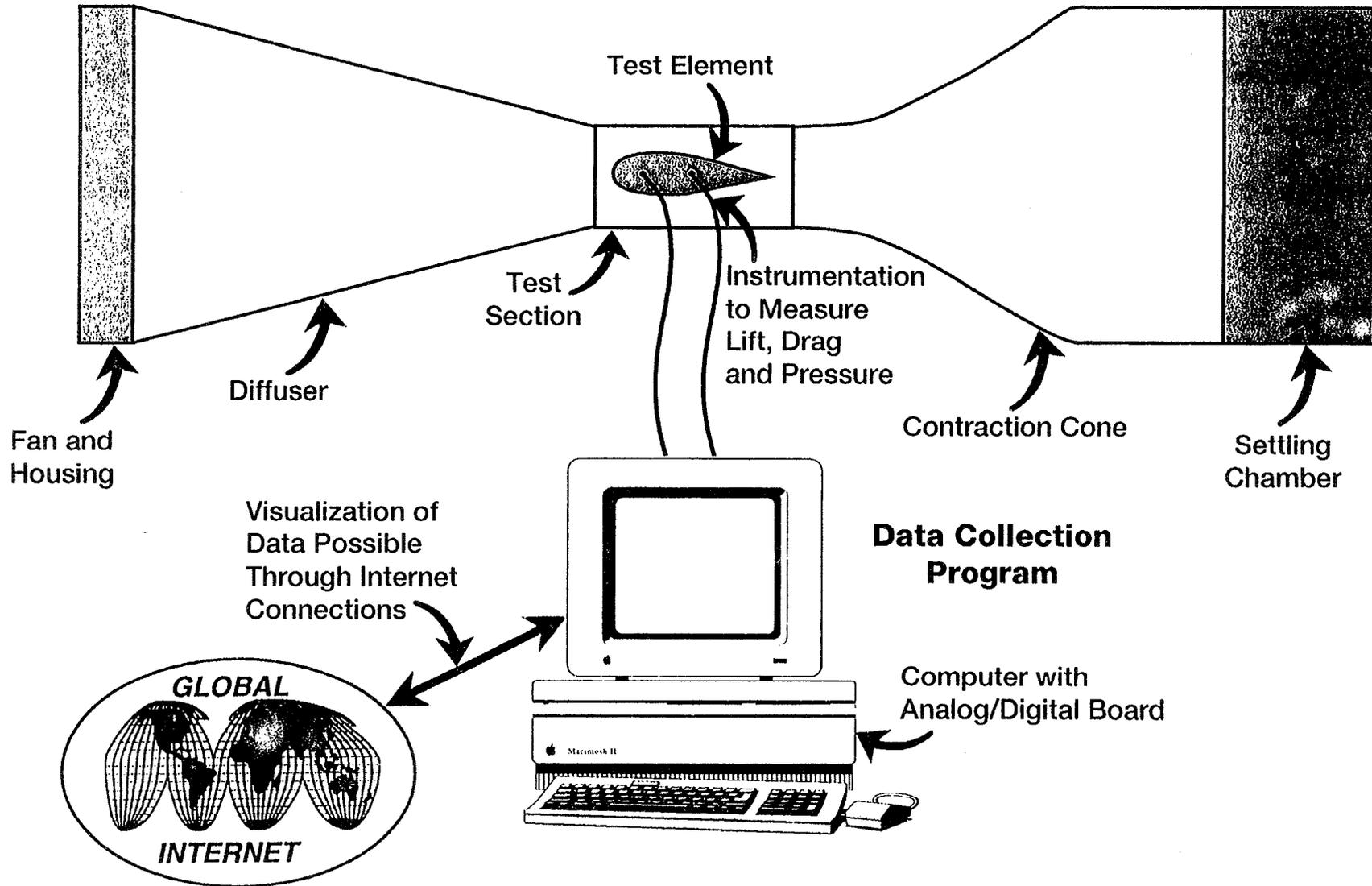
BUGONAYGESHIG GEOGRAPHIC INFORMATION SYSTEM



NASA Lewis HPCC K-12 Program CADAM Apprentice Program with East Technical High School



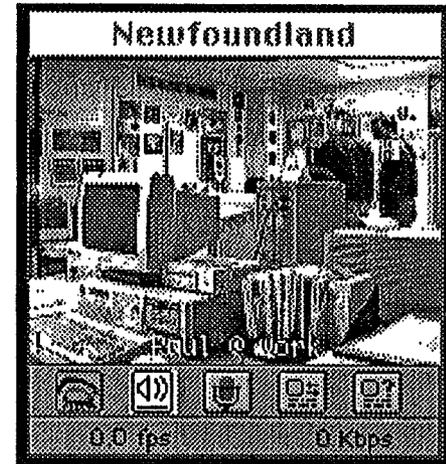
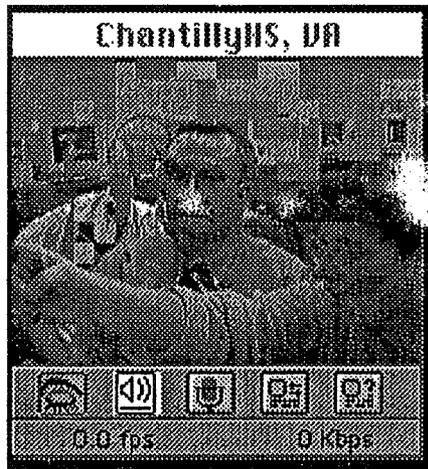
NASA HPCC K-12 Wandering Wind Tunnel Project With Barberton High School



NASA Lewis Research Center IITA K-12 Program

CUSEEME

Desktop Video Conferencing using the Internet





Curriculum Activities

- Barberton High School Using “Interactive Physics” in the Classroom
 - Students Use IP to Demonstrate the Three Laws of Motion After Classroom Lectures
 - Students Compare Hands-on Lab Results with IP Simulation
 - By Quickly Changing Variables on IP Students Learn How Values for Friction Change as Surface Types Change
 - Individual Classroom Projects are Assigned Using IP, For Example, Create a Pool Table and Billiard Balls

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Curriculum Activities

- Fairview High School Developed a Lab Project using Spyglass and Clarisworks to Determine the Ideal Flow Rate of “Slime”
 - Project Manager and Lab Manager Lead a group of 4 to 5
 - The Software Application Spyglass is Used to Generate 3-D Graphs of Data Collected in the Lab
 - Graphs are Used to Determine Ideal Flow Rate
 - Multimedia Lab Reports Generate Complete with Video and Sound Using Clarisworks, Adobe “Premiere” and “SoundEdit Pro”

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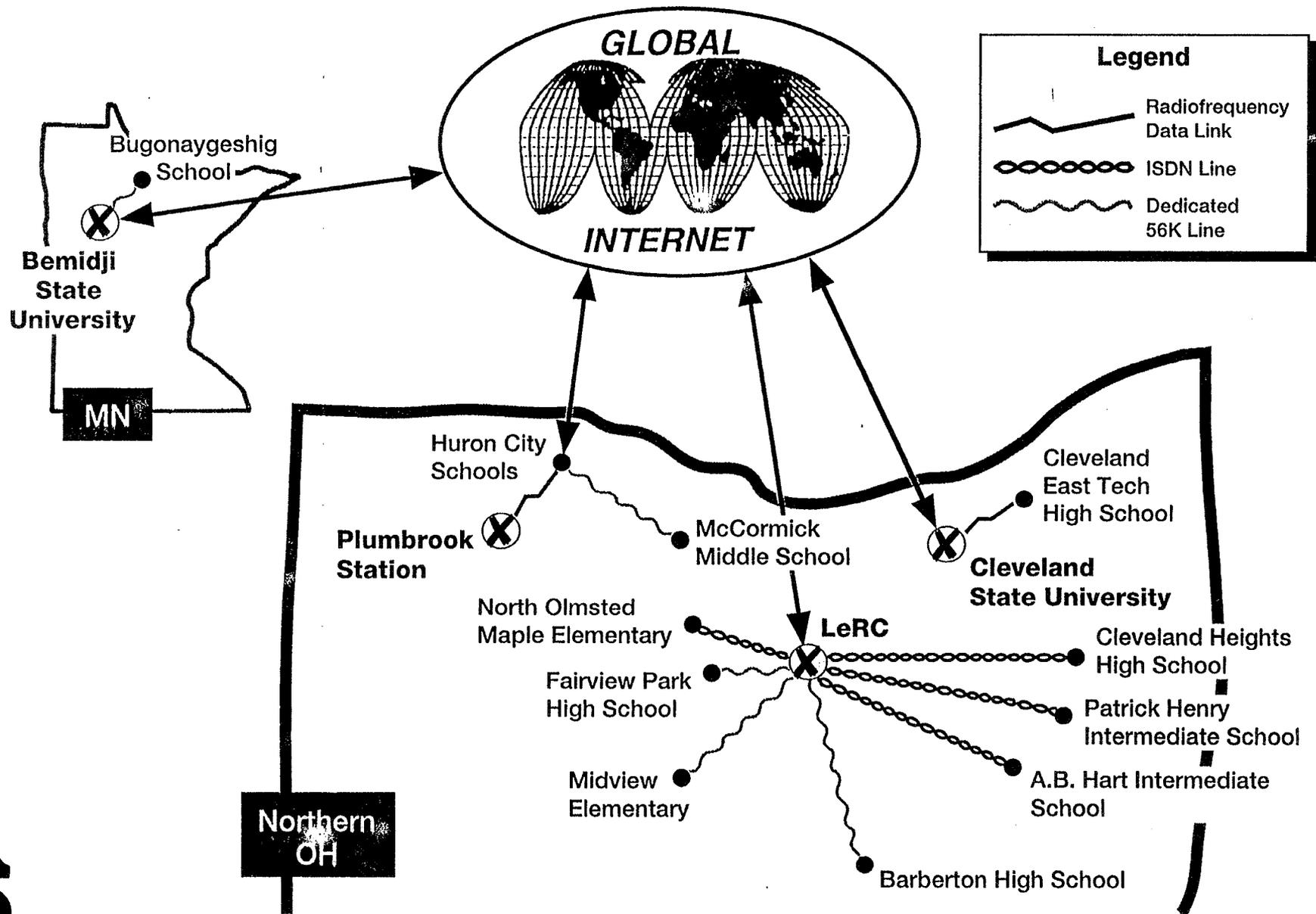


INFRASTRUCTURE SUPPORT

- **Standards-based Technologies**
 - RF
 - ISDN
- **Distributed POPs**
- **Network Design Support**
- **Network Applications**

Lewis Research Center

LeRC HPCC Network Connectivity for K-12 Schools





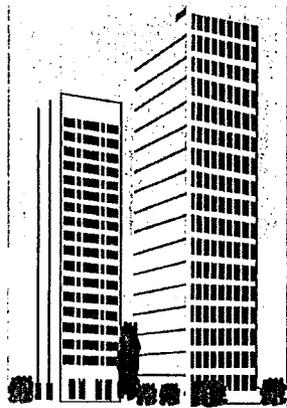
Radio Frequency Spread Spectrum Technology

- **Networks LAN's in Separate Buildings up to Five Miles Apart (Can be Extended to Ten Miles with Bi-Lateral Amplifiers)**
- **1.5 Mbps Effective Data Rate up to 40X Faster than Leased Lines.**
- **Instant Connection to Wired Backbone**
- **Compliant with IEEE 802.3 Ethernet Protocol**
- **902 - 928 MHz Spread Spectrum Radio - No License Required**

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RF Connectivity for K-12 Schools

Cleveland State University

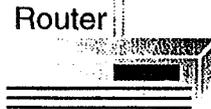


Rhodes Tower

- 2 Mbps Radio Link
- Spread Spectrum
- Unlicensed FCC Frequency
- 908Mhz - 928Mhz
- T1 Data Throughput
- No recurring charges
- 3-5 Mi radius



T1 Link



Router

RF/Ethernet Bridge



137.148.xx.xx

CSU Ethernet Backbone

East Technical High School



RF/Ethernet Bridge



East Tech Ethernet

137.148.205.xx



Server



Workstation



Cost of Radio Frequency Equipment

**Equipment Costs
(Router, Bridge, Antenna) \$2500.00/end**

Installation Costs \$50.00 - 200.00/end

No Usage Charge!

Lewis Research Center

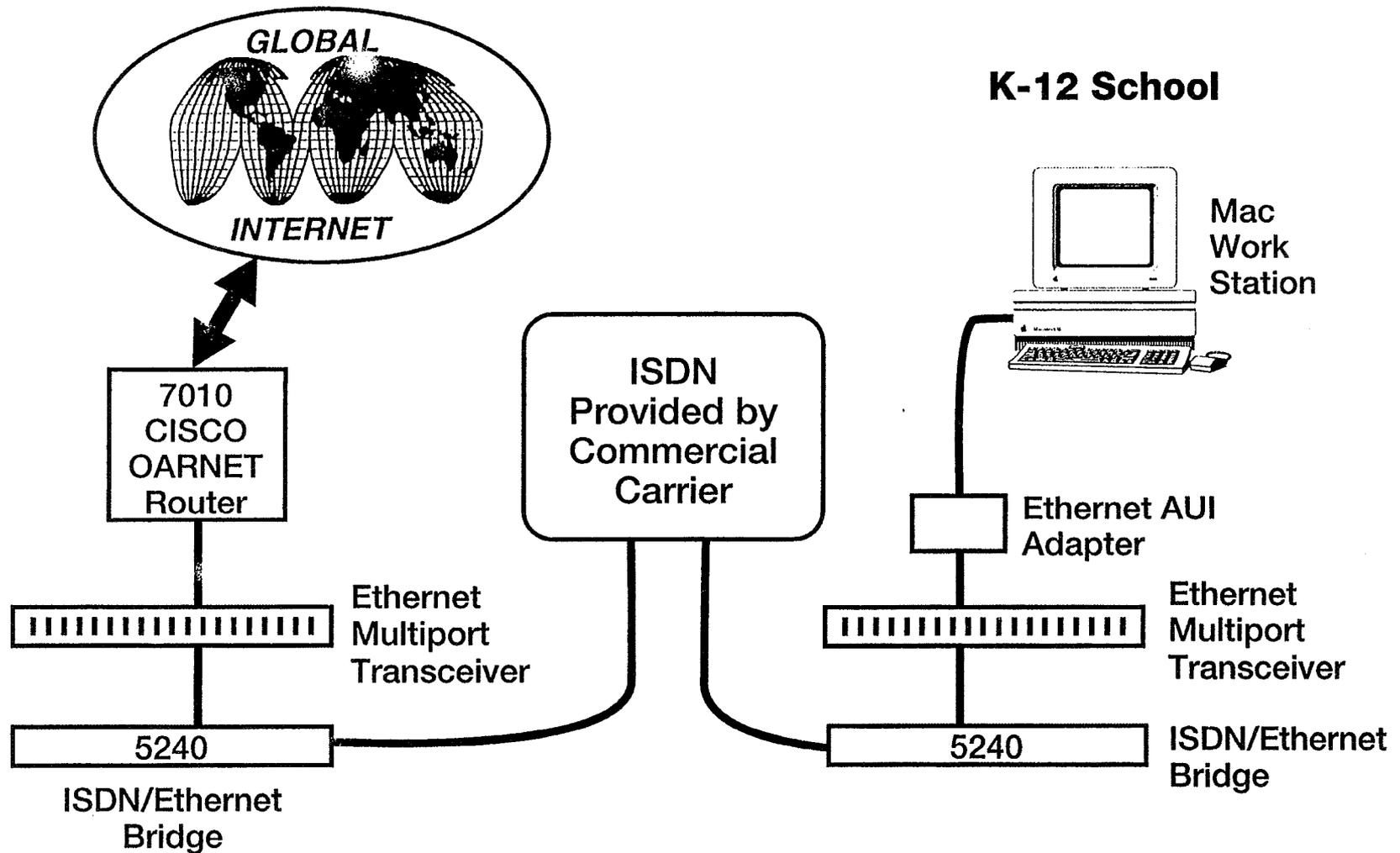


Integrated Services Digital Network (ISDN)

- **Integrated Communications Service, Provided by a Commercial Carrier (Ameritech)**
- **Service Includes one Basic Rate Interface (BRI) Line Comprised of 2B (2-64Kb) + D (1-16Kb signalling) Channels, Provides a 128Kb Bandwidth**
- **ISDN Equipment Uses Compression Techniques to Increase Bandwidth**

Lewis Research Center

ISDN Connectivity for K-12 Schools



NASA Lewis



Costs of ISDN Connections to K-12 Schools in the Cleveland Area

One Time ISDN Installation Cost \$200.00

ISDN Provider's Monthly Charge \$96.00 max

**Ethernet Bridge and Multiport
Transceiver Costs \$2500.00**

Lewis Research Center



FUTURE DIRECTIONS

- **Support Coverage**
 - 9/28 School Districts
 - RTRCs and EPO support
 - Project Development support proposals
- **Classroom of Excellence**
 - Extended Technology Center
 - Facilitators, Teachers, Parents and Student training
- **Aeronautics Curriculum Product**
 - Collaboration w/ Aeronautics Directorate
 - Support other curriculum efforts

Lewis Research Center

Dryden Research Center

Lee Duke

*NASA Dryden Flight Research
Center IITA K-12 Outreach
Program*

NASA Dryden Flight Research Center IITA K-12 Outreach Program

Plans:

In Fiscal Year 95, we have focused on using the Internet to integrate geographically isolated schools, under-funded schools with large minority enrollment, and a school serving students with severe emotion disturbances.

In Fiscal Year 96, we plan to expand this program by including a number of segregated schools within the Los Angeles Unified School District that serve students with physical and emotional disabilities.

Point of Contact:

**Lee Duke, MS-2131, Dryden Flight Research Center, PO Box
273, Edwards, CA 93523-5000, 805-258-3802,
duke@louie.dfrc.nasa.gov**

NASA Dryden Flight Research Center IITA K-12 Outreach Program

Goal: To use the Internet to encourage collaborative education in science and mathematics among schools serving diverse student groups in widely separated school districts.

Accomplishments:

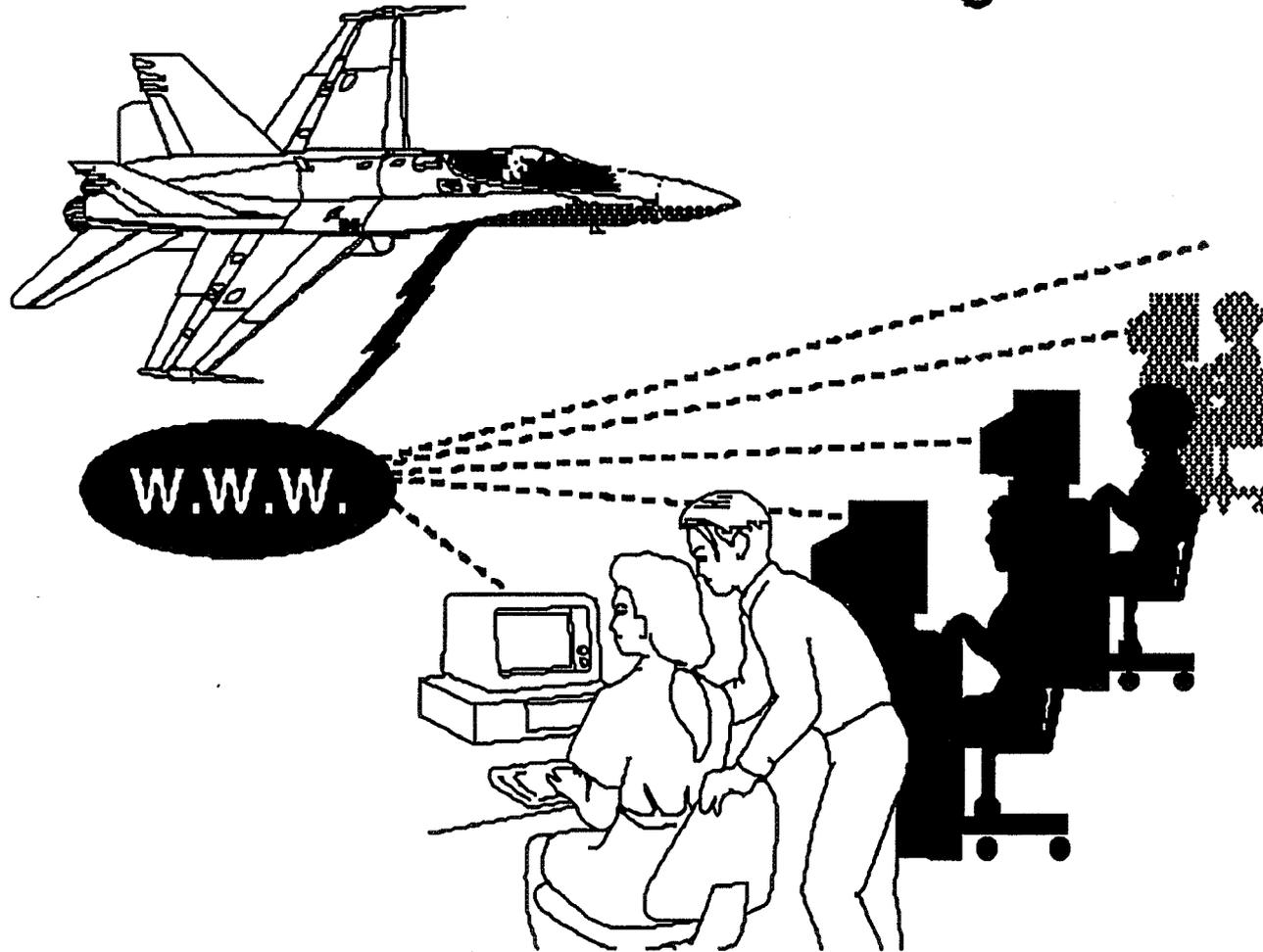
- **Electronic Busing: By working with schools in Pilot Project, we are developing curriculum materials and interactive experiments in which students learn about weather by using the Internet.**
 - **Selected schools for pilot program**
 - **Identified schools for possible inclusion in expanded program**
 - **Prepared Space Act Agreement for schools in pilot program**
 - **Hosted introduction to Internet in-services for educators in both pilot and expanded program**

NASA Dryden Flight Research Center IITA K-12 Outreach Program

Accomplishment (cont'd):

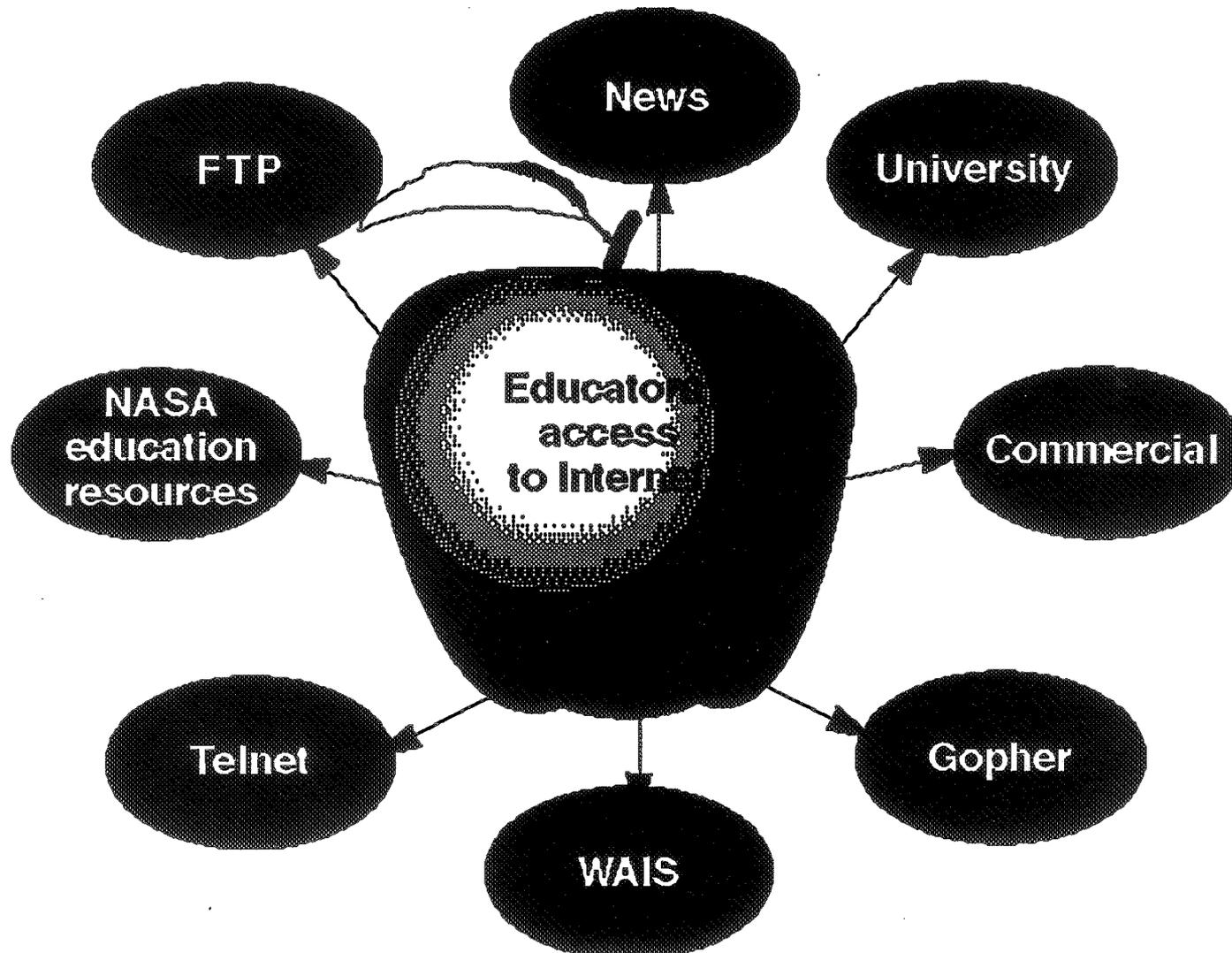
- **Educators' Access to Internet: Began development of a facility to introduce educators to World Wide Web Services, how to access those services, and how to prepare multi-media material for the World Wide Web.**
 - **Facility network design completed**
 - **Identified initial hardware and software for facility**
 - **Began procurement process of initial hardware and software**
 - **Began development of "A Teacher's Introduction to the Internet"**
- **Initiated FOSTER (Flight Opportunities for Science Teacher EnRichment) Online with the F-18 Systems Research Aircraft**

NASA Dryden Flight Research Center IITA K-12 Outreach Program

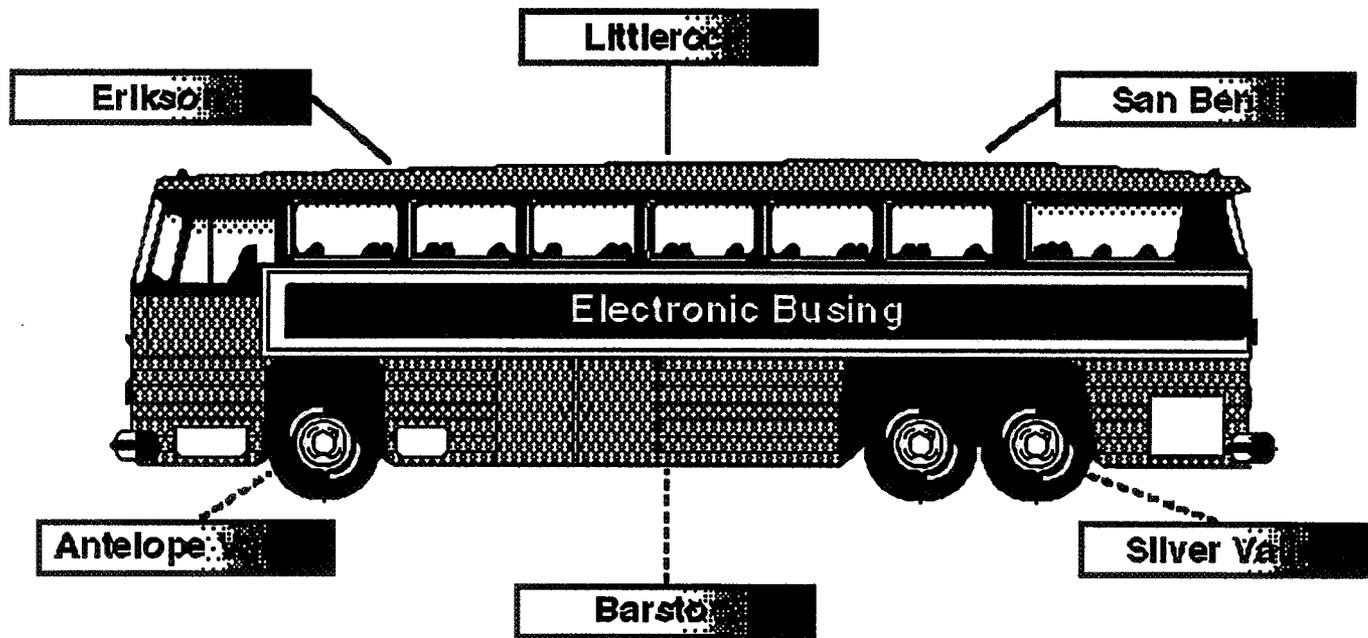


online with the F-18 Systems Research Aircraft

NASA Dryden Flight Research Center IITA K-12 Outreach Program



NASA Dryden Flight Research Center IITA K-12 Outreach Program



NASA Dryden Flight Research Center IITA K-12 Outreach Program

Schools in Pilot Program:

Hollister, California	San Benito High School	Dan Ryder
Littlerock, California	Littlerock High School	Lee Syer
Van Nuys, California	Erikson Center for Adolescent Advancement	Dr. Marianne McCarthy

Schools in Expanded Program:

Barstow, California	Barstow High School	Ken Nyborg
Lancaster, California	Antelope Valley High School	Bob Whitney
Yermo, California	Silver Valley High School	Linda Massimini

NASA Classroom of the Future

Bob Myers

*Exploring the Environment &
Astronomy Village*

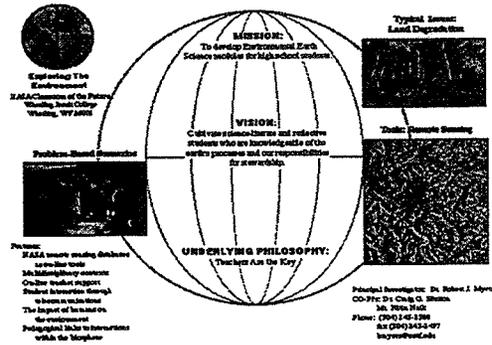
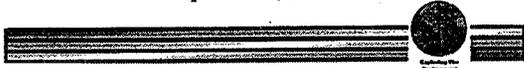
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Exploring the Environment

(Cooperative Agreement NCC5-107)

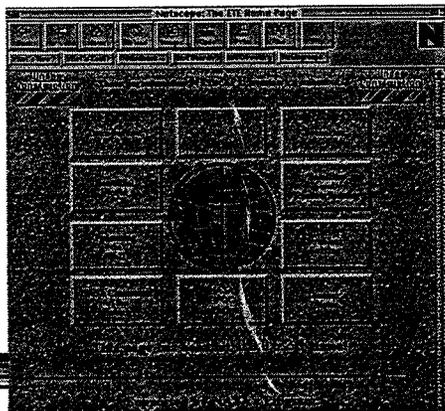
NASA Classroom of the Future Wheeling Jesuit College

IITA K-12 Educational Workshop
NASA Ames Research Center
April 11-13, 1995



Project Features

- Adjunct to high school Earth Science
- Teacher input in module development
- Teacher training, scaffolding and support
- On-line collaboration
- Problem-Based Learning



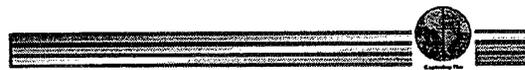
Partnership

- Bell Atlantic (West Virginia)
- West Virginia Systemic Initiative
- Chicago Systemic Initiative
- West Virginia University
- University of Arizona
- Old Dominion University
- Illinois Math and Science Academy (IMSA)



Selected Schools

- West Virginia (2)
- Pennsylvania (3)
- State of Washington (2)
- Illinois (2)
- Massachusetts (1)
- Virginia (?)

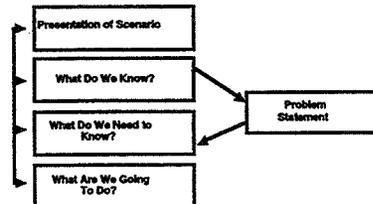


Introducing a Scenario

Ill-structured problem

- engages through anomalies or incongruities
- all activities anchored to a larger problem
- reflects complexity of real world
- gives ownership of problem to the student

Problem Solving Model



(Adapted from Stepien & Gallagher, 1993)

Tools

- Content specific to concepts subsumed by the larger issue
- Personal Accounts
- Maps, diagrams
- Remotely sensed images
- NIH Image
- Hands-on activities

TIME & SUPPORT

Students need them to:

- explore
- observe
- collaborate
- ask questions
- argue
- test ideas
- make meaning

Teachers need them to:

- plan
- learn new things
- collaborate
- take risks
- be creative
- manage instruction
- have access

Modules Currently Under Development

- Weather
- Deforestation
- El Nino
- Endangered Species
- Cratering
- Satellites and Remote Sensing

Challenges

- DOS or Windows Image Processor in Public Domain (e.g., NIH Image clone)
- Activities Facilitating On-line Collaboration
- Access to Images



Astronomy Village: Investigating the Universe

Education Product	
Teachers	Gr. 9-12

Astronomy Village: Investigating the Universe is a CD-ROM based multimedia program that provides teachers and students with ten complete investigations in astronomy intended to complement and extend the science curriculum in 9th and 10th grade classes. Students, in teams of three, use the *Astronomy Village* software to conduct investigations in astronomy and learn about the nature of scientific inquiry. The *Astronomy Village's* interface is based on the village-like appearance of major observatories on mountain tops. Tools available to students include an image processing program, a document "reader," an image browser, a telecommunications program for accessing the world-wide web, and various simulation programs. The simulation programs include a star life cycle simulator, an orbital simulator, and a 3-D star simulator. Other resources available on this CD for the student research teams include: digitized video clips; images from the Hubble Space Telescope and other instruments; audio clips of astronomers discussing their work; computer animations and graphics; and full text documents such as book chapters, NASA publications, and articles from astronomy journals and magazines.

Application Goal

The goal of the *Astronomy Village* is to provide schools with a multimedia curriculum resource aligned with national education reform efforts. The *Astronomy Village* provides opportunities for students to engage in scientific inquiry, learn about stars and stellar evolution, and make use of NASA resources and data.

Objectives

Students using NASA's *Astronomy Village* will:

- be motivated to learn about concepts in astronomy
- engage in scientific inquiry
- explore questions related to astronomy
- make use of technology to acquire, explore, and analyze information
- learn specific concepts related to stars and stellar evolution



Release Date: Spring, 1995

System Requirements

Astronomy Village is a Macintosh program. Its minimum system requirements are:

- Macintosh LC III* with System 7
- 8 megabytes of RAM
- 13" RGB color monitor (640 x 480 pixels, 256 colors)
- CD-ROM drive
- Hypercard 2.2 (not Hypercard Player)

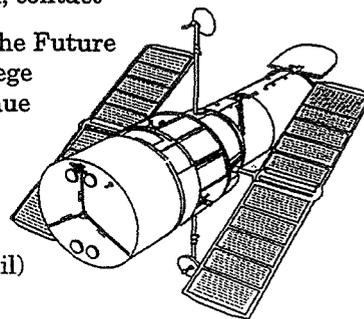
* *Astronomy Village* also runs on Power Macintosh

For more information, contact

NASA Classroom of the Future
Wheeling Jesuit College
316 Washington Avenue
Wheeling, WV 26003

304/243-2388 (voice)
304/243-2497 (FAX)

astrov@cotf.edu (email)



Windows to the Universe

Roberta Johnson

*An Earth & Space Science Internet-
Based Active Learning System*

Windows to the Universe

PI - Dr. Roberta Johnson, The University of Michigan

Co-Is

- **Dr. Joan Durrance, SILS, UM**
- **Dr. Claudia Alexander and Mr. Theodore Clarke, JPL**
- **Dr. Terry Weymouth and Dr. Craig Rasmussen, Turn of the Century Software**
- **Mr. Paul Orselli, Ann Arbor Hands-On Museum**
- **Dr. James Green, GSFC**

Consultants

- **Dr. John Clarke and Prof. Lennard Fisk, SPRL, UM**
- **Dr. Jonathan Linker, SAIC**
- **Mr. David Mastie, Pioneer High School, Ann Arbor**

Consultants

- **Dr. John Clarke, UM SPRL - Hubble Space Telescope Team, Astrophysics**
- **Prof. Lennard Fisk, UM AOSS - Astrophysics and Space Science**
- **Dr. Jonathan Linker, SAIC - MHD simulations, Solar Physics**
- **Mr. David Mastie, Pioneer High School - High School Earth Science Teacher, specialist in K-12 science education and curriculum development**

Project Goals

- **develop an innovative, Internet-based, and user-friendly learning system on the Earth and Space Sciences for the general public**
 - audience ranging from middle school children through adults
 - description, objectives, features, modes of use, content

- **deploy the system “Windows to the Universe” for public access in libraries, hands-on science museums, and classrooms**
 - team, synergistic activities
 - partnership with library, museum, and educational community
 - deployment and scaling plans

Project Goals

- **develop curriculum units on topics in Earth and Space Sciences which utilize system content and data resources**
 - working with curriculum development specialists
 - follow content guidelines provided by NSES draft and AAAS Benchmarks for Science Literacy
 - inquiry-based activities
- **test, evaluate, and revise the system in 6 month cycles**
 - plans for testing and evaluation
 - tracking metrics
- **provide training and technical support to library, museum staff, and classroom teachers**

MOSAIC-Based System

Windows to the Universe will provide a structure within which the user can access a wide range of Earth and Space science data resources in an intuitive fashion

- **remote sensing and in-situ data resources (images and data sets) enhanced by text, voice overlays, and animations**
- **hypertext capability utilized to structure multiple embedded learning windows**
 - highly graphically based at entry-level, to appeal to a wide audience
 - increasing sophistication in science content at deeper levels in window stack
 - users drawn into system to the level suiting their interest
- **enhanced to utilize collaborative learning technologies (COLLAGE or alternative software)**
- **develop associated CD with archive of frequently accessed images and data sets**

Key Objective

Utilize MOSAIC capabilities

- hypertext
- images (with embedded hot spots)
- voice overlays and sound
- movies

coupled with

- collaborative learning technology
- CDs

to relate RSDB resources (images, data sets) with:

- descriptions of state-of-the-art scientific understandings,
- basic concepts in science (content and processes)
 - » e.g., gravity, electricity, magnetism, systems, modeling
- relevant historical and cultural associations

Modes of Use

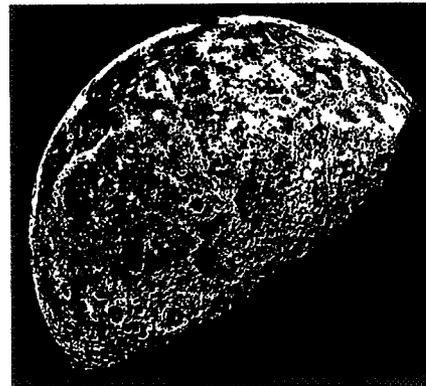
Three prime modes of interaction

- **individual learner mode: users explore the structured, value-added application at their own pace**
- **group learning mode: allow interaction between geographically disconnected groups**
 - » **share viewing and exploration of data resources**
 - » **interact via synchronous communication**
- **expert user mode: allows direct access to a selection of down-loadable formatted data sets available over the Internet**
 - » **display/manipulate using graphics interface (UMDL collaboration)**
 - » **user projects (complement K-12 curriculum needs)**

Sample Topic Area 1

The Earth's Moon

An end-user has clicked on the Earth system in the entry page, and subsequently clicked on the image of the moon to get a closer look at the body. Figure 1 appears, with an associated text describing the image, how it was obtained, and what it means. In this case, the color scheme is explained and related to lunar

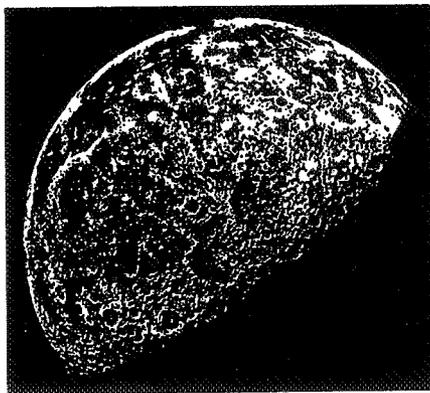


The Earth's Moon
As viewed from the Galileo spacecraft on December 7, 1992

This false color image of the moon is a mosaic made of a series of 53 images taken by the Galileo spacecraft. The northern polar regions of the moon are shown. The colors show the different kinds of rocks that make up this region of the Moon.

Bright pink areas are the lunar highlands. Blues and oranges show lunar volcanic lava flows.

Figure 1 - An example of the type of image that the user might encounter when learning about the Moon.



Lunar volcanic lava flows

The origin of the moon is unknown. These Galileo images show that volcanoes have been active on the moon for more than 2 billion years, but the youngest lava flows are about 1 billion years old. Some of the Moon's lava flows are more than 600 miles long, and are as thick as a football field is long. The lava flow from Mare Imbrium would stretch from Phoenix to Salt Lake City. Scientists believe the low lying areas were flooded early in the Moon's history. Those flows are covered with material thrown out of impact craters. Other meteorites punched holes in the old flows, bringing new lava to the surface.

Figure 2 - After clicking on lunar volcanic lava flows, the user reaches a deeper level of information describing lunar volcanism.

geology. The user then clicks on the text anchor "lunar volcanic lava flows" to access information on our understanding of lunar volcanism, volcanic features, and the age of the moon (Figure 2).

Sample Topic Area 2

Io and the volcano Loki

The user wants to learn about Jupiter, and has clicked on the image of the Jovian system in the initial display. A zoom-in image of that system then appears, including images of Jupiter and its attendant moons. The associated text would briefly describe the Jovian system and its unique features. Subsequent clicks on text anchors or image hot spots would allow the user to investigate Jupiter and its moons in turn and to delve further into higher resolution images of the planet and its moons. In this example, the user wants to learn about Jupiter's moon Io, and is interested in the volcano Loki and its mythological connection.

Volcano Loki

This volcano is a prominent feature on the surface of the Jovian moon Io. The volcano has an interesting shape of a heifer's (cow's) foot print. The inset painting "Jupiter and Io" by Correggio (16th century Italian Renaissance) relates to the myth in which the god Jupiter (the cloud) turns the maiden Io into a cow to hide her from the goddess Juno.



Figure 3 - An example of an image an user might encounter while learning about the Jovian moon Io. The inset painting is an art historical artifact associated with the volcano Loki.

Synergistic Activities

- **UM UARC (NSF) - A Scientific Group Communications and Collaborative Testbed for Upper Atmospheric Research**
- **UM Digital Library Program (NSF, ARPA, NASA) - Project to develop an Internet based digital library for the Earth and Space Sciences and provide public access at libraries, schools, and universities**
- **UM Blue Skies (NSF) - A UNIDATA-based weather display system, providing Internet access in Michigan classroom testbed**
- **Other K-12 educational (PBS), digital library, and public outreach activities - ongoing and proposed at SILS, SPRL, School of Education, Medical College, and UM Advanced Technology Laboratory**

Partnership with User Community

- **Co-Is representing library and museum communities are participating in development, deployment, training, testing, and evaluation**
- **These individuals bring unique expertise in user needs/concerns**
 - system hardening,
 - computer shy users,
 - staff training and support,
 - display considerations,
 - associated materials,
 - evaluation of application and content from perspective of end-user as well as on-site staff
- **Mr. David Mastie - ensure content development aligns with standards (NRC NSES, Benchmarks) and curriculum development**

Deployment Plan

- **Bare-bones prototype deployed for initial testing and evaluation at AAHOM and SILS laboratory August 1 (6 mo.)**
- **First test version of application deployed at one-yr mark in AAHOM and SILS, including expanded content and revisions based on results of first testing/evaluation cycle**
- **Yearly training workshops at SPRL**
- **Continued 6 mo cycle of testing/evaluation/revision to new test version throughout project**
- **Maximize cost-effectiveness and expand exposure to wider audience, including new installations at dozens of additional Michigan sites, working with UM Digital Library Program**

Scaling Plan

- **During second year, we will deploy regionally (Michigan, Mid-West, East Coast)**
- **During third year, we will deploy nationally**
- **Competitive proposals will be solicited from interested museums and public libraries for participation in second and third years**
- **At least one fully funded new site per year**
- **At least 4 fully funded deployments by end of 3rd year, including computer, ISDN Internet access, partial funding for on-site staff, training, and technical support**

Evaluation

- **Analyze application use via:**
 - transaction logs (URLs, time stamps, individuals, etc)
 - site visits
 - observation
 - interviews with selected users
 - focus group interviews
 - written evaluation instruments
- **Produce information for tracking metrics, as well as parallel research effort**

Evaluation - Continued

- **Research underway into baseline utilization of Internet/computer resources in the AAHOM**
- **Considering providing option for core user IDs - tracking**
- **Community as co-designers? Option for comments on each page**
- **Research: Studies of user's approach to library resources; primary access factors and barriers; models for providing access to complex digital information; changes in awareness of digital formats; learning enrichment**

Tracking Metrics

Four Metrics Identified

- **Attractiveness of Display and Application**
 - Fractional number of users at each site
- **User Interest - Tracking of Individuals**
 - Frequency of reuse by individuals
 - Duration of individual sessions
 - Depth of penetration into the system by individuals
- **Reasonableness of success metrics will be re-evaluated during evaluation of the first test version**

Project Status

- **February 1 1995 start date**
- **Completed most equipment purchases, hired programmer and student support, ISDN line installed to the AAHOM**
- **Graduate class (SILS) investigating baseline Internet utilization**
- **Bi-weekly project meetings plus collaborations with UMDL project**

Project Status - Continued

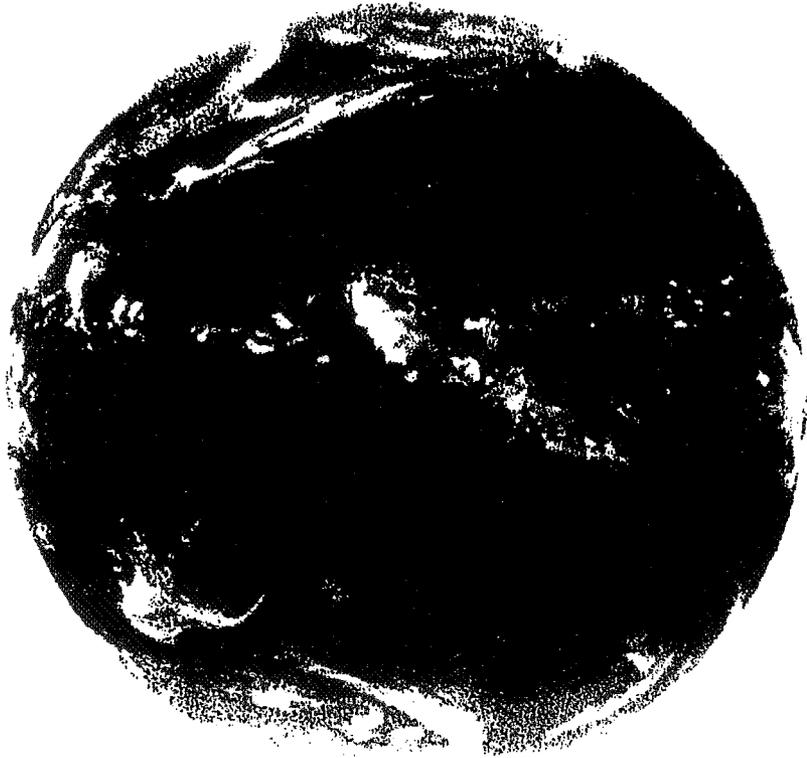
- **Discussions with additional sites for possible year 1 and year 2 deployment**
- **Beginning development of system with first public prototype available August 1, 1995**
- **Expansion of effort into middle and high school curriculum development activities**

The GLOBE Program

Dale Dickerson

*Global Learning & Observations to
Benefit the Environment*

THE **GLOBE**
PROGRAM



GLOBAL
LEARNING AND
OBSERVATIONS TO
BENEFIT THE
ENVIRONMENT

OVERVIEW



GLOBE IS A HANDS-ON PROGRAM INVOLVING STUDENTS (K-12 OR EQUIVALENT) IN SCHOOLS THROUGHOUT THE WORLD:

- TAKING A MINIMUM ACCEPTABLE SET OF GLOBE MEASUREMENTS USING GLOBE INSTRUMENTS AND PROCEDURES UNDER THE GUIDANCE OF GLOBE-TRAINED TEACHERS
- REPORTING OBSERVATIONS TO A CENTRAL DATA PROCESSING FACILITY
- RECEIVING GLOBE FEEDBACK AND USING GLOBE EDUCATIONAL MATERIALS UNDER THE GUIDANCE OF GLOBE-TRAINED TEACHERS
- MAKING A LONG-TERM INSTITUTIONAL COMMITMENT TO GLOBE

GLOBE OBJECTIVES



GLOBE WILL BRING SCHOOL CHILDREN, TEACHERS, AND SCIENTISTS TOGETHER TO:

- ENHANCE ENVIRONMENTAL AWARENESS OF INDIVIDUALS THROUGHOUT THE WORLD
- CONTRIBUTE TO SCIENTIFIC UNDERSTANDING OF THE EARTH
- HELP ALL STUDENTS REACH HIGHER STANDARDS IN SCIENCE AND MATHEMATICS

WHAT MAKES GLOBE UNIQUE?



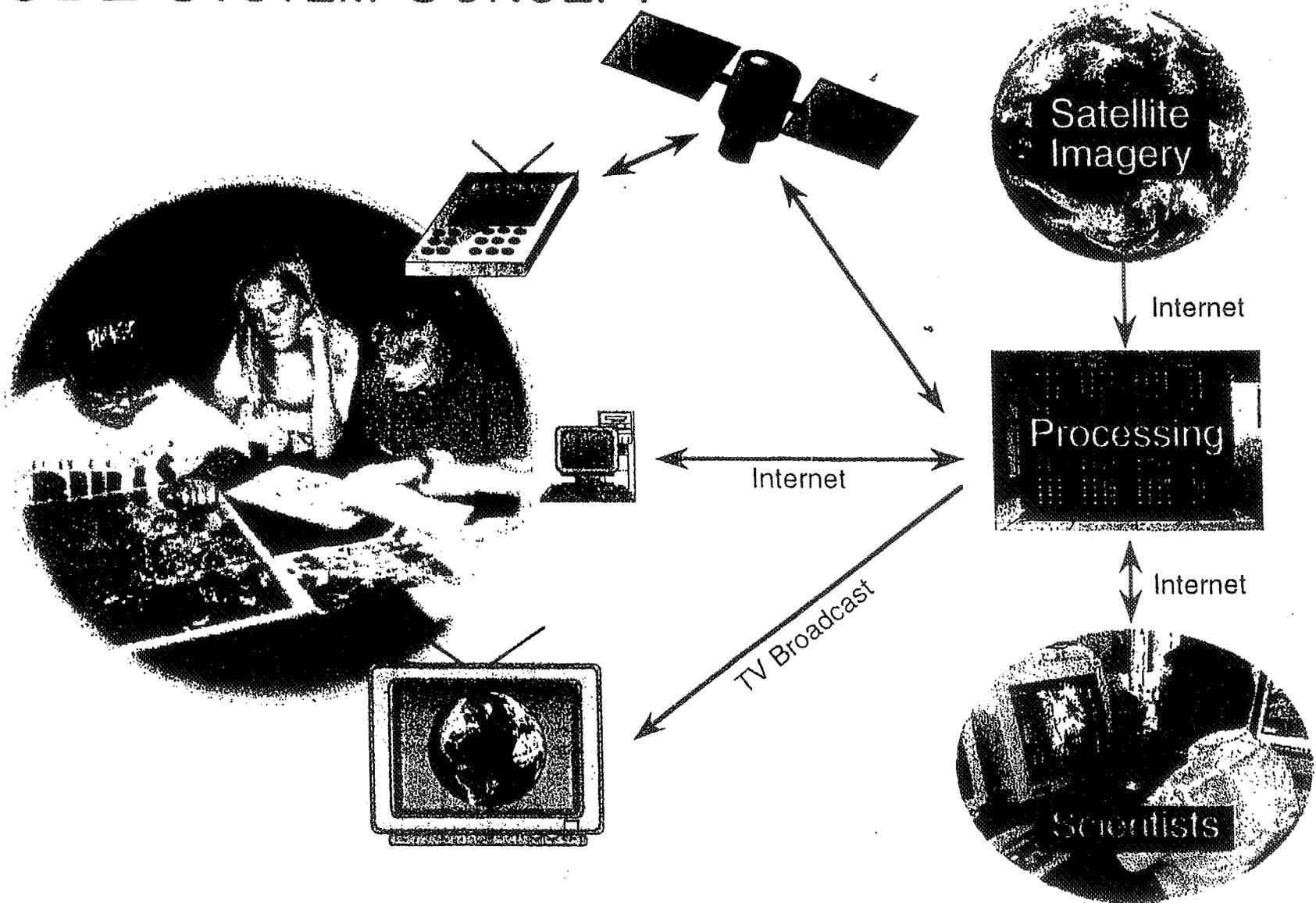
GLOBE IS VERY AMBITIOUS IN SCALE, PLANNING TO INVOLVE STUDENTS IN AS MANY NATIONS AS POSSIBLE

GLOBE STUDENTS WILL BE MAKING SIGNIFICANT SCIENTIFIC MEASUREMENTS, CREATING A VALUABLE NETWORK OF EARTH OBSERVATION STATIONS

GLOBE STUDENTS WILL SHARE THEIR OBSERVATIONS WITH ONE ANOTHER AND THE WORLD SCIENCE COMMUNITY

GLOBE STUDENTS WILL DEVELOP A GLOBAL PERSPECTIVE, RECEIVING TIMELY GLOBAL ENVIRONMENTAL IMAGES BASED ON THEIR OBSERVATIONS

GLOBE SYSTEM CONCEPT



2005

GLOBE
PROGRAM



GLOBE Measurements and Instruments



envmeas_feb24b

Atmospheric/Climate

Air Temperature	Max/Min Thermometer	K - 12
	Calibration Thermometer	K - 12
	Instrument Shelter	K - 12
Precipitation	Clear Plastic Rain Gauge	K - 12
Cloud Cover	Cloud Charts	K - 12

Hydrology/Water Chemistry

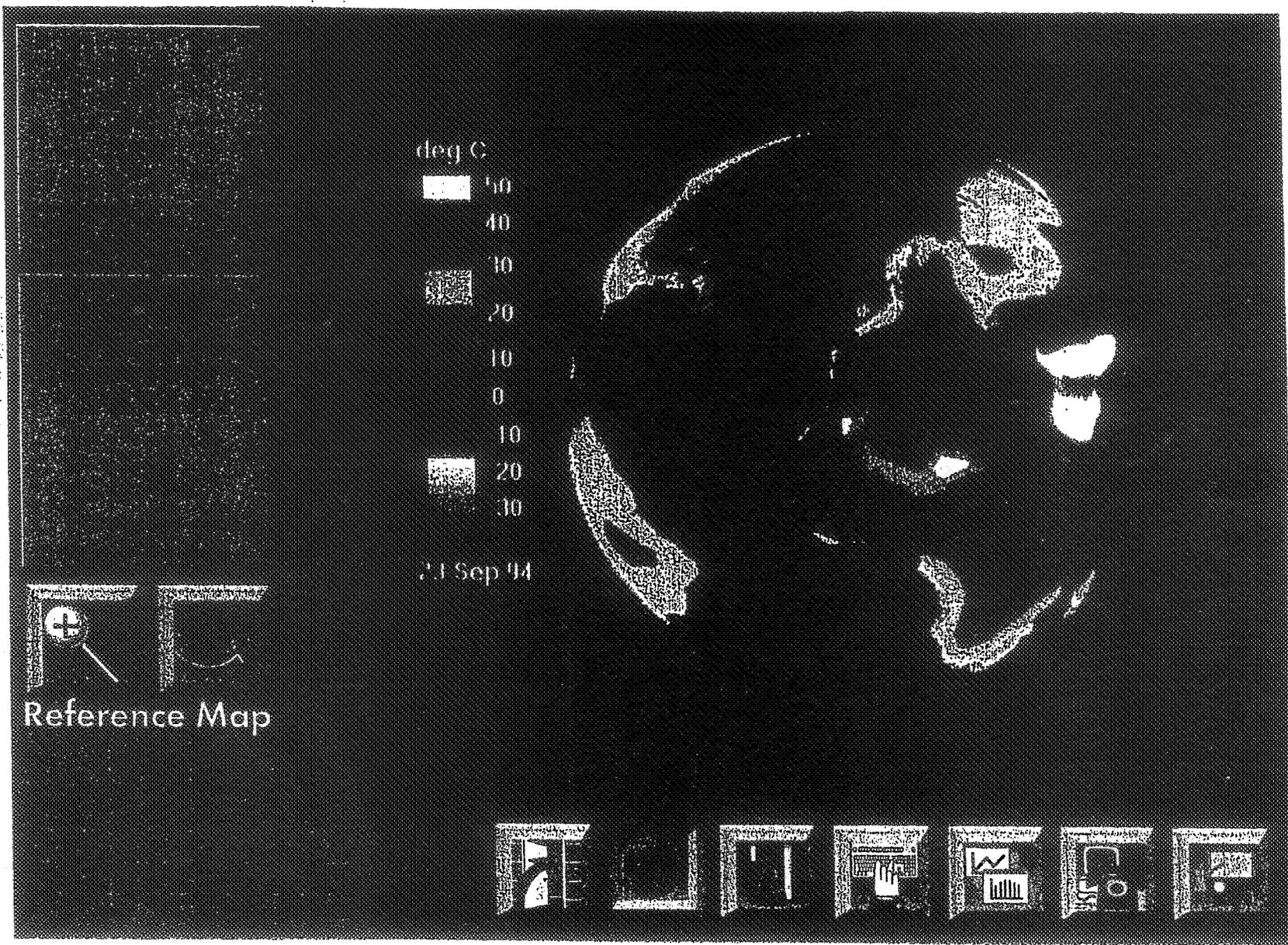
Water pH	Litmus Paper	K - 5
	pH Pen	6 - 8
Water Temperature	pH Meter	9 - 12
Soil Moisture	Alcohol Thermometer	K - 12
	Soil Moisture Meter & Gypsum Blocks	9 - 12
	Auger and PVC Piping	9 - 12

Biology/Geology

Habitat Study	Compass	K - 12
	Meter Measuring Tape	K - 12
	Surveying Markers or Stakes	K - 12
Tree Height	Home-made Clinometer	K - 8
	Clinometer	9 - 12
Tree Canopy	Home-made Densiometer	K - 8
	Densiometer	9 - 12
Tree Diameter	Diameter Tape	K - 12
Species Identification	Dichotomous Keys	K - 12
Phenology (seasonal change)	35 mm Camera and film	K - 12

The GLOBE Program





Passport to Knowledge

Geoff Haines-Stiles

*Electronic Filed Trips to Scientific
Frontiers via Interactive TV &
Internet*

34.80
93003
250675
101

PASSPORT TO KNOWLEDGE

Electronic Field Trips to Scientific Frontiers via Interactive TV and the Internet

An interim Report and Evaluation re: **LIVE FROM ANTARCTICA**, Dec. '94 - Jan. '95

“Imagine a planet packed solid with circuitry; a network of computers with eyes that look out at the universe, or at the inner world... It is a world packed with information. If its inhabitants remember that it is a tool for understanding, not an end itself, it will be a world full of wonders.”

THE ECONOMIST of London, lead editorial, October 8th. 1994

INTRODUCTION: AN “ELECTRONIC FIELD TRIP”

The PASSPORT TO KNOWLEDGE project delivered its initial 3-year NASA-supported activity in December 1994 and January 1995. LIVE FROM ANTARCTICA was an integrated, multimedia activity, including 4 one hour-long video programs (expanded from the 40:0 minute programs proposed), all with live components as well as taped segments, together with an extensive online element containing interactive as well as background information, and the printed LIVE FROM ANTARCTICA Teacher’s Guide, published by Prentice Hall School, suggesting hands-on, in-class activities.

A traditional field trip takes students out of their classrooms to locations they would otherwise not visit, and there lets them look around and converse with experts who respond to their questions by reference to the concrete experience of being in another place. UNLIKE a traditional field trip, LIVE FROM ANTARCTICA relied upon live interactive video and satellite communications rather than a yellow school bus for transportation!

This first MODULE was funded, in part, by the Information Infrastructure Technology and Applications Program of NASA’s Office of High Performance Computing and Communications (CAN OA-94-1), with additional NASA support from the Education Division and the Office of Life and Microgravity Sciences. In-kind assistance came from the NASA Science Internet, the K-12 Internet Project, and NASA Spacelink. The National Science Foundation funds and manages all American research in Antarctica, and without their support the project would have been impossible. PBS K-12 Learning Services and the U.S. Department of Energy were also credited as sponsors. NOAA (the National Oceanic and Atmospheric Administration) and the U.S. Geological Survey cooperated in critical aspects of the project. This collaboration between U.S. government research agencies in support of a televised educational project was unprecedented.

RATIONALE

The rationale for the project can be found in a comment by noted science writer Lewis Thomas ("Lives of a Cell"):

“The worst thing that has happened to science education is that the great fun has gone out of it... (science should be) high adventure, the wildest of all explorations ever taken by human beings, the chance to catch close views of things never seen before, the shrewdest maneuver for discovering how the world works.”

PASSPORT TO KNOWLEDGE is designed to provide teachers with ways to excite students about science by “taking” them to scientific frontiers, and there letting them interact over live tv and the Internet with some of the world’s best researchers. By providing an integrated learning package, it hopes to ensure that students are exposed to the most current *content* -- more up-to-date than any textbook -- while also improving *attitudes* and enhancing scientific literacy, and developing telecommunications and computing *skills* that will be still more important in the economy of the coming decades.

AN INTEGRATED VIDEO-PRINT-ONLINE EDUCATIONAL PACKAGE

However, it would be a mistake to think of PASSPORT TO KNOWLEDGE only as the LIVE FROM... specials. As can be seen in figure (a) the live video is, pun intended, only the “tip of an iceberg” of activities. The 4 live programs are supported by print and online materials. Teachers can find references to kits with which to undertake classroom experiments, or pointers to other print, video and online resources. A 1-800-626-LIVE Hotline provides information and support for those teachers and schools not yet online. The programs were initially distributed free over public television and NASA-TV, and are also available on tape from NASA CORE at cost. The Teacher’s Guide contains an Evaluation Form for teacher and student participants, which is also posted online. An extensive assessment and evaluation of LIVE FROM ANTARCTICA will lead to new ideas for the two currently funded follow-on projects, LIVE FROM THE STRATOSPHERE and LIVE FROM THE HUBBLE SPACE TELESCOPE.

The scientific content of the project focused on the co-evolution of the Antarctic continent and its unique life-forms, both the seals and penguins of its coasts, and the microscopic inhabitants of its interior. Another continuing element was a description of the tools it takes to support research in such an extreme environment -- ski-equipped planes, ice-breakers, modern telecommunications, and hardy, adventurous science teams and support staff. The programs and online components also featured images from many Remote Sensing Databases, including those showing the annual fluctuation of the sea-ice, the ozone hole, global cloud cover and near real-time weather imagery. Other graphics showed the movement of the continents over one billion years in time, and the

impact of fragments of Comet Shoemaker/Levy 9 on Jupiter, recorded by SPIREX, the South Pole Infrared Explorer.

LIVE UPLINKS REFLECTING GEOGRAPHIC AND STUDENT DIVERSITY

PASSPORT TO KNOWLEDGE intends to use the national reach of public television to reach out to otherwise under-served populations, to demonstrate the power of the Information SuperHighway to level the playing field, and redress geographic and other disadvantages. The four programs each had multiple live, uplink sites in the United States from which students were able to converse, live, with researchers in Antarctica.

In program one, the predominantly migrant students of the McAllen School District, in the Rio Grande Valley of Texas, joined youngsters at two sites in Maryland to speak with Antarctic researchers atop a mountain in the Dry Valleys, 70 miles outside McMurdo Station, America's main base, and in the "Weather Ops" building back in McMurdo.

The second program linked Hawaii, Maryland and the sea-ice near Scott Base, close to McMurdo, where an expert on seals and penguins responded, and the icy surface of Lake Hoare, where Diana Freckman discussed the strange and microscopic creatures of Antarctica's unique Dry Valleys.

The third program, "SPACESHIP SOUTH POLE", included the first-ever live video from the end of the Earth, an achievement only made possible by the cooperation of NSF, NASA, NOAA and many others in Antarctica and the U.S. It featured high school students in Chicago speaking live with a former class-mate, selected by NSF to travel to Antarctica. 18-year old Elizabeth Felton also participated in a ceremony to reposition the marker of Earth's exact geographic South Pole, and spoke about her dream to become an astronaut. 3rd grade students in Charlottesville, Virginia, talked with April Lloyd, their teacher, who had also been selected to travel south. The final uplink site was once more Hawaii, where the architect for the planned redevelopment of the South Pole station had been working with middle-schoolers on hands-on projects demonstrating the realities and rigors of life at the Pole.

The last program linked Barrow, Alaska, the northernmost school district in the United States with Maryland and Antarctica. Students from the ECOlogic Project at Gonzaga High School in Washington, D.C., demonstrated the use of the Internet to explore and understand ozone, while NOAA Lt. j.g. Kate McNitt responded live from aboard a Coast Guard icebreaker in McMurdo Sound. Students from Gallaudet's Model Secondary School for the Deaf used sign language to pass on questions e-mailed in live during the broadcast, via a translator, to researchers in the Antarctic, who responded to students all across America. Each program, but perhaps especially this last episode, demonstrated the new communications world of today and tomorrow in entertaining, exciting and memorable ways.

A STRATEGY TO "GROW" INTERNET FAMILIARITY AND USAGE

PASSPORT TO KNOWLEDGE recognizes, however, that most teachers and students do NOT have access to the tools available to model projects such as that of ECOlogic. Figure (b) shows the strategy adopted to reflect that fact, and help change the present reality. This figure shows a "pyramid", with the broader, lower end reflecting teachers' access to and familiarity and ease with various communications technologies. Television and print are obviously the most well-known, and easy to use. PASSPORT TO KNOWLEDGE tries to build on this broad base, and -- in LIVE FROM ANTARCTICA and future Modules -- encourage teachers to climb the pyramid of possibilities, until some fair number of them are able to engage on online publication using Mosaic and other high-end network tools.

Not all elements of the "Pyramid" chart were deployed in LIVE FROM ANTARCTICA. For example, it was found that most teachers seemed to think "fax-back" or document-on-demand services were not much more feasible than network connections. But future LIVE FROM... projects will attempt to encourage movement up the steps of the pyramid. The skills learned on each project (ability to send e-mail messages, or download text and graphic files) will be generic, even when the specific content changes from Antarctica to astronomy.

Such skills also apply to disciplines other than the sciences: "telecomms literacy" is an "Open Sesame" relevant to social studies, language arts, and a host of other areas, many of which were demonstrated by teachers participating in LIVE FROM ANTARCTICA and which will be documented in the evaluation.

ONLINE NETWORKS

The project worked with 3 online networks, primarily NASA's K-12 Internet Project for the interactive components. The "quest" server, housed at NASA's Ames Research Center, provided a "gopher" menu allowing access to:

- * a digital version of the Teacher's Guide, including diagrams
- * "Field Journals", regularly updated from scientists and other Antarctic travelers, including the video crew and the teacher-student pair;
- * "Researcher Q&A" -- permitting students to ask questions online for which there was no time during the live video programs;
- * a weekly Brainteaser, or "Challenge Question";
- * extensive files from NSF and CARA, the Center for Astrophysical Research in Antarctica, many of which had never before been made available to the public;
- * "Antarctic Resources", a listing of addresses and content of the major sources of Antarctic information in the U.S. and around the world; and,
- * Teacher and Student Evaluation forms.

LIVE FROM ANTARCTICA: interim Report and Evaluation, as of Jan 31st 1995

A weekly "Update" with information on the project's "3 T's" (Television, Telecomputing and Teachers) was mailed electronically to nearly 1,000 teachers (samples appended.) A 300-member "discuss-lfa" conference allowed teachers to exchange ideas and comments (samples appended), some of which suggested ideas to the video production team, and an "info-lfa" list allowed new subscribers to quickly scan the online resources.

The project's World Wide Web Home Page can be found at:

<http://quest.arc.nasa.gov/livefrom/livefrom.html>

The online resources were echoed by NASA Spacelink (and can be found under the "Hot Topics" menu) and by PBS Learning Link.

Nearly 100 classrooms collaborated on projects over the Internet as "Classroom Co-Investigators", each adopting a certain area of study, and becoming expert and able to answer peer questions, an experience research has shown to lead to greater learning than more passive receipt of information.

CARRIAGE AND DISTRIBUTION

209 of the nation's 350 public television stations either carried the programs live, or recorded them for future broadcast. (PASSPORT TO KNOWLEDGE had suggested 50 PBS stations to NASA as a metric for success in this first electronic field trip.)

The programs aired live in New York, Chicago, Philadelphia, Washington (over MPT), Cleveland-Akron, Denver, Baltimore, Indianapolis, Charlotte and Cincinnati (among the top 30 markets.) Los Angeles, San Francisco, Detroit, Houston, Atlanta, Pittsburgh, Orlando, San Diego and Portland have either committed to record and hold the program for future broadcast (for example, Portland intended to air in March), or the school districts already have direct satellite into the school systems. In summary, 23 of 37 "top 10" stations, 33 of 57 "top 20" stations and 78 of "top 50" stations have either aired the program live, or are committed to air the programs over the coming months, totaling 209 of 349 PBS stations, comprising 78.85% of U.S. homes or school districts.

NASA-TV carried each program either live, or on tape delay, and has re-broadcast them several times. Additional broadcasts were scheduled for February, March and April, with a "marathon" back-to-back re-airing on Saturday February 25th. Additional broadcasts are expected throughout 1995. Videotapes are available to educators at cost plus shipping, via NASA CORE.

DISTRIBUTION OF TEACHER GUIDES: PRELIMINARY RESULTS

Prentice Hall School, part of the Simon and Schuster Education Group, published the LIVE FROM ANTARCTICA Teacher's Guide, available free, except for the cost of postage. Nearly 10,000 copies were distributed directly by the project. Prentice Hall retained 10,000 to distribute directly. 5,000 copies each will be used to support further re-broadcasts and videotape distribution.

In conjunction with WTTW/Chicago and the New Explorers series (which will air a primetime hour on Antarctica June 7th, 1995, using original footage taped by the LFA team during this last research season) a "flyer" announcing the series and the availability of the Guide (free, except for the cost of mailing) was distributed to some 25,000 teachers. Usage was widely distributed, with over 46 states and the District of Columbia represented. Nearly 2,000 individual requests were received, a response rate of 8%, relatively high for a project which for reasons of funding commitments was announced within a month of air time.

California (the largest number of requests), Florida, Georgia, Illinois, Michigan, New York (second largest response), New Jersey, Ohio, Pennsylvania, Texas, Washington, Wisconsin and Virginia returned highest numbers of individual requests.

Maryland Public Television, through Devillier Communications, distributed Guides to Education Coordinators at every PBS station nationwide, and encouraged them to make copy masters available for local schools.

Mass distribution of Guides was undertaken in many regions and districts, clustered primarily around those live uplink sites where "local interest" sparked teacher awareness and interest.

In Virginia, such districts included the Fairfax County Schools, Goochland County, Albemarle County, Charlottesville and Richmond. Hawaii (where the state comprises one single, unified school district) received 750 Guides, which were distributed to every middle school science class.

In Texas, the "Satellite in the Classroom" Project distributed Guides directly to its 350+ member schools; TI-IN (the state educational network), the San Antonio District and the state's Migrant Education Program also received bulk orders.

Chicago, site of a live uplink for program 3, distributed Guides to all schools participating in NSF's Urban Systemic Initiative, via the Department of Energy, a sponsor of WTTW/Chicago's New Explorers series. One thousand additional Guides were distributed directly by WTTW and the University of Chicago.

Maryland, home state of co-producer MPT, distributed Guides to all districts and counties.

In other states, the Dade County (Florida), Lexington (Kentucky) and Dayton (Ohio) school districts all received bulk orders. In New York, the POST's "Newspapers in Education" program distributed Guides to over 300 schools. The Catholic Television Network, in the San Francisco Bay Area, distributed Guides and cooperated with NASA-Ames to produce a special teacher training videoconference to introduce the project, and explain its online components. Guides also went to the Astronaut Memorial Foundation at Kennedy Space Center, and the Center for Space Education.

Internationally, 400 Guides were supplied to RADIO QUEBEC, to support the project in Canada, as well as to the New Brunswick Department of Education.

NASA CORE will be supplied with Guides, as needed, to support the distribution of videotapes, and future broadcasts.

ONLINE AND 1-800 RESPONSES

Online usage reports are still partial, but over 9,000 connects came into the "quest" server of NASA's K-12 Internet Project alone. NASA Spacelink reports access at about "1/8th of a Shuttle Mission" per month, a gratifying number given educators' long-standing knowledge of and interest in the Shuttle and the contrasting "newcomer" status of LFA.

To date, there have been over 8,250 calls to the 1-800 "Hotline".

MEDIA NOTICE AND COVERAGE

Stories about the project have run in: USA TODAY, the Washington POST, the Washington TIMES, the New York DAILY NEWS, the New York POST, the Baltimore SUN and several other national publications (copies appended.)

Front page articles appeared in the regions of the live American uplink sites, such as in the Rio Grande MONITOR. (Additional regional clips are being compiled by our partners at the various live uplink sites, and will be supplied as received.)

Reports appeared in many educational publications, such as NSTA (National Science Teachers' Association) Reports, Classroom CONNECT, PBS Learning Services Newsletter and many other national journals (copies appended.)

ABC News Overnight broadcast a 9:00 excerpt, and the project appeared also on CBS News Up to the Minute and CNN (air checks submitted to project technical monitors.) BBC Radio in the United Kingdom aired a 6:00 minute report on "SPACESHIP SOUTH POLE".

Local newscasts in the following “top 30” markets also showed the project:

Chicago, Philadelphia, San Francisco, Minneapolis, Pittsburgh, Denver,
Baltimore, Orlando, San Diego, Cincinnati and Richmond.

RESPONSES

A full evaluation is ongoing, but some initial, qualitative responses indicate that project goals were met.

13-year old Charlie Contreras in Texas showed LIVE FROM ANTARCTICA had succeeded in bringing back a little of the “fun” to science education, as in Lewis Thomas’ comment cited above:

“That’s exciting. It’s like, Wow! It makes you amazed. You would not believe that could happen. It’s a miracle what the world makes.”

The father of a 6th grade student wrote to her teacher about Sara’s new computer skills:

“I’ve never seen a science project that was more alive with the breath of what it means to do ‘the work of science’... (Sara) learned to use a paint program to capture the graphics and a ‘help compiler’ to build the software... (to write) the core text as well as thinking through all the pop-up windows and hypertext links...”

A Michigan teacher wrote to the ‘discuss-lfa’ list:

“We have 53 3rd graders and over half the students were able to watch it live last night, many with parents and siblings... we showed the tape during lunch, and the classroom was full of students who chose to stay in and view it, some for the second time, and miss recess... the responses from parents have been fabulous... Thanks again for creating such a great experience...”

Wrote a New York state teacher, thinking about the future re-use of the programs on tape, supported by ongoing online materials:

“The discovery was made that (a) teachers don’t know everything, and that (b) having the answers from scientists on the computer proved to be like having a library in the classroom... My vision would be to have the tapes in the school library... and send the students out to act as coaches to train either students or staff on using the resources, and perhaps continuing the project despite the fact that the last broadcast was today...”

From a state which shall be nameless for reasons that will soon be apparent came the comment:

“The online materials are far more than we had ever imagined. The access to principal investigators and support personnel was extremely motivating to our students... We have all learned a lot. Mostly we have learned how sadly out of date our state of ___ is with respect to these wonderful learning opportunities. You have helped us take some exciting and significant steps forward.”

THE FUTURE

PASSPORT TO KNOWLEDGE has already begun work on two follow-on Modules, LIVE FROM THE STRATOSPHERE, and LIVE FROM THE HUBBLE SPACE TELESCOPE, in conjunction with the relevant NASA Office at Headquarters, at Ames Research Center and at the Space Telescope Science Institute.

The Kuiper project will involve several science museums and other partners, who will host overnight “camp-ins” in conjunction with live programming from a Kuiper flight.

The Hubble project will allow some students to undertake investigations on the nation’s premier space telescope, through the commitment of Director’s Discretionary Observing Time.

In addition, plans are underway for LIVE FROM MARS (in conjunction with Mars Pathfinder '97), from active volcanoes and undersea trenches, from the Amazon rainforest and the place where the dinosaurs died. All such projects will benefit from the lessons learned in LIVE FROM ANTARCTICA, and will be designed (see figure c) to support the recommendations of the various national science standards groups, such as Project 2061/Benchmarks (AAAS) and the NAS/NRC group.

SUMMARY

PASSPORT TO KNOWLEDGE is an innovative project which seems to have found a positive response from teachers, students and parents. It was only made possible by an unprecedented collaboration between several U. S. Government research agencies, together with public television and Prentice Hall. Several respondents have indicated they know of no other project that has so imaginatively melded media into an exciting, effective learning package. We plan to build on this solid foundation, and advance still further in the months and years ahead.

LIVE FROM ANTARCTICA: interim Report and Evaluation, as of Jan 31st 1995

CREDITS

LIVE FROM ANTARCTICA was a co-production of Geoff Haines-Stiles Productions, Inc. and Maryland Public Television, in association with WTTW/Chicago and The New Explorers, which will air a primetime program on Antarctica in June 1995, adding an additional 6 million viewers to those who saw LIVE FROM ANTARCTICA.

The New Explorers is a co-production of WTTW/Chicago and Kurtis Productions, Ltd., and is funded in part by Amoco, Duracell and the Department of Energy.

2011
7.237

ECOlogic

**Farzad Mahootian &
Michael Keeler**

*Earth System Science Curriculum
Testbed*

1995 NASA IITA K-12 Conference, NASA Ames

The Earth System Science Community Curriculum

<http://www.circles.org/>

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Gonzaga College High School
Washington, D. C.



Earth System Science

"A holistic approach to the study of the Earth that stresses the investigation of interactions among the Earth's components in order to explain Earth dynamics, Earth evolution and global change."

-- *Earth System Science: A Closer View, 1988*

Purpose

- Enable Student Investigation of the Earth System

Method

- Community Development
- Curriculum Development
- Systems and Services Development

Community Development

- Teacher Professional Development
- Teaching and Learning in the Classroom
- Collaboration and Mentoring
- Team-based Investigation

Participants

- 6 high schools
5 US and 1 Canadian: DC, MO, NM, CA, PA, MD, BC (CN)
- **Selection and Demographics**
Open enrollment and handpicked students
Mixed ethnicity
Co-ed and single sex schools,
4 Public and 2 Private
2 hearing impaired.
Class sizes vary from 8 to 30
- 4 new high schools each year
- 2 universities
Penn State University
U.S. Naval Academy
- 2 new universities each year

Current Mentorship Program Partners

- NASA
 - HPCC
 - Mission to Planet Earth
 - Earth Sciences Directorate
 - EOS Project Science Office

- University Space Research Association
 - Cooperative University-Based Program in Earth System Science Education (ESSE)

- American Geophysical Union
 - Directorate of Education and Research



Curriculum Development

- Science Scope

Processes taking place on time scales of direct human concerns

Time Scale: 1 - 100 years

*Processes: Physical Climate System
Biogeochemical Cycles*

- Educational Scope

A full-year research course for high school

One semester course for university students

Elective Course

An interdisciplinary applied science course

Curriculum Development

- Learning and Teaching Goals
 - Understanding the Earth as a System
 - Learning the Process of Scientific Investigation
 - Problem Formulation and Problem Solving
 - Project Planning and Management
 - Professional Behavior
 - Thinking in Terms of Systems
 - Model-Making, Data Visualization
 - Scientific Communication
 - Hypertext Publication on WWW

- Learning and Teaching Model
 - Collaborative Learning; Peer Education
 - Guided Discovery: Teacher as Co-Investigator, Coach and Guide

- Evaluation Techniques
 - 35% Team Performance
 - 35% Individual Performance
 - 30% Work Quality

Systems and Services Development

- Collaboration, problem-solving and quality control environment
- Interconnection of ESS labs in high schools and universities
- Comprehensive communication and information system
- Transparent user interface
- Community memory: an evolving knowledgebase

Method: Iterative Design and Development

- Collect data on interactions across the community
- Identify recurring interactions and processes
- Define community, curriculum and system needs
- Develop system and GUI
- Test, evaluate and optimize

Strategies

- Coordinate with NASA Infrastructure: EOSDIS, USGCRP
- Enhance data provision services
- Responsive integration of existing tools and research
Electronic, print, video publication and distribution media

Accomplishments

- Continuation of ESS Courses in 1995
- Use of NASA Data Resources
 - Technical report summaries
 - Full reports
 - Electronic brochures
 - NASA Facts
 - Data Products (All Schools)
 - Raw Data (Gonzaga):
 - ERBE, ISSCP, SAGEII, UARS HRDI, TOMS, CAC-SST, TOPEX/Posiden, TOGA, Ocean Flux
- Modeling, Visualization, Publication
- Interactions Matrix
 - Scientist
 - Undergraduate Professors
 - Undergraduate Students
 - High School Teachers
 - High School Student

Accomplishments

- New Curriculum Features:
 - More lecture
 - More structure:
 - seed models
 - project checklist
 - logs - student and teacher
 - More scientist mentoring
- New System Features
 - Bandwidth scalability
 - Intelligent Search Tools: ILIAD and ASK

Problems

- Infrastructure
 - School
 - Internet Access
- Use of Tools and Data
 - Teachers
 - Students
- Faculty Prerequisites
 - Open inquiry teaching experience required
- Collaboration
 - Expected more frequent interactions
- Support
 - Internet vs. Fedex
 - Local technical support
- Mentor Training
 - Correction vs. Facilitation of student research

Rice University

Patricia Reiff

Creating the Public Connection

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93007
250676
287

"Creating the Public Connection: Interactive Experiences with Real-time Earth and Space Science Data"

Patricia H. Reiff, P. I. Tamara S. Ledley, Co-I.

RICE UNIVERSITY

Carolyn Sumners, Co-I. Ryan Wyatt, Co-I.

HOUSTON MUSEUM OF NATURAL SCIENCES

Abstract:

The Houston Museum of Natural Science, with over 2 million visitors annually, is less than two miles from Rice University, a major hub on the Internet. This project links these two institutions so that NASA near-real-time data and imagery can flow via Rice to the Museum where it reaches the public in the form of planetarium programs, computer-based interactive kiosks, and space and earth science problem-solving simulations. Through this program at least 200,000 visitors annually (including every 4th and 7th grader in the Houston Independent School District) will have direct exposure to the earth and space research being conducted by NASA and available over the Internet. Each information conduit established between Rice University and the Houston Museum of Natural Science will become a model for public information dissemination that can be replicated nationally in museums, planetariums, Challenger Centers, and schools.

This project capitalizes on the experience of the Space Physics and Astronomy Department of Rice University in organizing and updating data and image databases, combined with the Museum's expertise in developing public software interfaces, planetarium programs, interactive science curricula, and problem-solving computer simulations. Data began reaching the public within two months of grant funding with continuous evaluation and expansion of the program continuing. The Rice-Museum collaboration delivers NASA near-real-time data to five different museum environments: a "Space Update" kiosk in the Museum's Entry Hall, a Sun-Earth Environment Interactive Exhibit, Planetarium school and public programs, the Challenger Learning Center Mission Control, and the Earth Forum Information Network.

This grant supports a continually updated server collecting and organizing data and image databases from materials found on the Internet, either retrieved from various network sources or generated by real-time models running at Rice or at the University of Alaska, and a T1 line connecting Rice to the Museum. The Museum's display computers will automatically, periodically access the server at Rice University for these near-real-time images and data. Once a program module is installed and tested at the Museum, it will be evaluated in two school settings where the real-time databases provided will be related to existing earth science curricula via student activities and teachers guides. In the grant's third year, the program will be replicated in at least one non-Houston planetarium, museum, Challenger Center, and school.

Organization Chart "Creating the Public Connection"

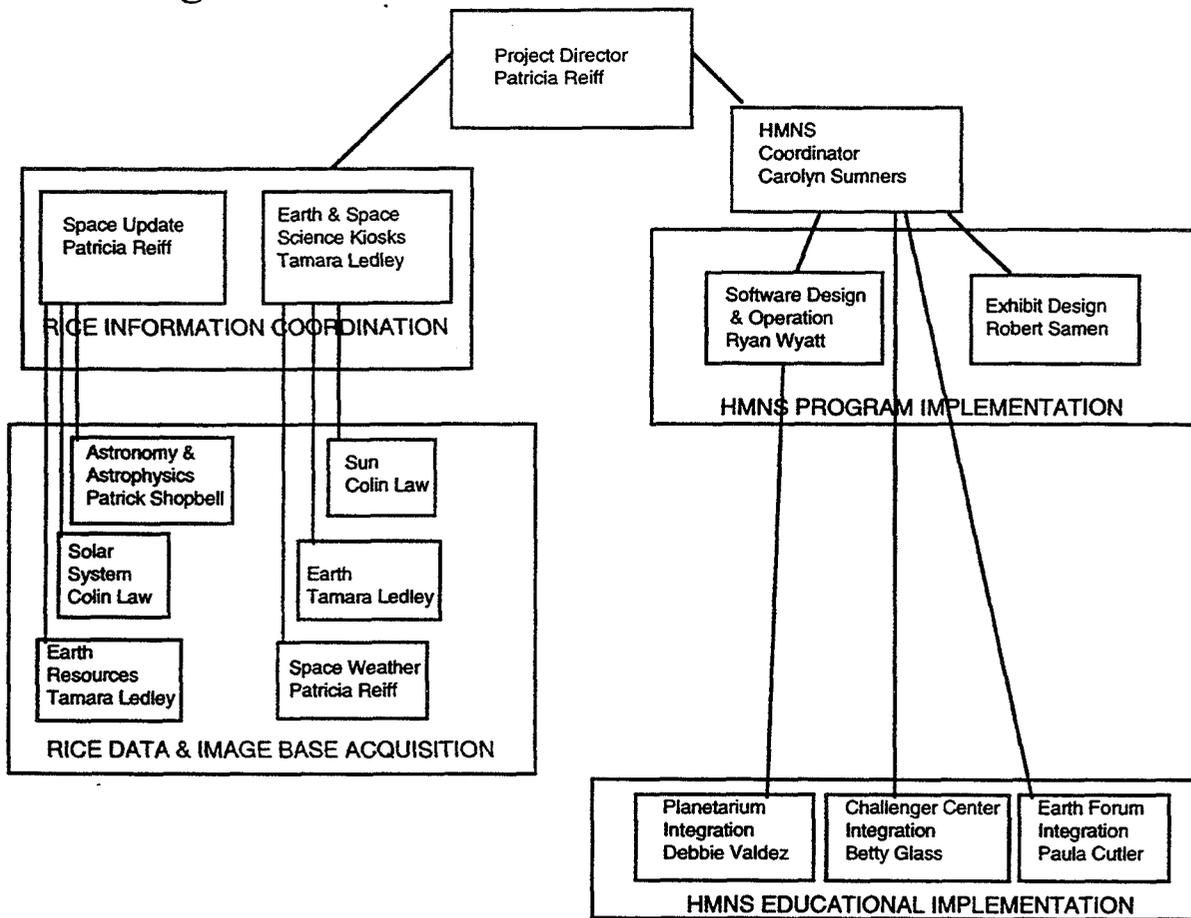


Figure 1: Organization chart of "Public Connection" Program. The left-hand portion of chart is physically located at Rice University; the right-hand portion at the Houston Museum of Natural Science.

√Task 1: Physical Internet connection and other common tasks
(required for all other tasks) (*done*)

Task 2: "Space Update" kiosk and programming (*sl9 done*)

Task 3: "Sun" "Earth" and "Space Weather" kiosks and
programming (*beta versions ready now*)

Task 4: Planetarium, Earth Forum and Challenger Center
applications (*first planetarium show started 1/6/95*)

Task 5: Replication to other museums and Challenger Centers
(*in progress; mostly contributed by HMNS*)

Task 6: Replication at schools (*in progress; mostly contributed
by HISD, NSF and Rice University*)

CONTENT: Rice "Connections" Project

P. Reiff, Rice University

SPACE UPDATE: All of Earth and Space Science (Mostly remote sensing)
In Grand Hall (no ticket necessary to view): highest traffic
Highlights: Recent Results (asteroids, Clementine, SL9)
Real-time Information
NASA Press Releases
(Online NASA Select by CU-SeeMe?)
Good selection of interesting archival
images & movies, in all wavelengths
Earth, Sun & Space Weather: some data included here, but for
detailed information, reference to other kiosks.
Astronomy & Astrophysics: HST, GRO, ground-based, etc.
Solar System: Voyager, Magellan, Galileo, ground-based, etc.

EARTH: MTPE focus (TOMS, UARS, EOS,...)
Highlights: updated ozone maps, bioactivity maps ...
shuttle imagery (recent and archival)
local environment information
views of Earth from space

EARTH WEATHER: local, national and world-wide weather
Highlights: display of local conditions (at museum and local
school network)
NOAA satellite imagery, weather maps (hourly)
sea temp, ice cover maps (biweekly)
historical weather events (images, movies)

SUN IN ACTION: The sun in various wavelengths, with emphasis on real-time data
and its effects on the Earth
Highlights: Yohkoh X-ray data (daily)
visible, H-alpha, magnetograms (daily)
coronagrams (daily)
historical events: flares, prominences, CME's
eclipse videos, imagery

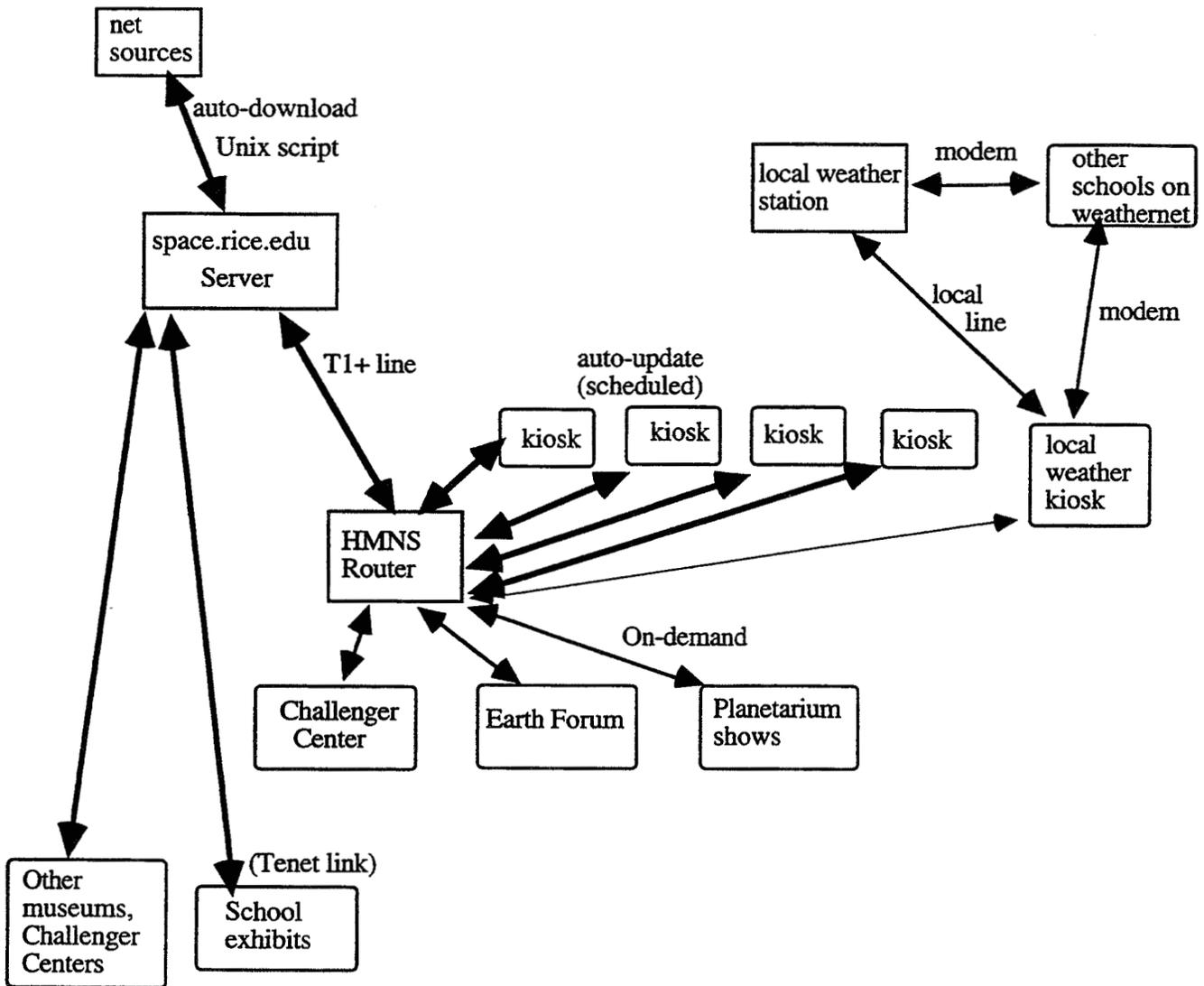
SPACE WEATHER: To teach the concept of "Space Weather" and to show the
dynamic changes in Earth's local plasma environment, and its
effect on people and spacecraft
Highlights: real-time display of Rice magnetosphere model
solar flare warnings (real-time)
last-nights's auroral images
real-time ionosphere model

APPROACH: Rice "Connections" Project

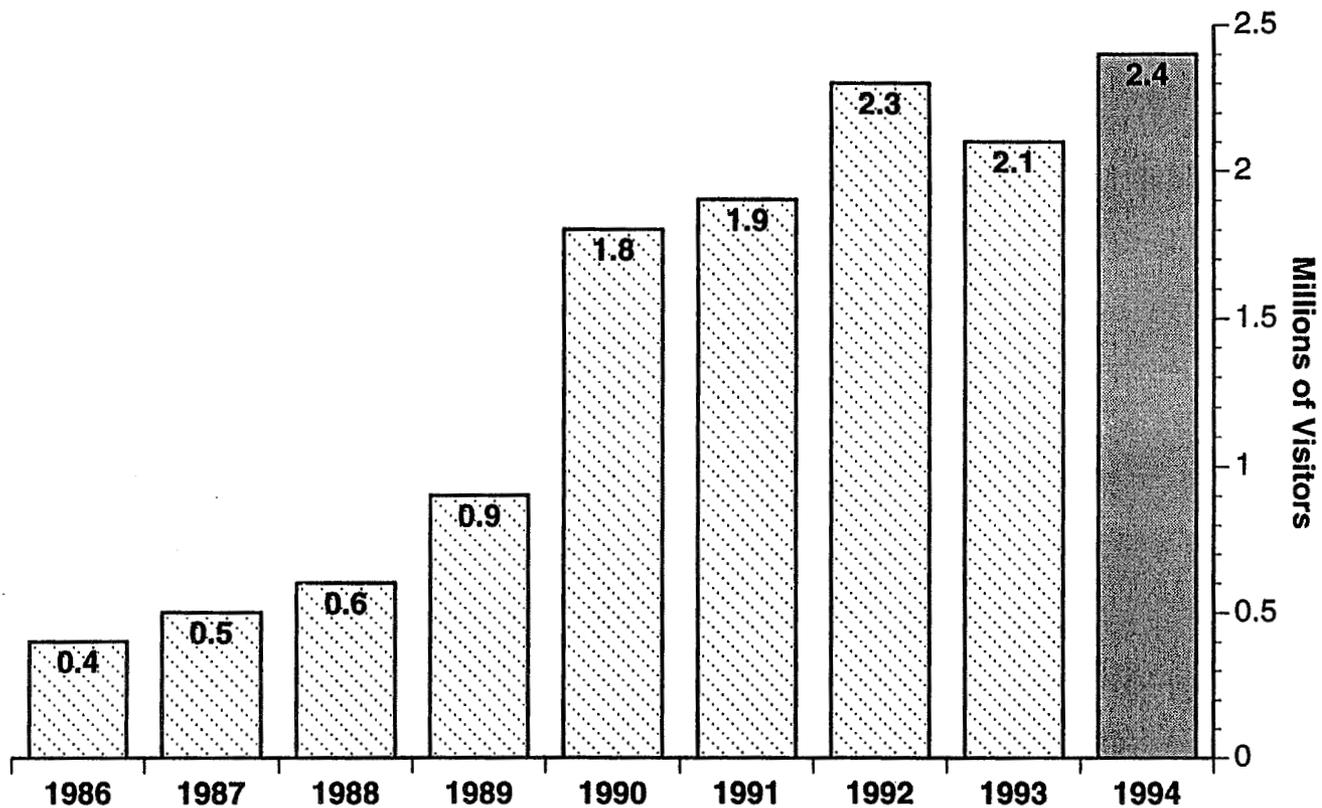
P. Reiff, Rice University

- MODULAR:** All pieces Internet Accessible
no fragment > 10 MB
All segments individually replaceable
Each kiosk has "latest results" as separate small file,
replaced frequently in background.
Initial distribution by CD-ROM to minimize network traffic for
non-realtime portions of modules, and for schools
without net connections
- LANGUAGE:** "Macromedia Director"
Multimedia - can access laser disks, external programs, etc.
Multiplatform - easily ported to pc's (but 8-bit color only)
Faster access than WWW browsers, and doesn't require
keyboards (fragile)
- REAL-TIME:** all kiosks have real-time imagery included
all imagery is updated in the background, transparent to
visitor
"Latest Results" in separate Director file for easy update
"News Bulletins" in separate files for easy updates
some real-time data available even for schools with dial-up
access
local weather - network of 14 schools in area online
local environmental information will be in kiosk, WWW and
dialup format
- DISSEMINATION:** software already available through WWW, anonymous ftp
is cross-referenced through AGU and Code S
Other internet museums have expressed willingness to use
modules
"National Museum Network" being formed
Space Center Houston is negotiating for display modules
Several schools will have at least SL9 module by this April
(emphasizing minority schools)
Software will be advertised through TENET (Texas
Education Network) and its gopher servers
Challenger Center network - will be brought in next year
Several Presentations at Teacher Workshops planned

NETWORK LAYOUT: Rice "Connections" Project



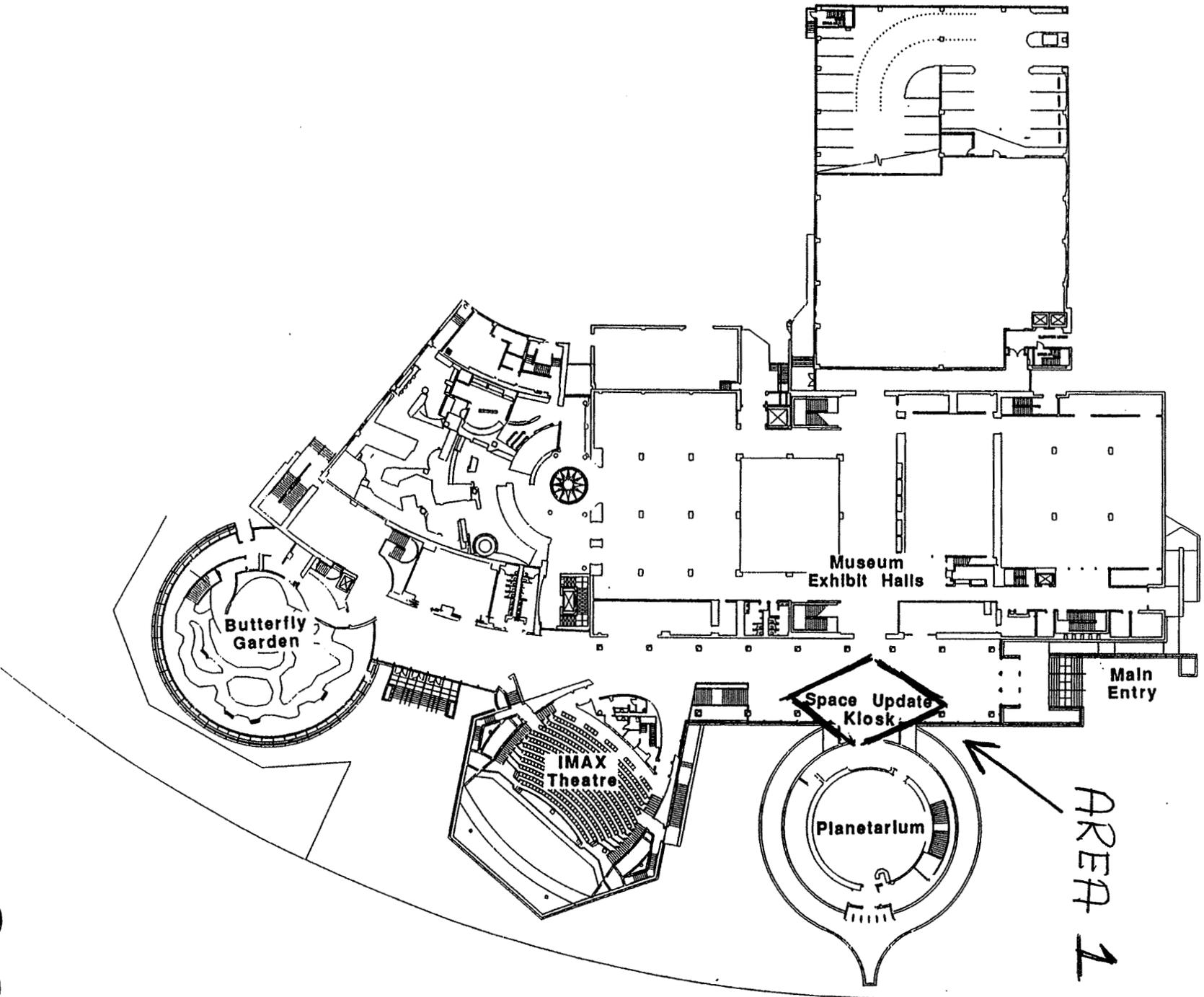
Houston Museum of Natural Science Annual Attendance



1994 Museum Attendance

Smithsonian Institution	20,214,488
Metropolitan Museum of Art (NY)	4,308,881
American Museum of Natural History (NY)	3,000,000
<i>Houston Museum of Natural Science</i>	<i>2,400,170</i>
California Museum of Science & Industry (LA)	2,100,000
Museum of Science and Industry (Chicago)	1,985,609
Denver Museum of Natural History	1,587,706

Houston Museum of Natural Science
(Entry Level with Planetarium and Space Update Kiosk)



A universe at your fingertips

NASA-Rice collaboration brings space to museum computer

By STEVEN LONG
Houston Chronicle

Visitors to the Houston Museum of Natural Science soon can take a free trip on the information superhighway into outer space.

Their ticket will be paid by an \$800,000 NASA grant to Rice University.

With the touch of a finger, museum patrons will be able to view the wonders that NASA tracks daily, including images of the Earth from space shuttle missions, the Landsat satellite and the Hubble Space Telescope. Images of the sun, weather, space weather and the planets also will be on line.

"NASA wanted to come up with a way to get the beautiful imagery that they are collecting to the people," said Dr. Carolyn Sumners, director of astronomy at the museum. "All of the material is on the Internet."

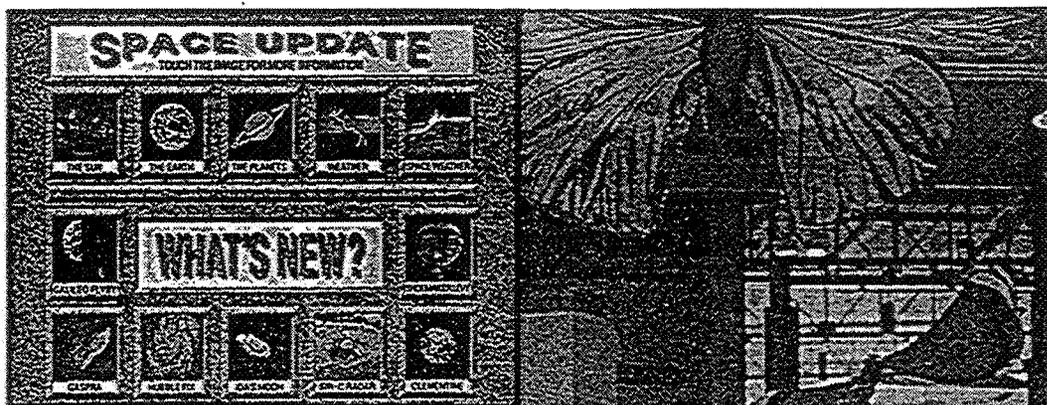
Rice graduate students will capture the NASA images from the Internet — the worldwide web of linked computers used primarily by government, universities and businesses — and transfer them to a Space Kiosk computer in the entry hall of the museum.

"The goal is to transfer as much of that information to direct public access as possible," Sumners said.

In some cases, images will be accompanied by narration by a Rice University professor.

Rice students will transfer new NASA images on the Internet daily to the kiosk computer. Not only will their involvement keep the information current, it also will let museum visitors have instant access without wading through the often-labyrinthine Internet system.

NASA spokesman Brian Welch said the grant for electronic public



Houston Museum of Natural Science

NASA's space images can be called up via a computer screen icon like the one above. At right, the Museum of Natural Science's director of astronomy, Dr. Carolyn Sumners, and Rice graduate student and programmer Colin Law confer at the Space Kiosk.

access to NASA images is part of an ongoing commitment by the space agency.

"Everyone at NASA, from the very beginning, has always had a deep commitment to providing the widest public access to data collected on our missions," he said.

Welch said technology is reaching a point where almost anyone can access NASA information "through the Internet."

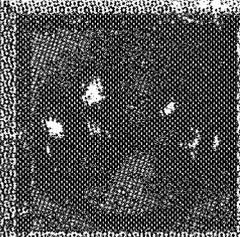
"As time goes by, that is only going to increase as we are able to place more and more information in the system," he said.

The first kiosk will be up and running by the end of the week, said museum spokeswoman Terrell Faulk.

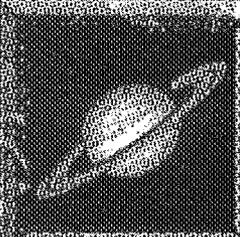


Richard Carson / Chronicle

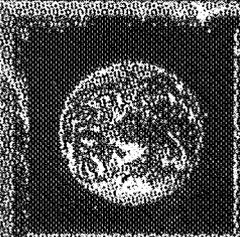
SPACE UPDATE



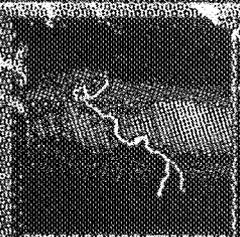
THE SUN



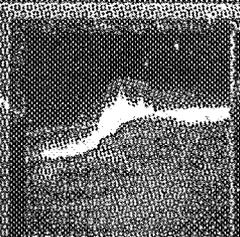
THE PLANETS



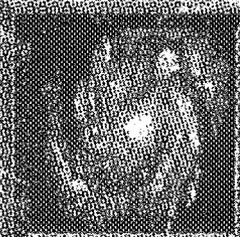
THE EARTH



WEATHER

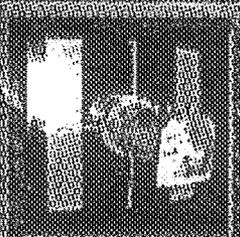


SPACE WEATHER

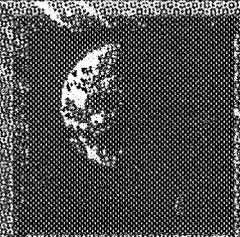


HUBBLE FIX

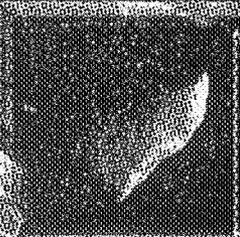
WHAT'S NEW?



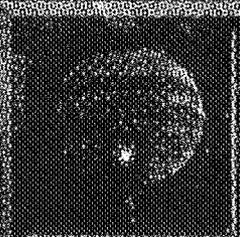
LATEST HUBBLE



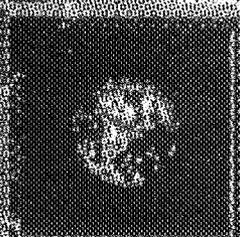
GALILEO



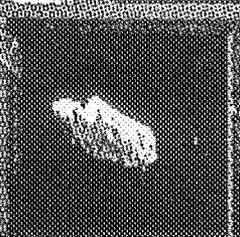
GASPERA



COMETS



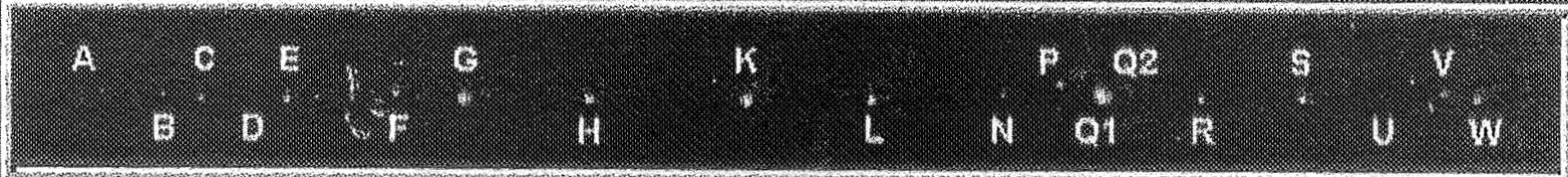
CLEMENTINE



THE MOON



COMET SHOEMAKER-LEVY 9

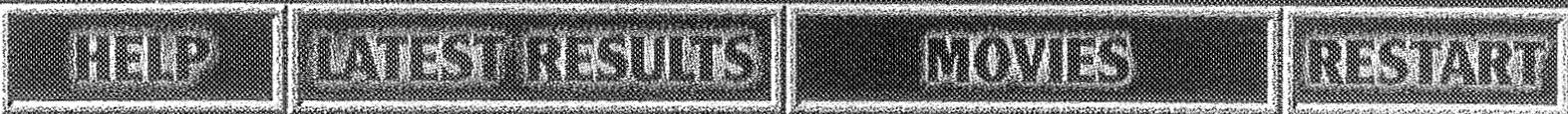


Soon after its discovery on March 25, 1993, by Eugene and Carolyn Shoemaker, David Levy, and Philippe Bendjoya, it became apparent that Shoemaker-Levy 9 was not an ordinary comet. It had been captured by Jupiter's strong gravitational field which ripped it apart into 21 distinct fragments. Calculations of its orbit soon showed that it would begin impacting the planet in July of 1994. Such a tremendous interplanetary collision had never before been witnessed in the solar system. This Hubble Space Telescope image of the fragmented pieces was taken a few months prior to the first impact on July 16. All of the impacts took place just around the limb of the planet out of the Earth's line of sight. This meant that observers had to wait for the impact sites to rotate into view. They were not disappointed, however, as the images were more spectacular than they had hoped for.

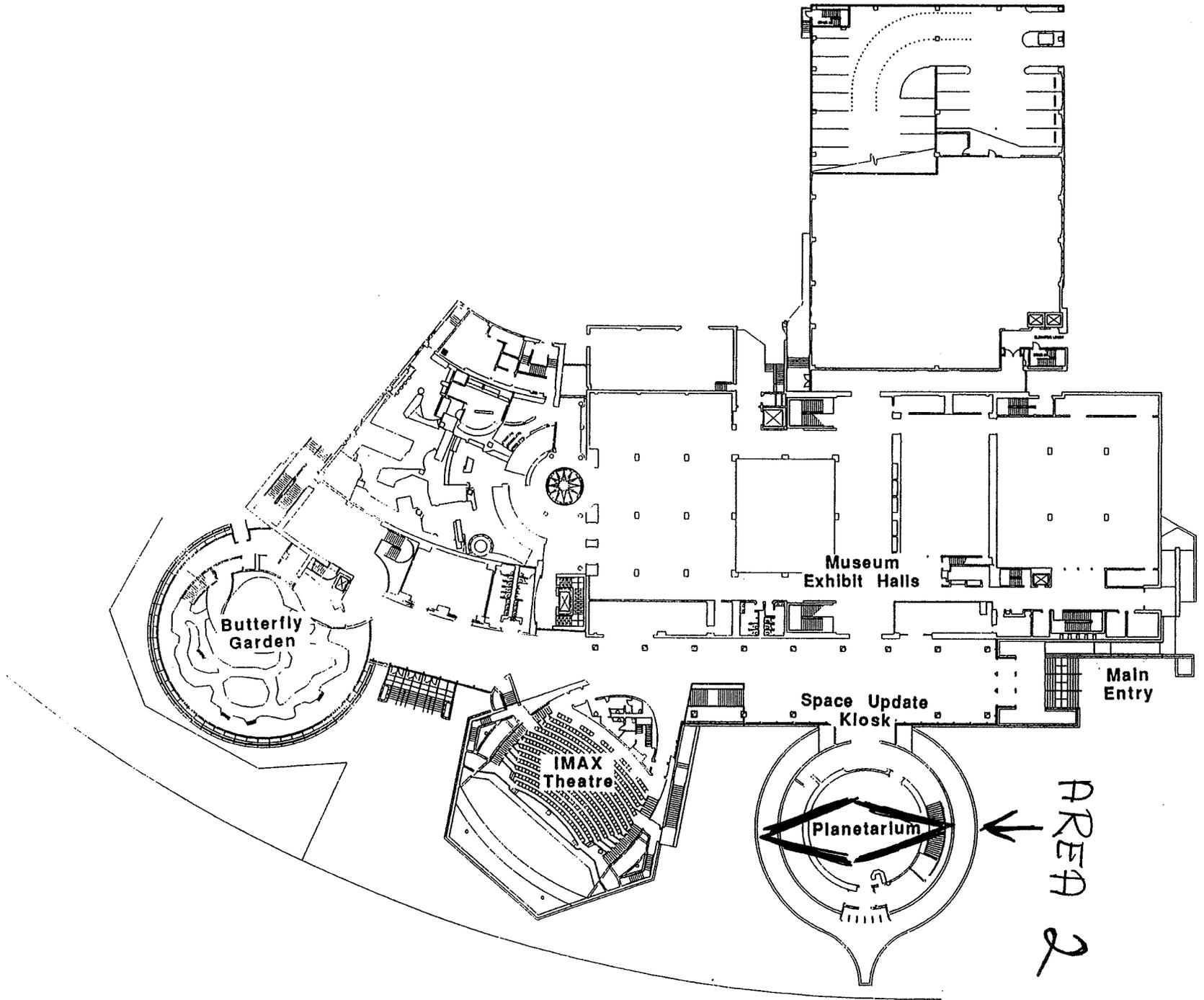
TOUCH the fragment whose impact images you want to see.

Yellow label: Specific fragment

White label: Multiple fragments



Houston Museum of Natural Science
(Entry Level with Planetarium and Space Update Kiosk)



For Immediate Release

December 27, 1994

Public Information:
(713)639-4600

Press Information:
Terrell E. Falk, 639-4607
Mike Olson, 639-4613



NEWS RELEASE

Houston Museum of Natural Science Planetarium Feature *CONNECTED* Offers Internet Access January 7–May 28

CONNECTED, a new Planetarium feature at the **Houston Museum of Natural Science**, will allow visitors to view the latest available images from the Hubble Space Telescope, NASA spacecraft and other sources beginning January 7 through May 28. Museum staff will continuously update images recorded from a variety of sources to incorporate into *CONNECTED*. The new show can be seen Monday through Friday at 1:00 p.m. and 3:00 p.m., or on weekends at noon, 12:30 p.m., 2:00 p.m., 2:30 p.m., 4:00 p.m. and 4:30 p.m.

From cyberspace to outer space, the Planetarium is now connected to astronomers around the world and to telescopes beyond our planet. Museum staff and others are continuously searching the Internet computer network for the latest images of the sun, planets, and deep space objects, which will then be incorporated in this constantly changing Planetarium feature. *CONNECTED* also explores how humankind now communicates farther and faster than anyone imagined just a century ago.

Networks of copper and glass connect us to observatories around the world, to orbiting telescopes, and to satellite probes transmitting images and data earthward from destinations throughout the solar system. We are now Connected– to the earth, to the sun, moon and planets, and to the stars and galaxies lying at the limits of our extended electronic vision.

Images transmitted over synapses billions of miles wide carry our senses to the edge of the solar system. Telecommunications approaching the speed of light connect us to events happening in galaxies far away. We are now Connected to humanity's greatest virtual adventure– on a cosmic journey of the collective human mind.

Clementine is a reformed spy. This satellite, fresh from duty in the Cold War, has been retargeted for a mapping mission of the moon's friendly terrain. Unlike the Apollo missions, with their human cargo, tiny Clementine can be patient in its lunar mission. Once in orbit,

-MORE-

Clementine methodically mapped the moon in two months of overlapping orbits. *CONNECTED* incorporates images from Clementine and other satellites to demonstrate how computer networks and telecommunications have progressed in recent years.

Now that the Hubble Space Telescope's vision has been successfully corrected, scientists are ecstatically studying the flow of images being telegraphed back to earth. After computers compose the stream of data into recognizable images, the images are released onto the Internet computer network. With the recent telecommunications connections at the Museum via Rice University and NASA, HMNS can now receive these latest Hubble images as they become available and incorporate them into programs such as the *CONNECTED* Planetarium feature.

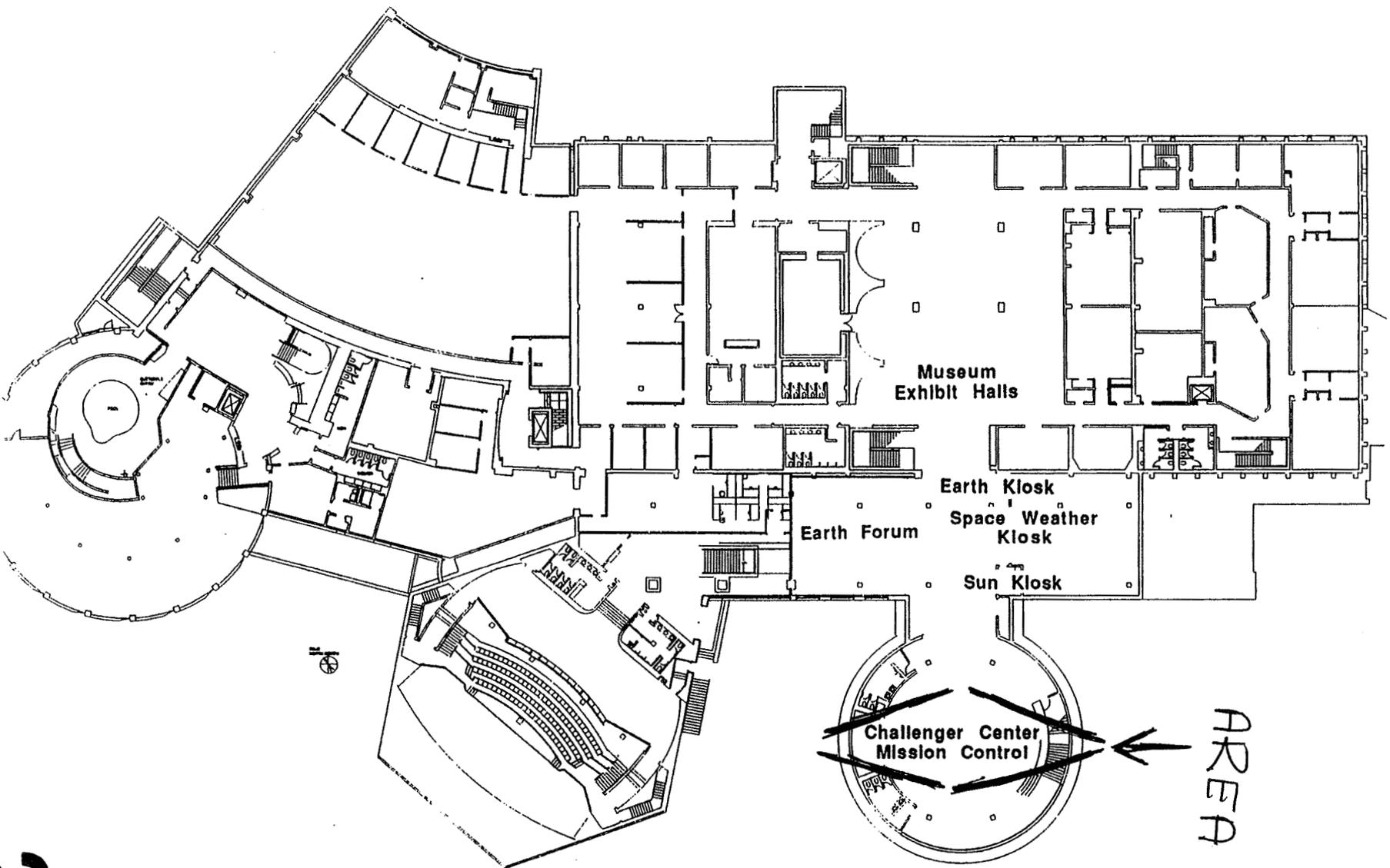
Internet access offers more than government satellite images. In March of 1993, a Spanish amateur astronomer living near Madrid scanned the magnificent M81 spiral galaxy. His eyes suddenly focused on a star that he had never seen before. Quickly he checked the image in his star atlas. The star wasn't there. The next day astronomers around the world connected by Internet received the following electronic message: "*A supernova has been discovered in M81 by amateurs in Madrid. It will be one of the brightest we've had in a long time. Happy observing!*" Soon images and data on the new supernova flooded Internet. From radio telescopes to x-ray satellites, the astronomical world watched the celestial drama unfold.

CONNECTED is also the story of our search for the ultimate connection: the Search for Extra-Terrestrial Intelligence (SETI). Could it be that among the billions of stars that make up the hundreds of thousands of galaxies currently visible, that there is another planet hosting an intelligent life form?

Admission to Planetarium features and family laser shows is \$2 for adults and \$1.50 for children under 12. For ticket information please call 639-IMAX.

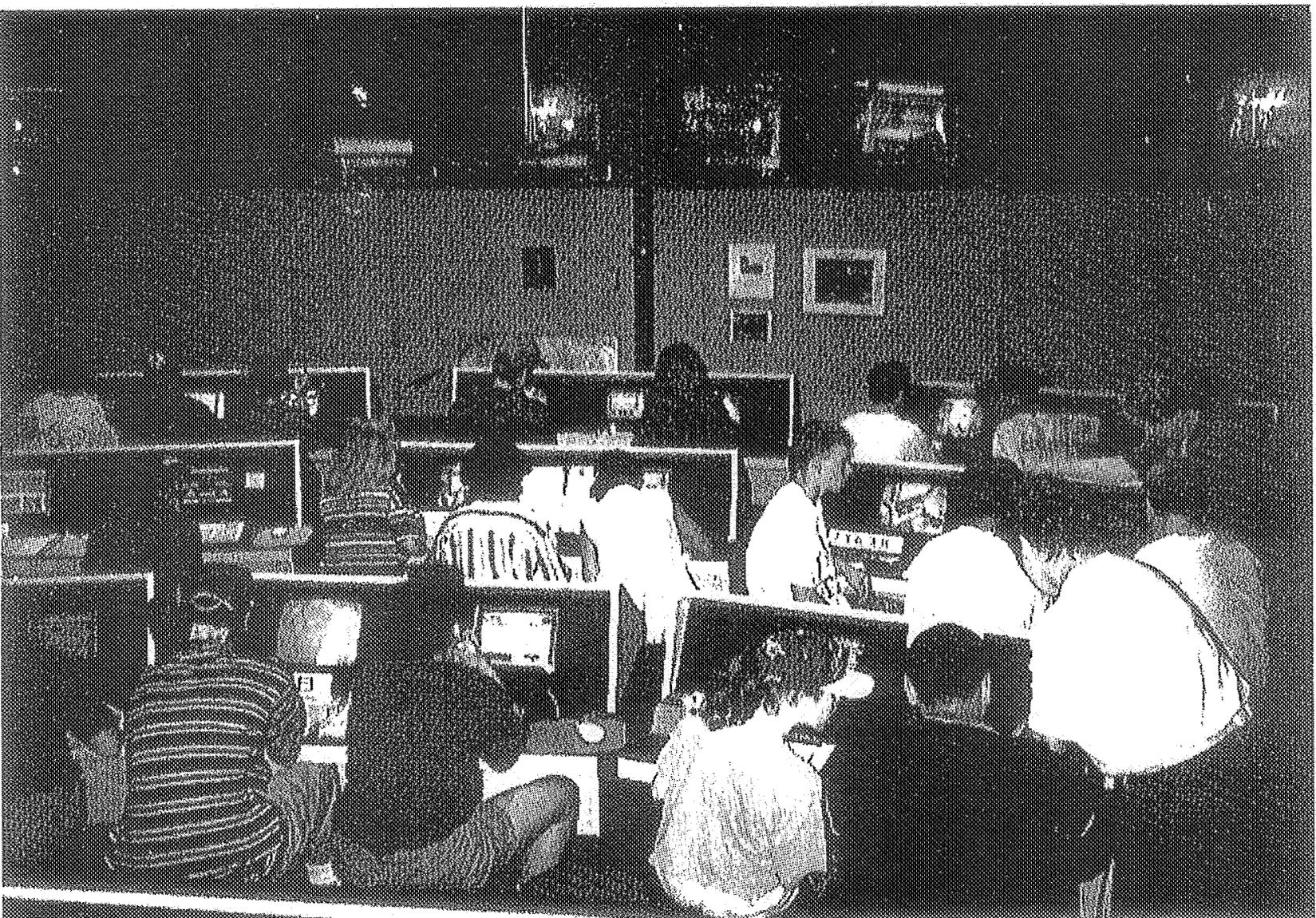
The **Houston Museum of Natural Science**, a private non-profit organization, is located in Hermann Park across from Miller Outdoor Theatre. The Museum is open Sundays, noon to 6 p.m. and Monday through Saturday, 9 a.m. to 6 p.m. Admission to the Museum is free to members; \$2.50 for non-member adults; and \$2 for non-member children under 12. For more information, please call 639-4600. For Museum information in Spanish, please call 639-4603.

HOUSTON MUSEUM OF NATURAL SCIENCE
Lower Level (Below Planetarium & Entry Hall)

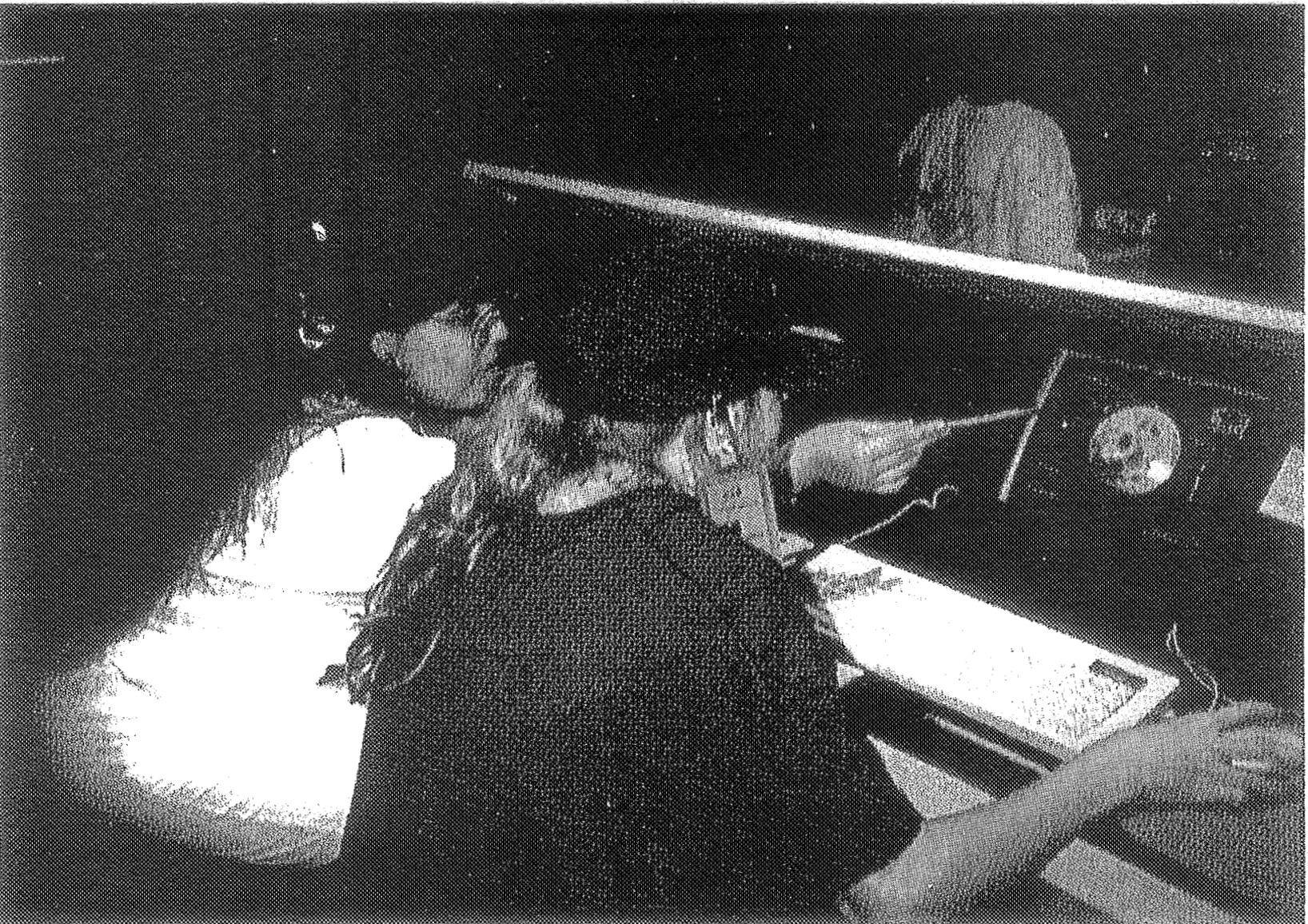


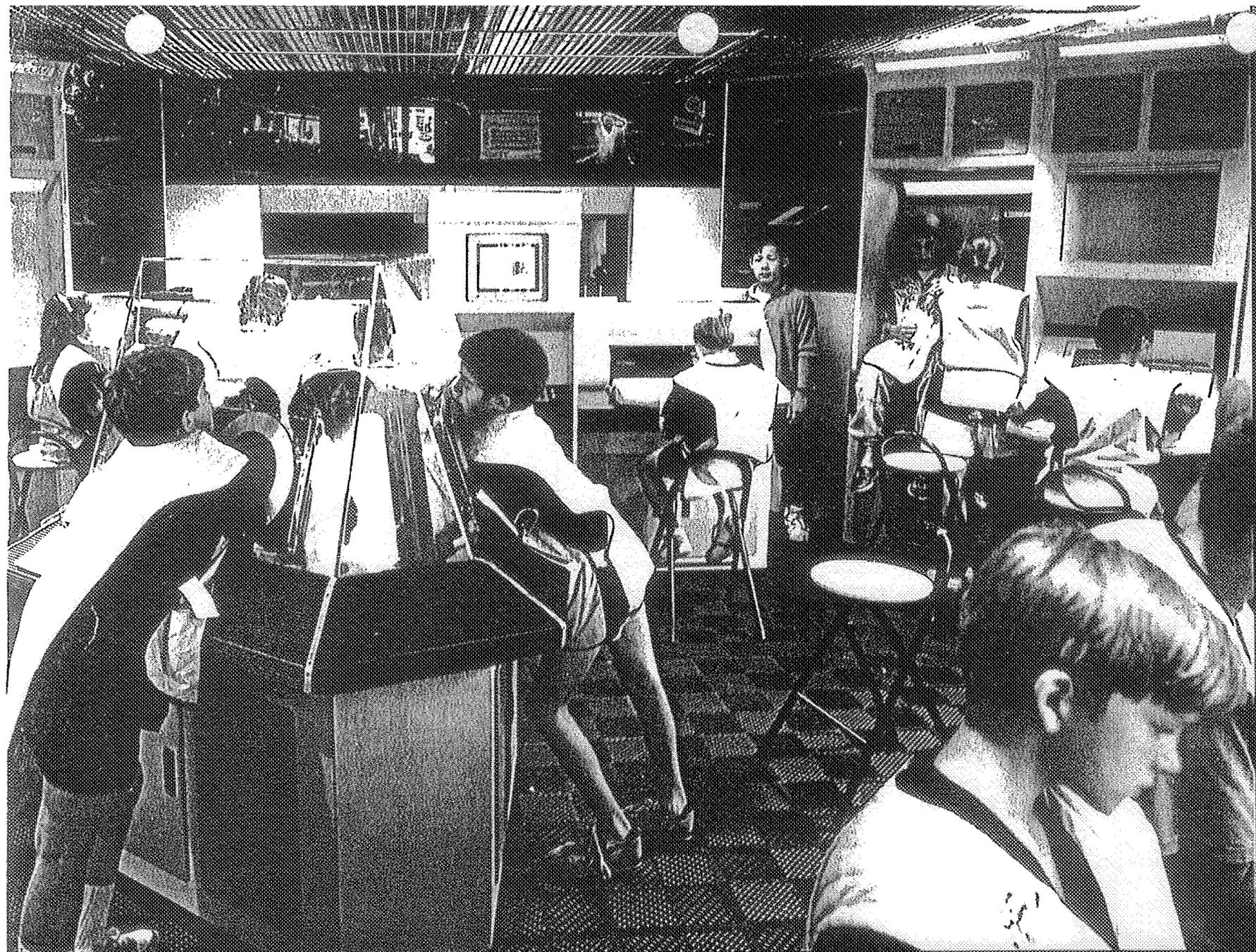
AREA 3

CHALLENGER CENTER MISSION CONTROL
& Internet Classroom



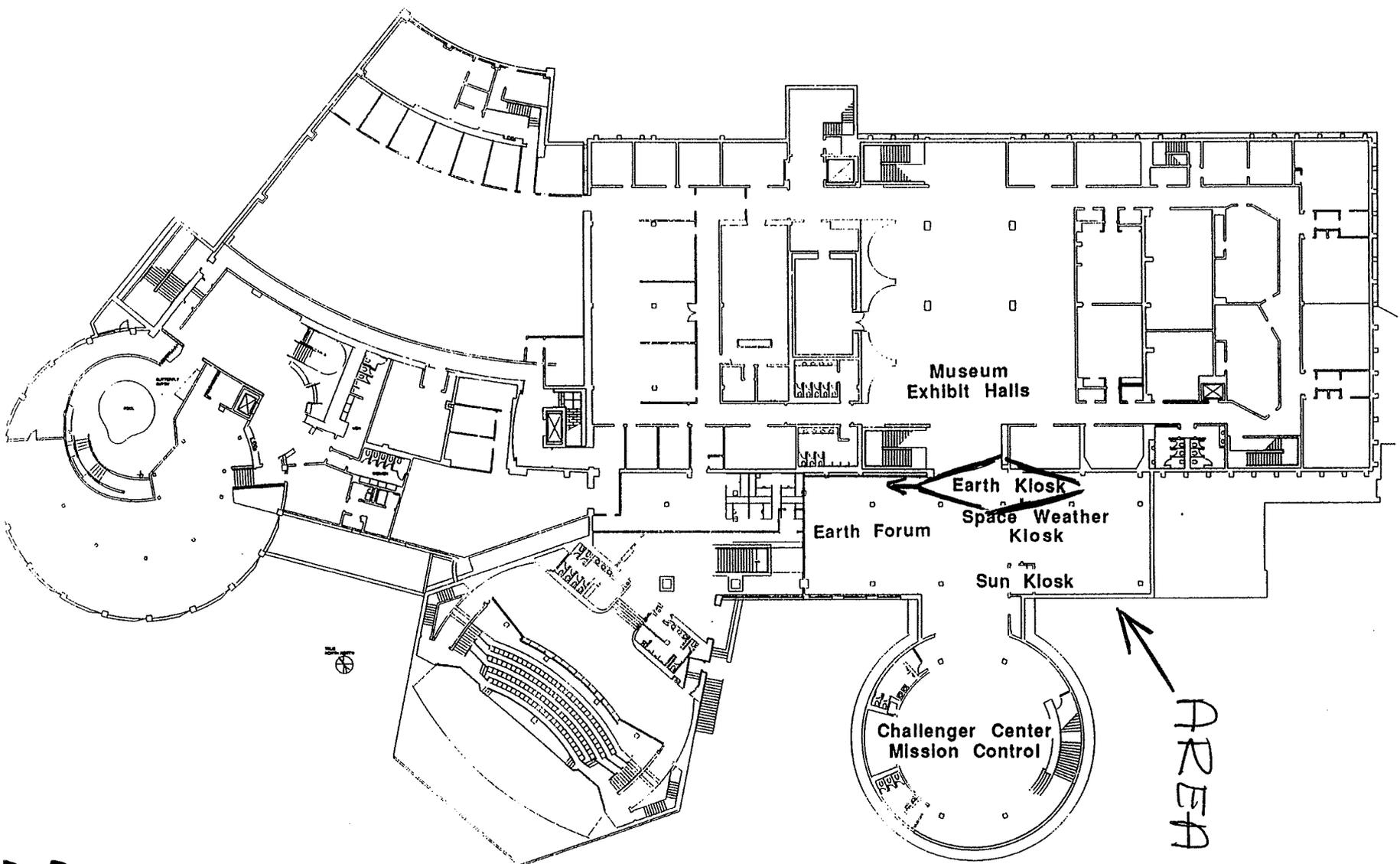
Challenger Center Mission Controllers
(Navigation Team solving Moon Orbit retro-rocket burn problem)





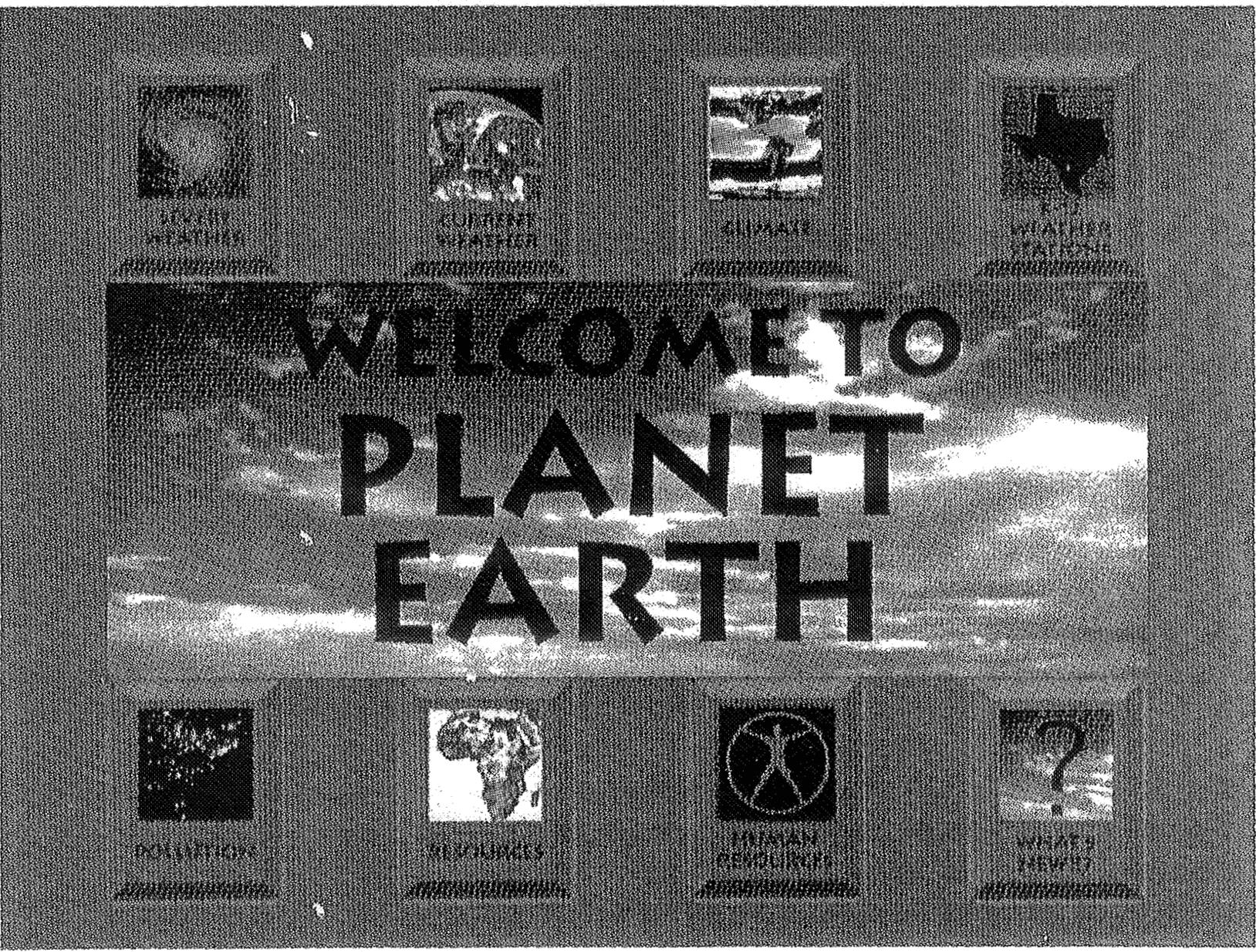
**Challenger Center Mission Site
Houston Museum of Natural Science**

HOUSTON MUSEUM OF NATURAL SCIENCE
Lower Level (Below Planetarium & Entry Hall)

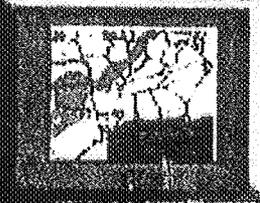


AREA 4

Earth Environment Kiosk Splash Page
(located adjacent to The Earth Forum, HMNS)



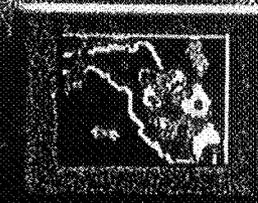
CURRENT WEATHER



TEMPERATURE



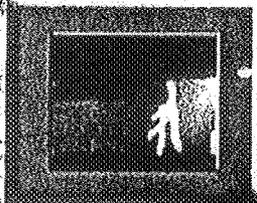
AIR MASSES



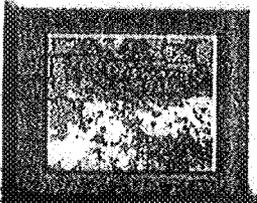
WIND &
PRESSURE



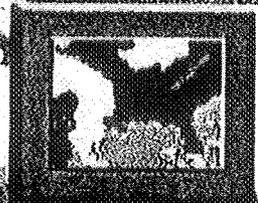
RAIN &
SNOW



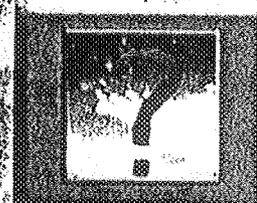
LIGHTNING



SATELLITE



FORECAST

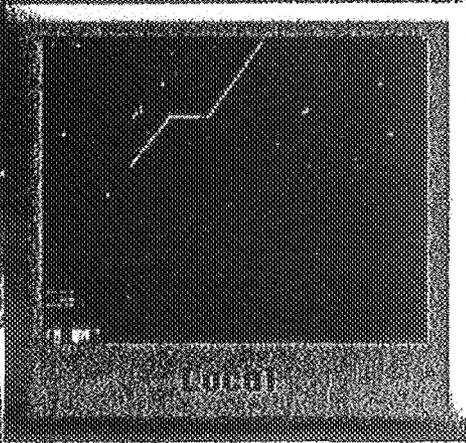
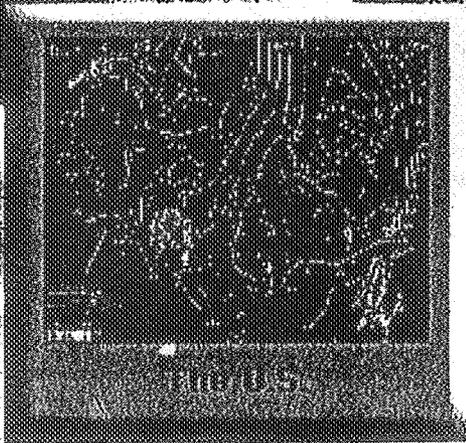


WHAT'S
NEW



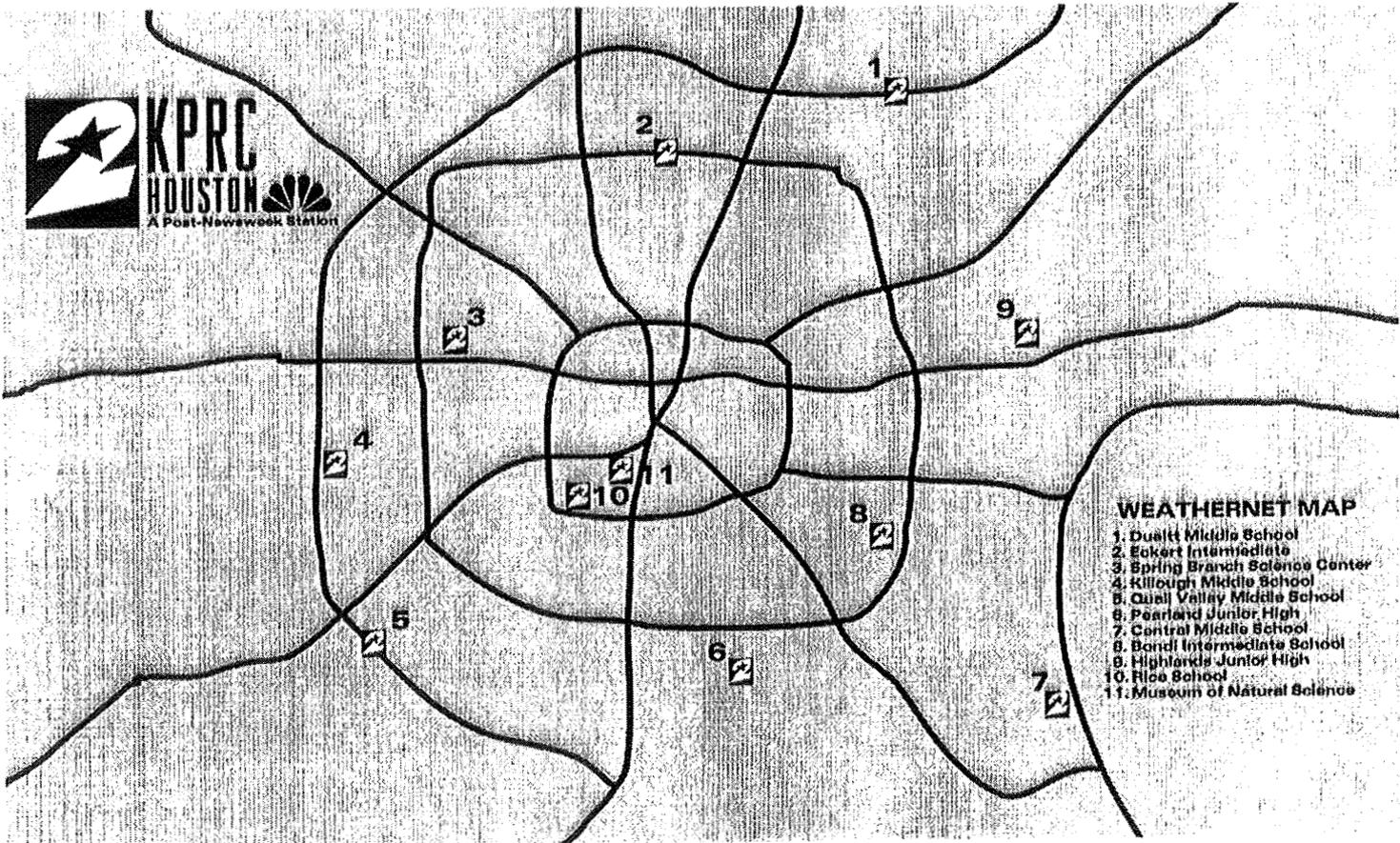
RESTART

WIND & PRESSURE



RESTART GHOOSER

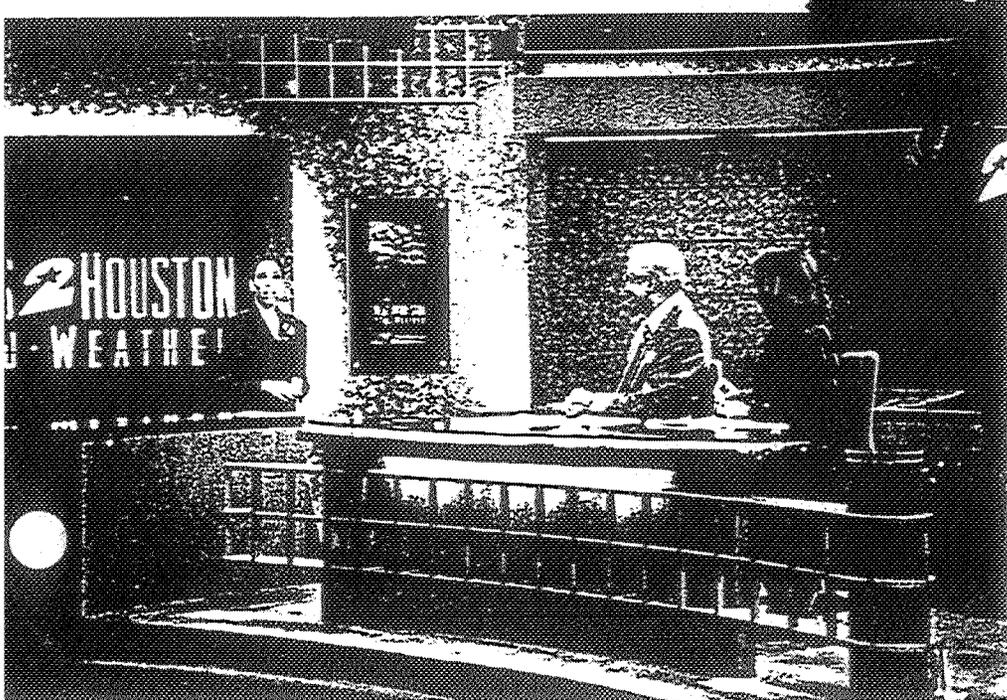
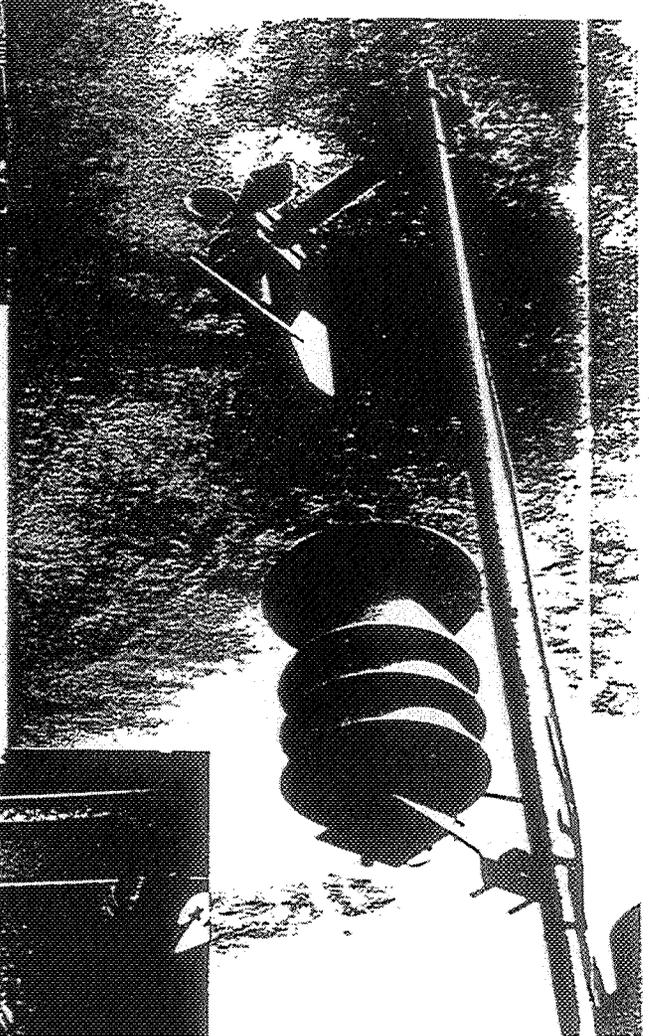
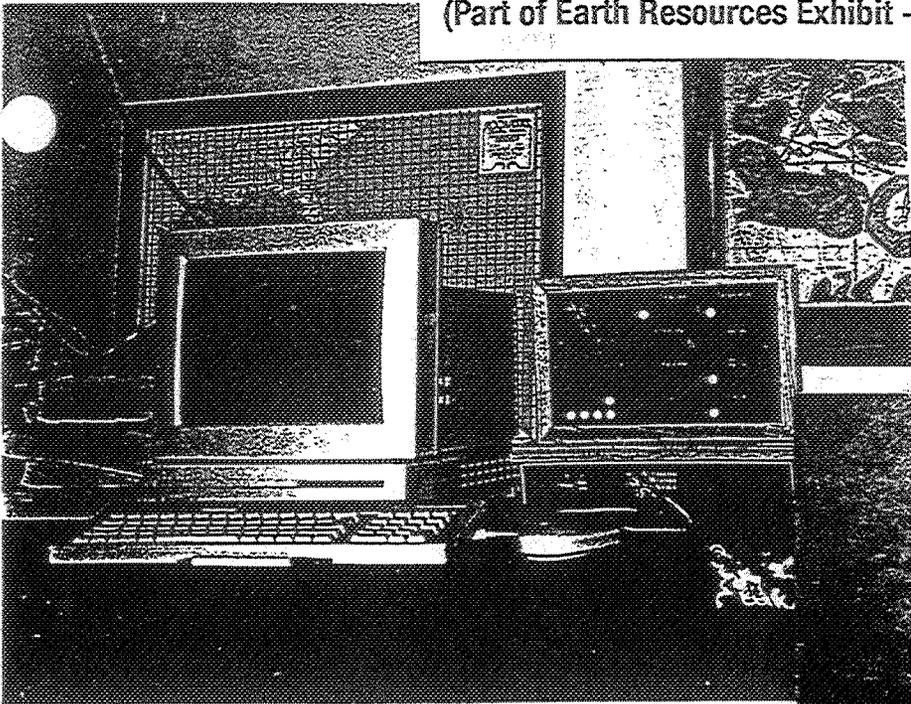
Map of Houston Area Weather Stations



weather station

(located on rooftop - Houston Museum of Natural Science)

(Part of Earth Resources Exhibit - Data Transmitted to KPRC-Channel 2)



main menu

local station

area stations

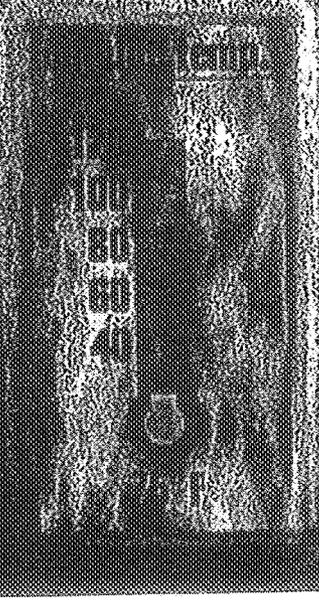
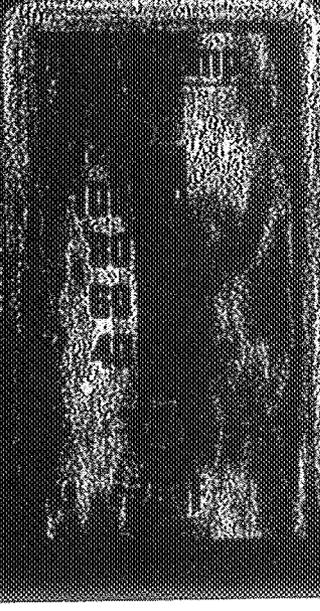
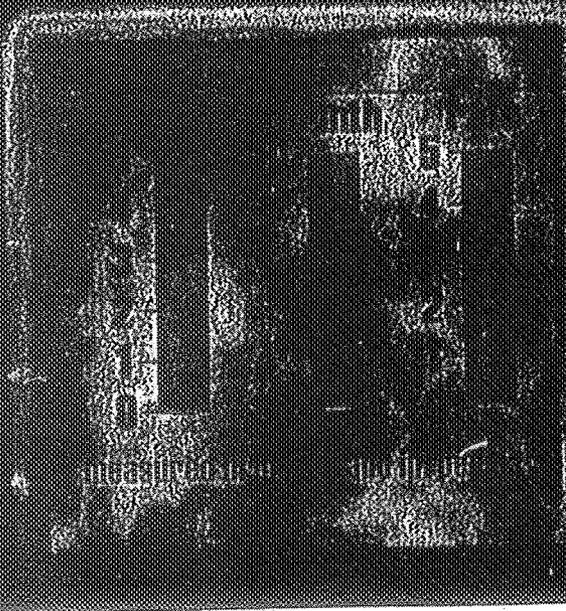
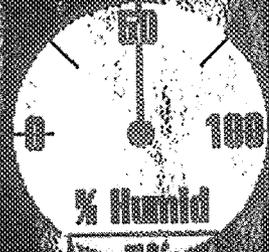
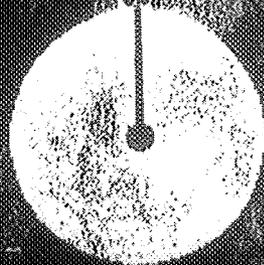
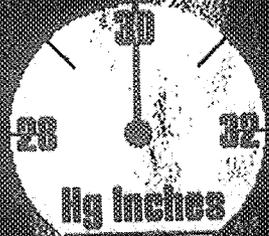
area map

changing data

cloud casting

pressure predicting

Current Weather Conditions



main menu

local station

area stations

area map

changing data

cloud casting

pressure predicting

set station

set left axis

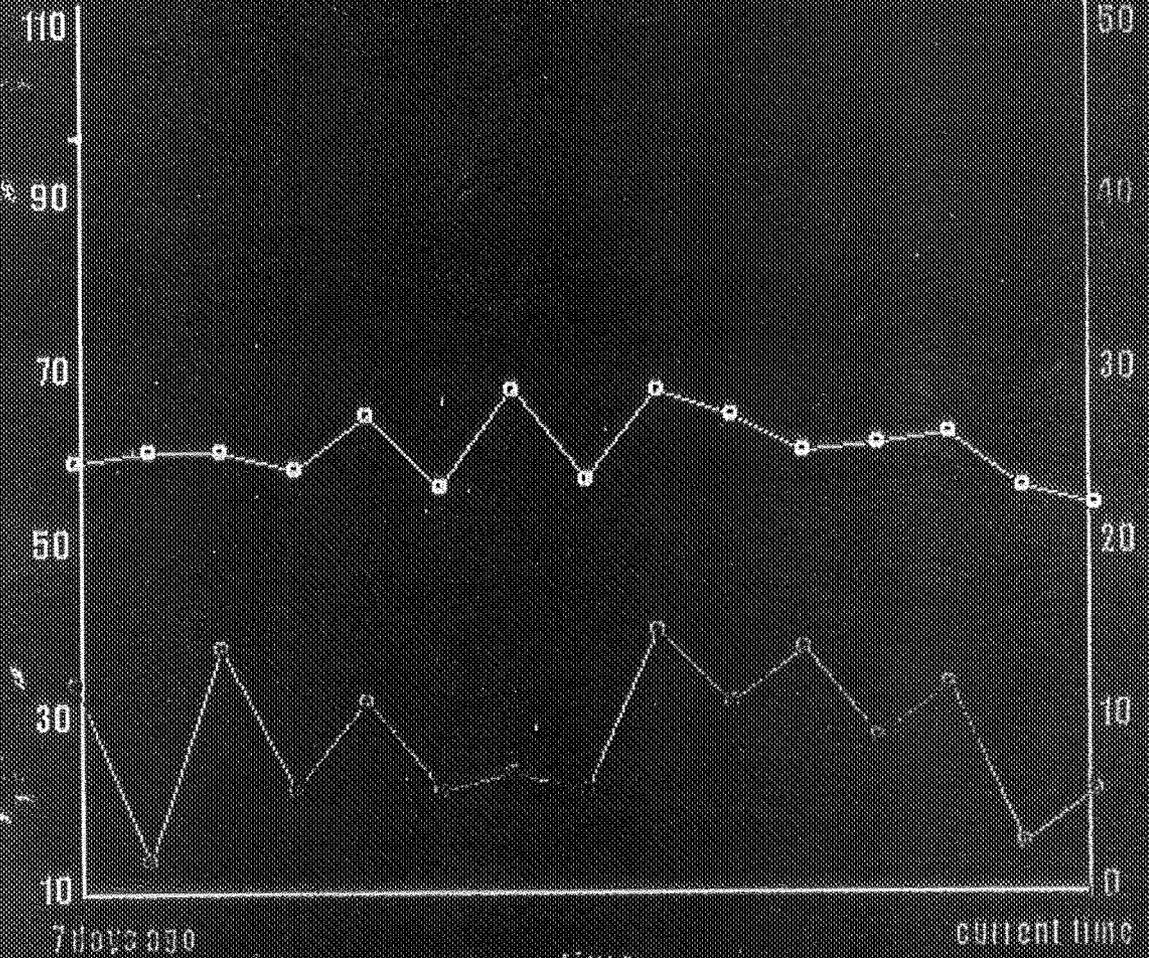
set right axis

set time base

Outdoor Temperature

1990-7-1

Wind Speed



main menu

local station

area stations

area map

changing data

cloud casting

pressure predicting

altocumulus

more info

altostratus

more info

cirrocumulus

more info

cirrus-fibratus

more info

click on a cloud to be most like sky outside

A101

SHEET NO.

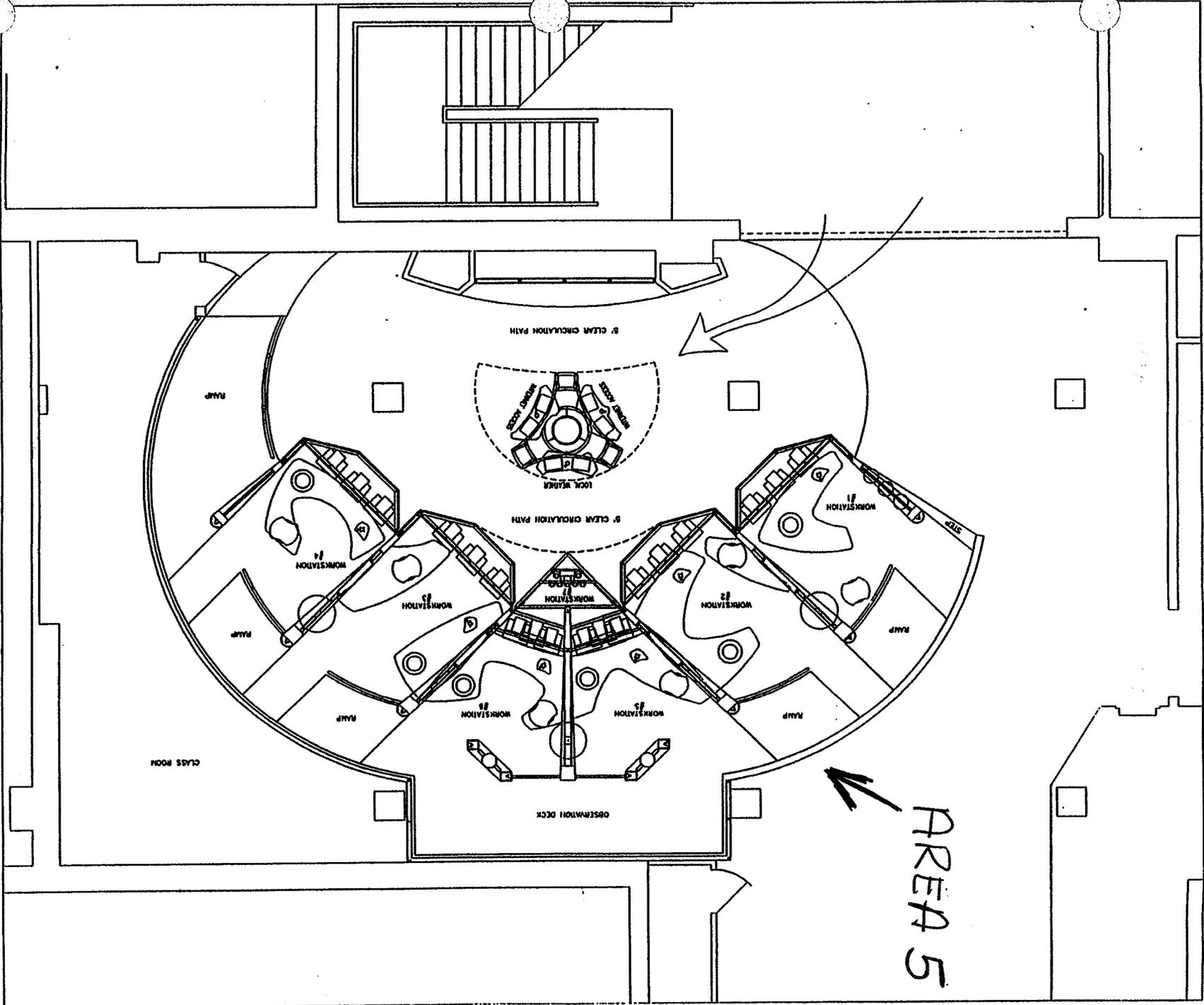
SCALE
1/8"=1'-0"

DRWG TITLE
PLAN

DATE
3/6/95

CREATING THE PUBLIC CONNECTION
"INTERACTIVE EXPERIENCES WITH REAL-TIME EARTH AND SPACE SCIENCE DATA"
RICE UNIVERSITY/HOUSTON MUSEUM OF NATURAL SCIENCE
ONE HERMANN CIRCLE DRIVE HOUSTON, TX

263



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153

THE GLOBAL ENVIRONMENT

The Earth Forum

DR. CAROLYN SUMMERS

DIRECTOR OF ASTRONOMY AND THE PHYSICAL SCIENCES

HOUSTON MUSEUM OF NATURAL SCIENCE

Welcome to the Earth Forum. Using this global communication and information network, visit different continents and investigate the planet's changing population and natural resources. Capture space images of Earth in action or compare global graphics and resource data bases. Watch the planet's population grow and predict its effect on the world's future. The tools for global discussion and debate are at your fingertips.

THE PHILOSOPHY

Thus begins an interactive and self-directed exploration of the challenges now facing planet Earth. For the first time in its history, humanity can identify absolute limits to its expansion and to the extension of its control over the environment.

Apollo astronauts captured the first images of a finite Earth with limited land, water, air, and natural resources. Humans have also learned that it is very difficult to create a sustainable remote biosphere and that other planets are not frontiers to absorb humanity's expanding population. Meanwhile, global death rates are dropping and the population is soaring in regions that are least able to support it.

Worldwide communication has brought awareness of worldwide living conditions. Developed nations are faced with images of the plight of humanity around the world and must address the moral dilemma associated with allocating limited food, fuel, water, and habitat resources. Computing power and data-storage capabilities provide tools that allow humanity to address complex global problems with realistic assessments of current conditions, of future options, and of the consequences following specific decisions.

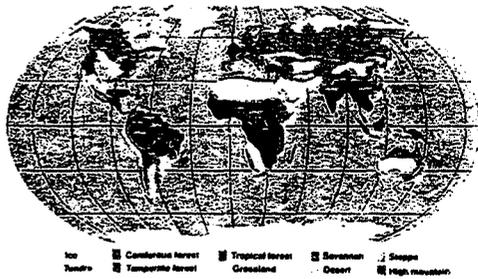
The Earth Forum shows how global databases (with information, tables, graphics, images, and video) are constructed and how they can be accessed and compared. Six different world work stations demonstrate how people around the planet can be connected on an information superhighway, with the whole world as close as a computer screen.



THE FOCUS

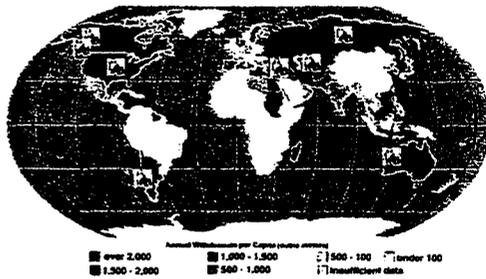
Each of The Earth Forum's world work stations is an exhibit space with a continent and resource focus. At each work station, visitors determine the global impact of a resource, the dynamics of global population change, and the specific conditions for one-sixth of the planet's surface.

WORK STATION 1: SOUTH AMERICA & BIODIVERSITY



The exploding human population threatens the habitats of all living creatures. This threat is most immediate where humans are expanding into rich, fragile, and irreplaceable ecosystems such as the world's tropical rain forests.

WORK STATION 2: NORTH AMERICA & FRESH WATER



Life cannot exist nor can populations remain healthy without fresh water withdrawn from rivers, lakes, and under ground.

WORK STATION 3: AUSTRALIA, OCEANIA & THE OCEANS



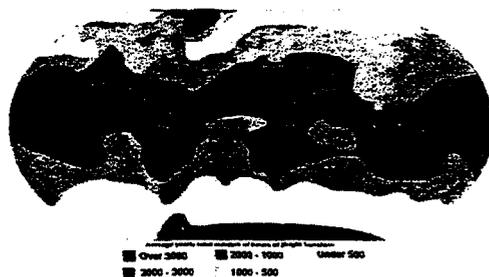
The oceans provide food, minerals, and fossil fuels while they protect fragile ecosystems in the sea and on isolated islands. Ocean currents encircle and connect the planet.

WORK STATION 4: ASIA & THE ATMOSPHERE



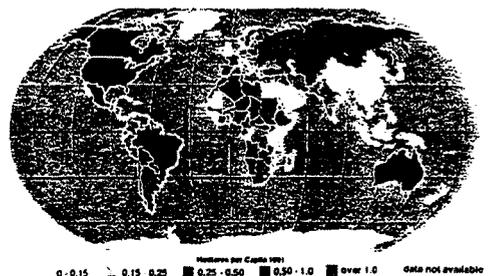
The planet's encircling blanket of air protects all life underneath. Growing populations, especially in urban areas, pollute this most precious and global of all resources.

WORK STATION 5: EUROPE & ENERGY



Sunlight is the ultimate source of Earth's energy. Capturing and using solar energy can address the planet's inequitable and accelerating consumption of fossil fuels.

WORK STATION 6: AFRICA & FOOD



Africa is a land of fragile ecosystems and an exploding population. Worldwide food production has more than doubled in thirty years, but its distribution is uneven and the environmental costs of the increased productivity must be considered.

THE EXHIBIT

The Earth Forum exhibition has been created by the Houston Museum of Natural Science (HMNS) in cooperation with FotoFest to highlight Earth resources, world geography, and global information access. At FotoFest's Fifth International Festival of Photography, a sixteen-foot-wide moving Earth image draws visitors through the darkened Hall of Globes onto this information superhighway of the future. In its center, an interactive theater presents Earth images and the status of activity on the encircling electronic network.

Visitors climb a curved ramp to enter world work stations connected in an information and video network. The ramp's arc symbolizes global connectivity surrounding a dynamic Earth. Crystal-shaped cubicles extrude from the ramp's inner curve. Each is an electronic work station where real crystalline lattices store and process millions of data bits each second.

Within each cubicle, angular forms dissolve into an ergonomic curvilinear design that welcomes its human passengers. Maps, overlays, transparencies, globes, and laser disk imagery assist teams on their worldwide information journey. Telecommunication lines provide video conferencing between work stations.

Access to The Earth Forum's information and communication network reflects the way humans communicate and acquire information in the real world. The work station computer is a facilitator guiding visitors to information about the worldwide state of resource variables. The computer also establishes the specific problem solving strategy of each work station. Teams at other work stations around the network are as close as video conferencing can bring them.

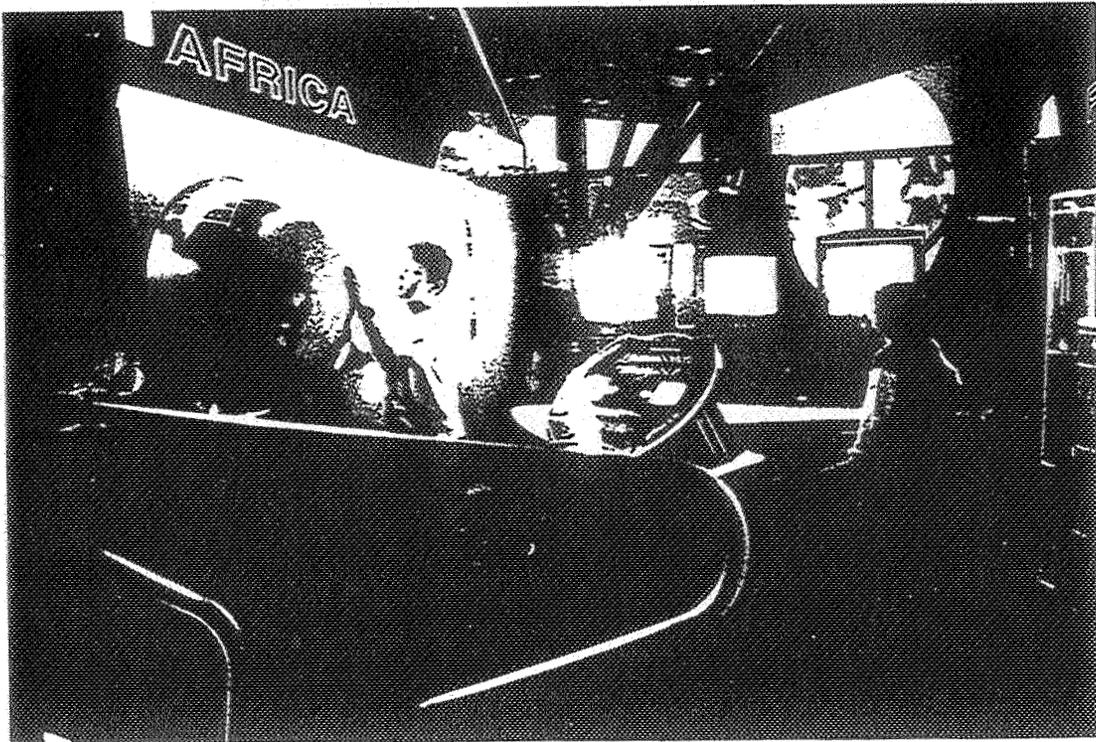
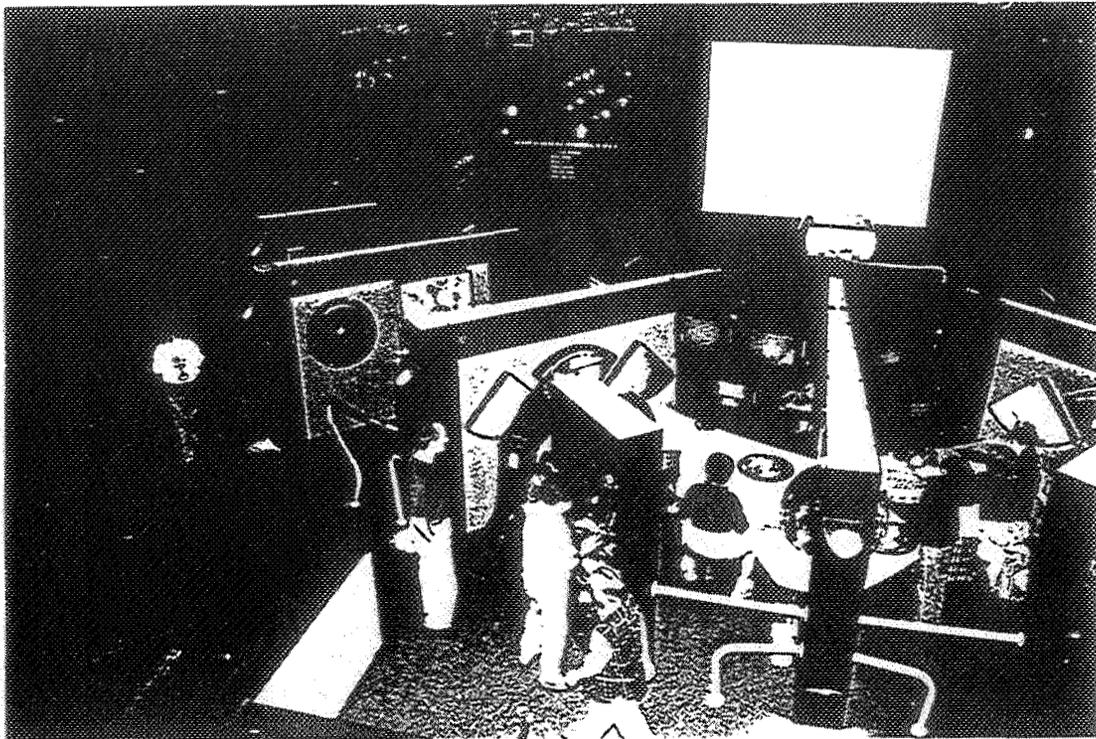
After the FotoFest Festival, The Earth Forum will be given by FotoFest to the Houston Museum of Natural Science as a permanent earth systems education center for Houston. The center will have multiple functions: a computer lab for students, an interactive museum exhibit for the general public, and an Earth Theater within the Museum's Burke Baker Planetarium. A National Aeronautics and Space Administration grant to Rice University will connect The Earth Forum and other Museum space and earth science exhibits to Internet data and image sources around the globe.

The Earth Forum is a joint creative effort of Dr. Carolyn Sumners, the Museum's director of astronomy and the physical sciences; Robert Samen, project architect and Robert Sumners, project software designer and programmer. Dr. Robert Fox has compiled all population data from United Nations databases. Maria Villanueva is responsible for design of all graphics. Debbie Valdez, Paula Cutler, and Janel Badrina have produced work station databases, while Neal Desai and Dawson Valdes assisted in the programming. Ryan Wyatt is responsible for projection of Earth Forum imagery in the Burke Baker Planetarium.

NASA's Johnson Space Center has provided images and film stock for exhibits. The National Geographic Society has donated the earth surface videos and stills. The World Resources Institute has provided global databases with additional information from the United Nations, the World Health Institute, and WorldWatch. WorldSat International has created the high-resolution global satellite view, and Spherical Concepts has produced a unique collection of database globes.

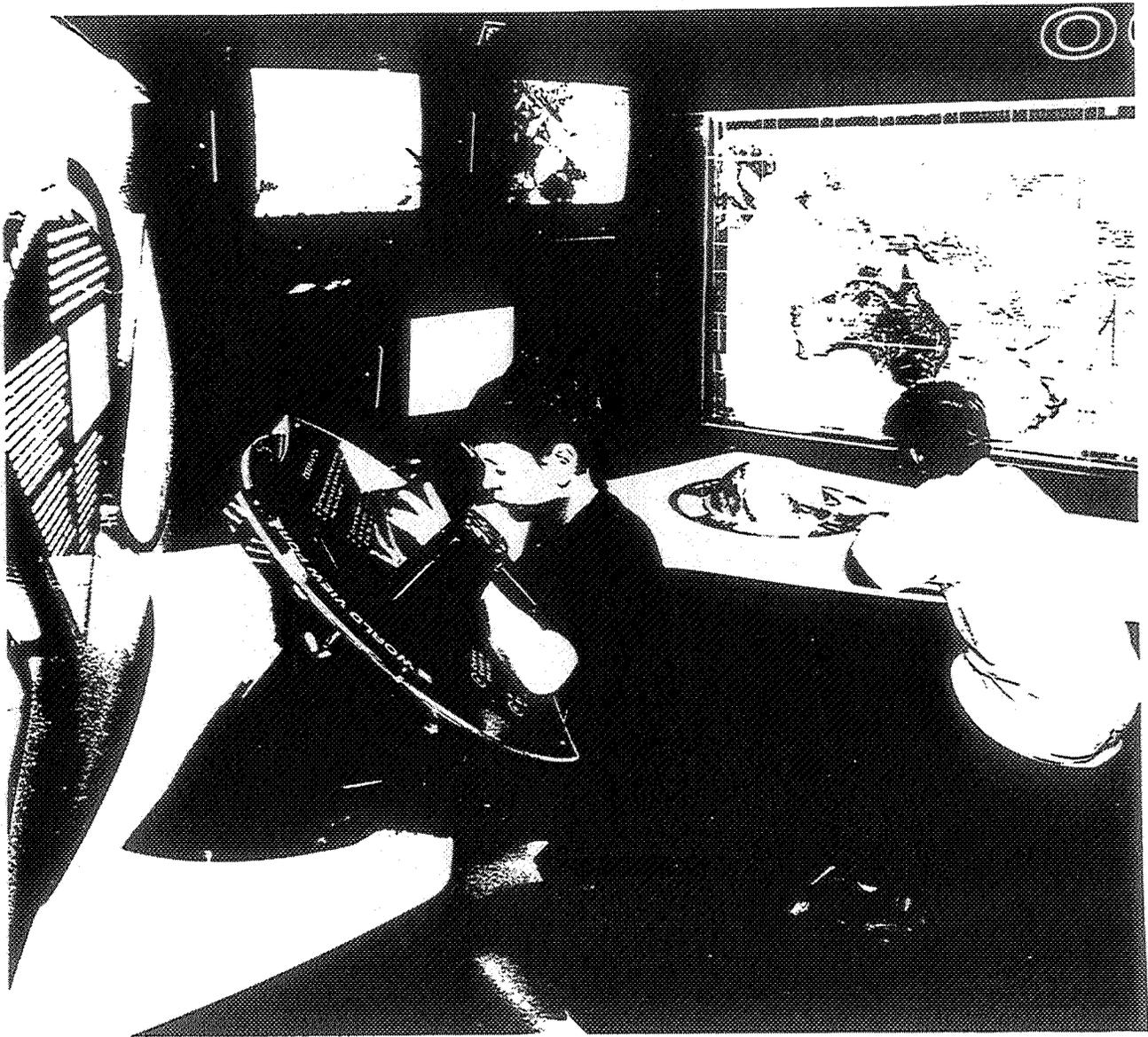
The graphs on page 119 are by Robert Fox.
The NASA satellite images on pages 115 (view of earth from Apollo),
119 (Northern Persian Gulf region), and 120 (top, Caribbean; bottom,
Strait of Gibraltar) are reproduced courtesy of NASA.

Earth Forum
(as installed in the George R. Brown Convention Center)



Africa World Workstation
(Earth Forum - Agricultural Data Base)

The Earth Forum Environment: The Tools



View Ports provide windows to the planet's surface.
Globes and maps show location, elevation and surface coloration.

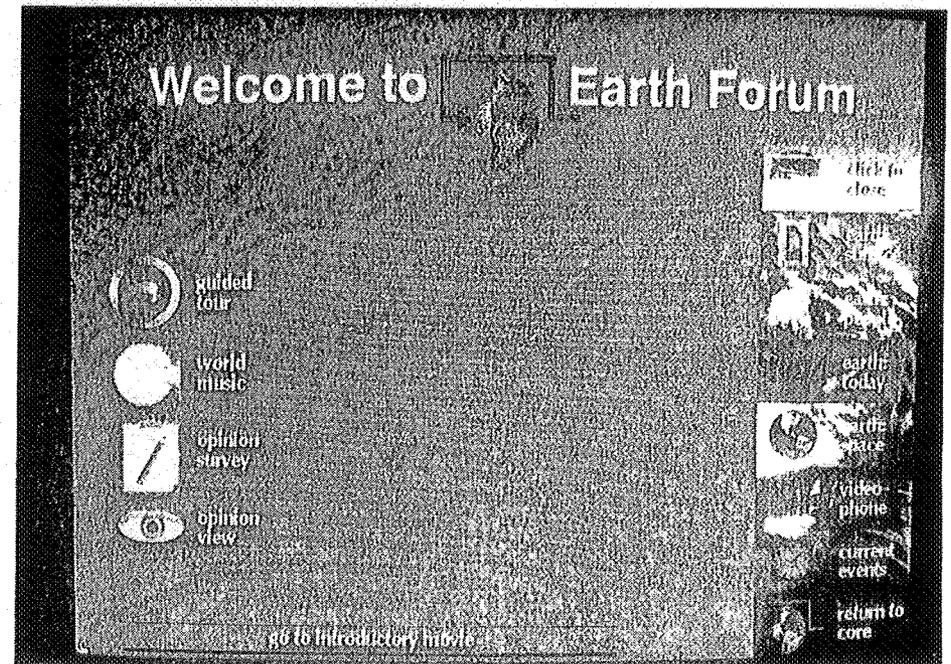
The Earth Forum Superhighway

The Earth Forum Information Superhighway has six World Work Stations: each representing a continent and a resource endangered by expanding world populations.

The computer welcomes you to your continent and resource. This Earth-from-Space map from WorldSat shows the continent's topography and ground cover.

The CORE screen shows the software options at the operator's fingertips. Individual buttons provide a guided tour, an opinion survey, or music of the continent. The toolbox on the right provides six basic superhighway options:

- Earth: Surface - with over an hour of video of the continent and the status of the resource. Most video tours are provided by the National Geographic Society.
- Earth: People - with continents that dramatically change through time to show changing demographic data. These data sets are provided from the United Nations.
- Earth: Today - with maps, tables, and graphics illustrating the worldwide condition of a specific resource from data provided by the World Resources Institute.
- Earth: Space - with astronaut imagery that illustrates how the planet is changing and how changing environments are interrelated.
- VideoPhone - with video transmission that allows data to be shared and compared.
- Current Events - with online updates of news, trends, and resources



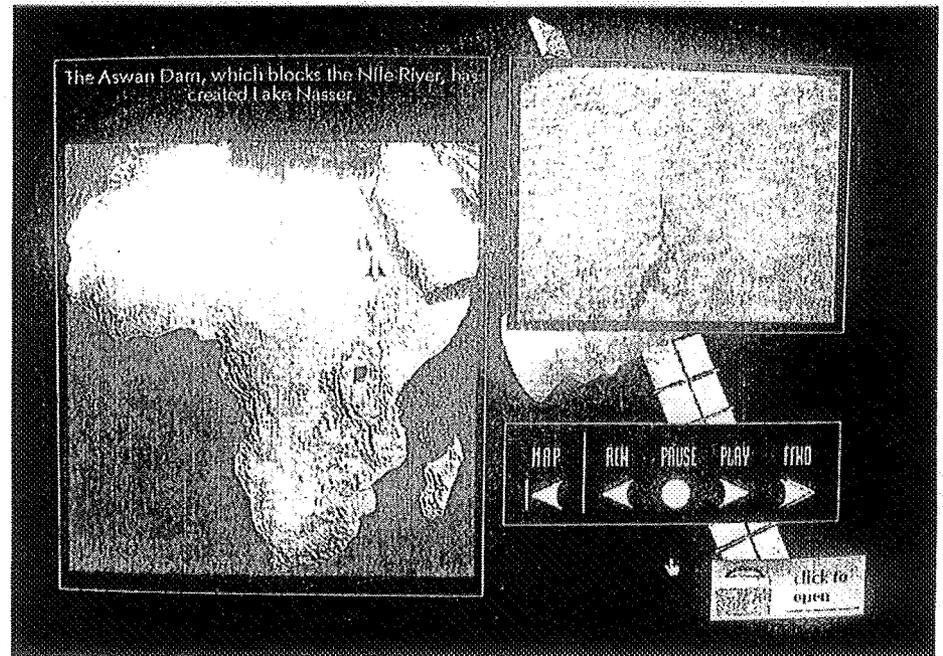
Computer Screen for the Earth: Surface Tool

Visitors can tour the entire continent by making selections from the left column on the screen. Their narrated tour appears on the left side monitor. The right column and right side monitor feature the resource and how it is used. Once a video has been chosen, the visitor can play, pause, fast forward, or reverse it. Over an hour of video footage is provided in each world work station.



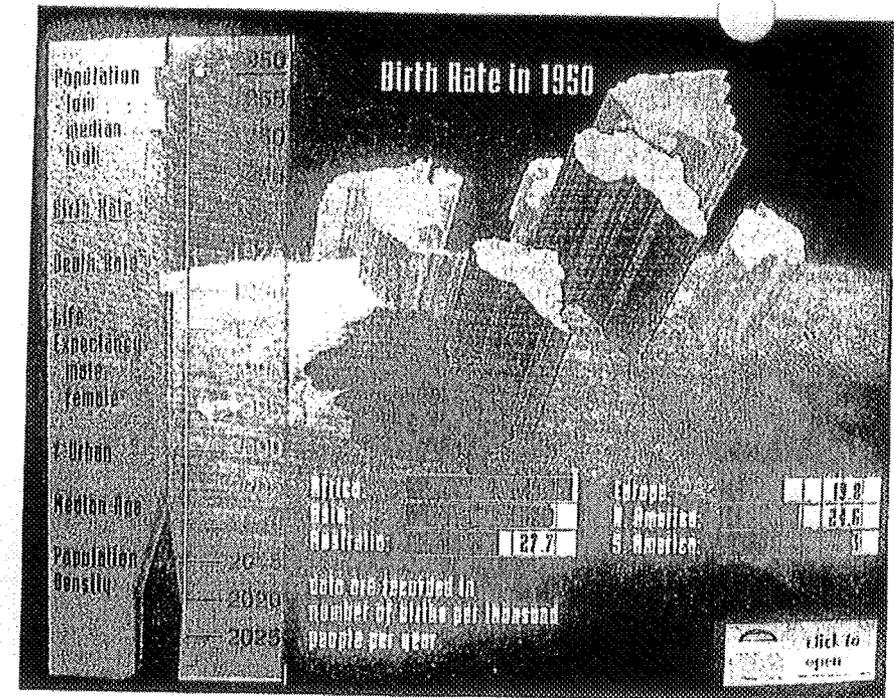
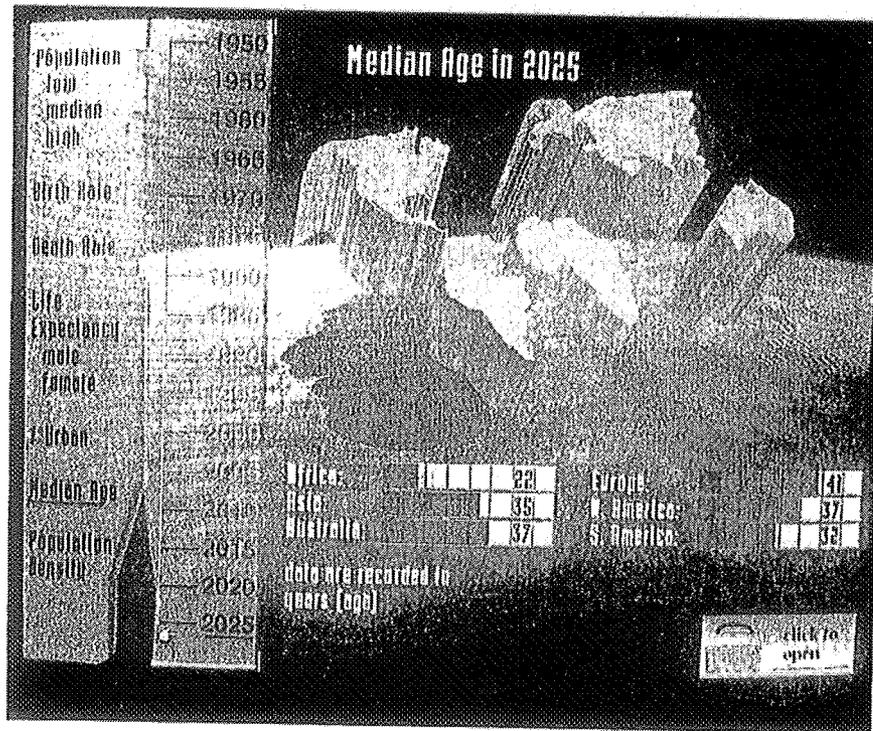
Computer Screen for the Earth: Space Tool

Small spacecraft appear on the continent and the visitor can choose to see the earth below from any location. The images will be in the form of stills, a series of stills, or a movie photographed realtime through the Shuttle window. Environmental information is provided through captions accompanying each image.



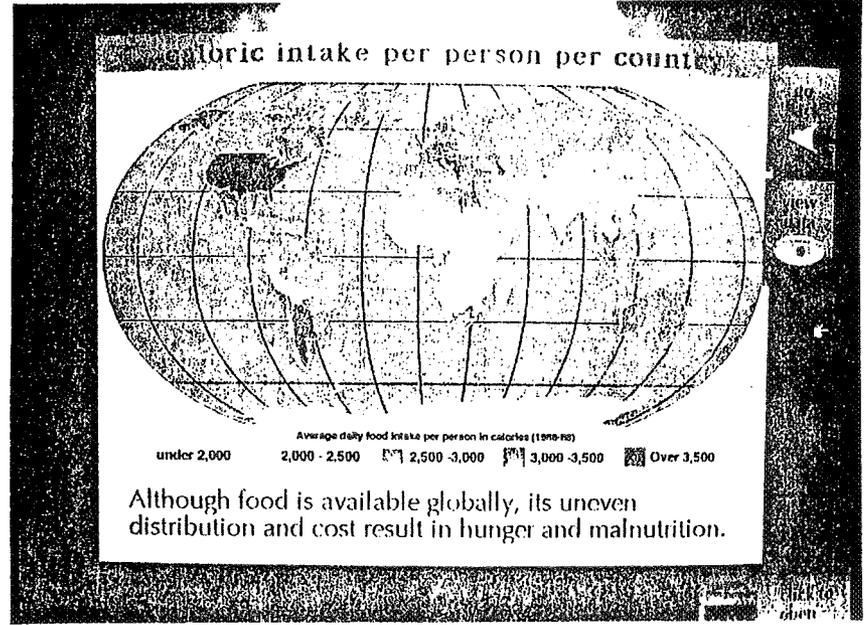
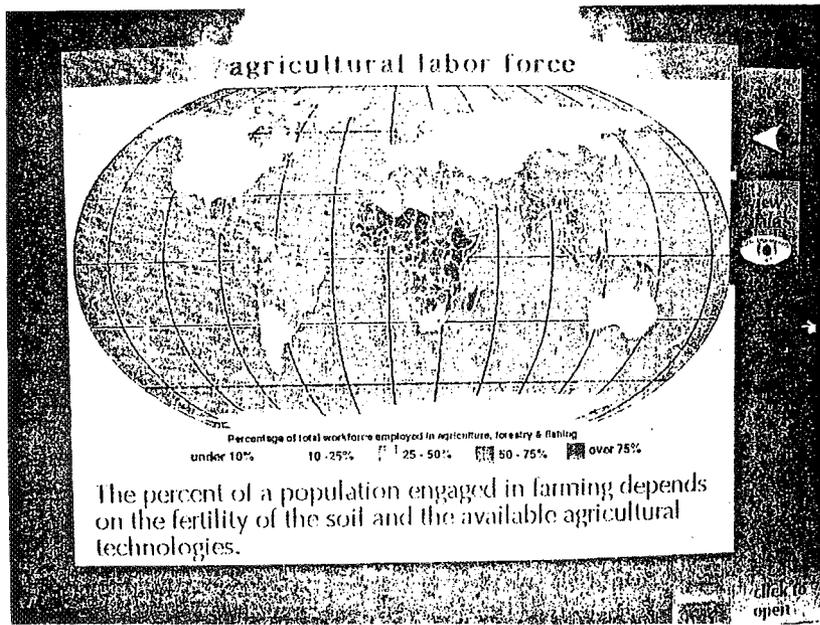
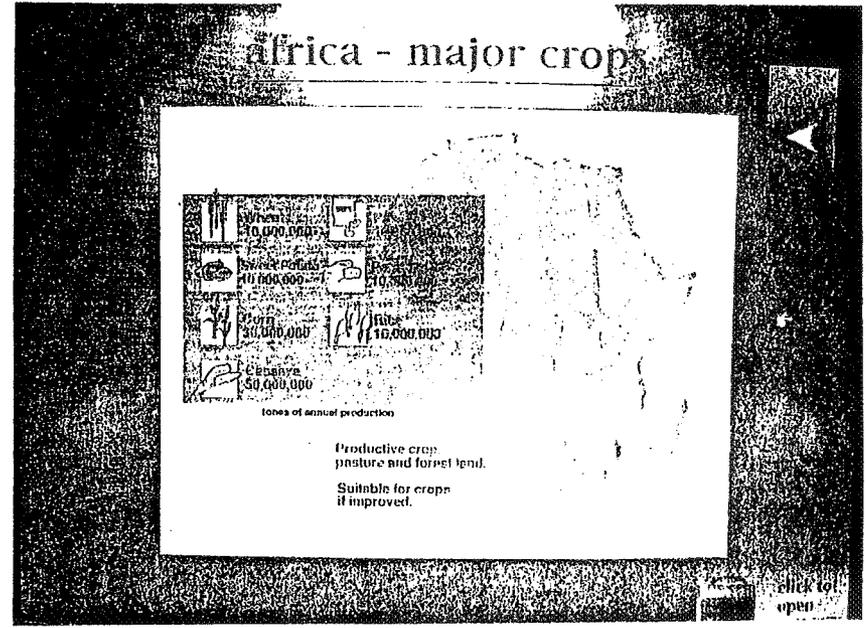
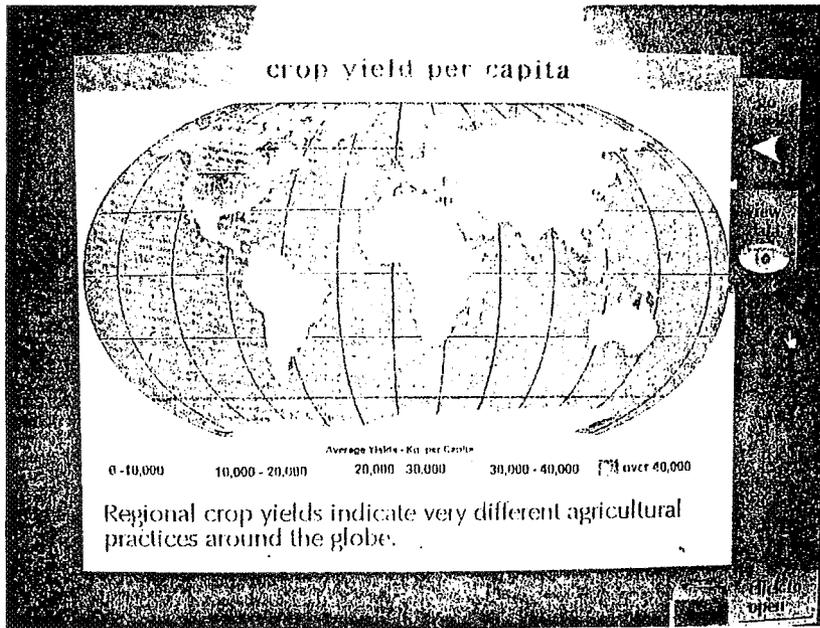
Computer Screens for the Earth: People Tool

Notice how the growing continents dramatize the difference in birth rate from continent to continent and how birth rates are changing over time. Also notice the relationship between continent values for birth rate and for median age.



Computer Screens for the Earth: Today Tool

In Africa the resource is food with agricultural variables illustrated. Notice the different relationships between the number of farmers, crop yield, and calorie consumption. The major food crops and livestock for each continent are also displayed.



The Earth Forum Environment: The Spirit



All Earth's systems are interrelated with resources that must be shared among the continents. Each child can touch his world, enjoy its beauty, and watch it change.

"Public Connection" Extensions

Interactive Programs for Teachers and Students

1. Afternoon Astronomy

Once each month Houston area teachers can visit the Museum and talk about latest astronomy events. The Planetarium is used for observational practice. The Challenger Center Mission Control Center is used as an Internet classroom for teachers to use in accessing space data and image bases.

2. Ask the Astronomer

This is a pilot program with Houston area schools. Teachers and students with Internet connections can leave questions in The Astronomer's mailbox at Rice University. Staff at the Museum and Rice University divide the task of responding.

3. Astronomy On Line

Monthly observing activities are posted on Internet for students to do and report back their observations.

Summer Camps for Kids

1. GeoQuest

Earth Surfing on an Information Superhighway

Explore the planet's past and present and then predict the future in this unique cyberspace journey around planet Earth. *Use a computer network on the Internet to investigate the world's places, resources, wildlife, and oceans. Conference with kids in other cities and countries. Discover how the astronauts see our changing planet. Become a delegate to the Earth Forum and cooperate in a great world game.*

Geology You Can Eat!

Explain geologic changes by experimenting with edible volcanoes, plate tectonic cookies, candy crystals, ice cream glaciers, and sticky stalactites and stalagmites. Collect current earthquake data from Internet sources and then construct an earthquake-proof graham cracker house and test its tremor tolerance.

2. Light Speed!

Sky Search

Build your own small telescope and use it to travel at the "speed of light" to the moon or a distant star. *Use Internet connections to see the latest images from the Hubble Space Telescope and other observatories. Make an experimental moon garden filled with plants and moon-like dust. Decide if we could someday live on the moon or another planet.*

Lights, Lasers, and Moving Images

Explore polarized light, black light, white light and laser light. Experiment with lenses, mirrors, and fiber optics. Make a camera obscura and an animated stop action science fiction movie of aliens on a mystery planet. The telescope, moon garden, and movie are yours to take home after this week of Aliens, Astronomy, and Action Optics.

Presentations at Conferences

1. Space Station Teacher's Workshop, Johnson Space Center: spring, 1995
2. all Regional National Science Teachers Association Conferences: fall, 1995
3. National NSTA Conference: spring, 1995

Spring 1995 Adult Lecture Series

- featuring Internet Connectivity

1. The Interactive Earth

The continents are connected in a global computer network where you can explore the planet's surface and its resources. The Museum's unique graphic interface provides instant access to image and data bases of the World Resource Institute, the United Nations and NASA. You can investigate the Earth's exploding population, discover how we are handling limited resources, and visit the planet's surface region-by-region. This class includes a discussion in the planetarium's new Earth Theater and an Information Superhighway adventure in the new Earth Forum.

2. Where are those Planets, anyway?

-- a Rice University/HMNS Astronomy Lecture

Become familiar with the night sky using the Digistar planetarium projector and discover why the planets are really "wanderers". Explore the spring starfield, find the difference between the ecliptic and Zodiac, and watch as the planets perform their own special dances. Prepare for the upcoming "ghost rings of Saturn" and planetary conjunctions.

3. Surfing for Planets -- a Rice University/HMNS Astronomy Lecture

"Surf" the Internet for up-to-date information on the planets and their satellites. A live on-line demonstration of network-based software brings in real-time images of the Earth and recent discoveries of the planets and comets (including Comet Shoemaker Levy 9 and its crash into Jupiter last summer).

4. Astronomy On-Line

Every ten years, astronomical observations of the universe double in number. How can anyone keep up? With new information bombarding astronomers, they have learned to use the Internet for fast and easy data dissemination. Images of planets, nebulae, star clusters, and galaxies appear daily on world-wide computer systems—from telescopes around the world and satellites throughout the solar system. In "Astronomy On-Line," you'll see the newest pictures from the orbiting Hubble Space Telescope and learn the latest about astronomers' discoveries -- all placed in the context of the planetarium's spring starfield.

Milestones Reached for Rice "Connections" Project

P. Reiff, Rice University

- 9/1: Start of Grant (start of effort: ~1 Aug)
- 10/7: SL9 Beta version complete; available over net
- 10/21: Version 0.9 of SL9 module (PC) on display in museum (in time for opening of Energy Hall).
- 10/30: Version 1.0 (PC) on display at Museum; available over internet.
- 11/15: Version 1.1 (Mac touchscreen) with 16-bit color on display in Museum. Real-time "Space Weather" information placed on net (WWW) from real-time running of Magnetospheric Specification and Forecast Model.
- 11/30: SL9 module taken to Rice K-8 School for demo. Layout for control panel (hierarchical) for planetarium decided upon. Two weather stations installed and "online" (on Channel 2 nightly weather report).
- 12/6: Participated in AGU Education and Public Information Committees: will highlight internet projects in online session at spring AGU meeting, Baltimore (May). WWW pointers to internet projects will be cross-referenced in AGU WWW page. Space Weather module to be part of "Electric Space" exhibit.
- 12/9: Informal demonstration of SL9 module at AGU poster session. Module given to Jim Willett of Code S, NASA HQ to show there.
- 12/14: Phone cable for internet laid to museum. Local nets being laid.
- 12/20: Demonstration of SL9 module to Larry Angermiller for possible kiosk at Space Center Houston.
- 1/7/95: "Connected" planetarium show began. Remaining 2 weather stations installed and online. Live broadcasts on Channel 2 for all stations.
- 1/10: Full network interconnection of Museum.
- 1/18: Demonstration fully online Planetarium show. Live videoconference from around the state.
- 1/20: Teacher workshop for weather stations. Live TV broadcast of teachers learning.
- 1/24: Presentation of project to NASA CAN PI's meeting.
- 2/19: "Earth Forum" opens at Museum. User logging installed in SL9 module.

- 3/3: Preliminary design work for "Earth Today" kiosk completed.
- 3/6: "Earth Today" kiosk design approved by Museum. Construction drawings begun.
- 3/29: Project-based "Surfing the Solar System" course begun, cosponsored by Rice Continuing Studies and the Houston Museum of Natural Sciences. Real-time internet display in planetarium as part of the course. (Continues through May 2)

Milestones Planned for Rice "Connections" Project **P. Reiff, Rice University**

- April 22: First (simple) modules of Earth and Earth Weather to be completed and put into "Space Update" kiosk. Construction of Earth and Weather kiosk in progress. (Grand opening for Earth Day, April 22)
- May: "Earth Today" kiosk construction to be finished (program installation, end of May)
- June 1: First versions of Sun and Space Weather modules installed and running, initially as part of "Space Update" kiosk. (Space Week, July 20, grand opening)
- Fall: Kiosk design for Sun and Space Weather to be finished. Construction begins.
- October 95: Demo at regional National Science Teachers Assn meeting (Salt Lake City, UT).
- December 95: Demo at regional National Science Teachers Assn meeting (San Antonio, TX).

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P 355

The Exploratorium University of Berkeley

Bob Semper

*A Science Infrastructure for
Access to Earth and Space Data
Through the Nation's Science
Museums*

SCIENCE INFORMATION INFRASTRUCTURE

Bridging the Gap Between the Frontier of Research and the K-12 and General Communities through the Nation's Science Museums

The Science Information Infrastructure (SII) project has established a natural partnership of research institutions, science museums, industry, teachers, and other educators to stimulate awareness and use of the rich resources of remote sensing data from NASA and other institutions and to deliver this information to the K-12 and general communities. The information will be available through resource centers at the science museums created in collaboration with local teachers, who will be assisted in extracting scientific data and information and applying it to the development of science curriculum materials. The SII, along with its demonstration project "Science On-Line" has received funding from NASA's High Performance Computing and Communication Division and NASA's Astrophysics Division. The SII fosters a key collaborative strategy which (a) avoids duplication of effort, (b) results in a program that contains substantive feedback and input from participants, and (c) provides a natural mechanism to adapt cutting-edge research and technology in a manner that responds to the needs of educators, students and the general public.

Lead Institutions

U.C. Berkeley's Center for Extreme Ultraviolet Astrophysics (CEA)

The CEA represents a culmination of twenty years of research and student training in the field of extreme ultraviolet astronomy brought to a focus by the June 1992 launch of NASA's Extreme Ultraviolet Explorer (EUVE) satellite. As an extension of the twelve-year involvement of U.C. Berkeley undergraduate students in the EUVE satellite project, the CEA has developed the SII and other innovative educational outreach programs for the K-12 and general communities.

Smithsonian Astrophysical Observatory (SAO)

The SAO is a bureau of the Smithsonian Institution with a history of scientific innovation, technical invention, and intellectual excellence which continues through SAO's diverse multi-disciplinary research. SAO's deep commitment to

education is demonstrated by its sponsorship of a variety of diverse programs for diverse audiences. The programs emphasize advanced technology, development of curriculum materials, teacher enhancement and teacher networks.

Partnership Elements

Within the SII, each partner operates primarily in their area of expertise:

Science Museums

- Teacher professional development and public outreach
- Innovative teaching methodologies
- Curriculum development and lesson plan construction
- Hands-on experiences for teachers, students, and the general public

Teachers

- Innovative teaching methodologies
- Creation of lesson plans and other curriculum materials
- Presentation of materials to students
- Feedback and evaluation on efficacy of program activities and materials for use in the classroom

Research Institutions and Researchers

- Scientific and technological discoveries
- Network, computer and software setup (technical expertise)
- Methodologies for producing and accessing data
- Scientific interpretation of data

Industry

- Technical expertise and equipment for K-12 schools and science museums
- Technological innovations
- Relevance of subjects taught in schools
- Guidance on technological skills needed for full participation in the work force

Longevity & Benefits to Participants

By design, the SII enables the museums and local communities to perpetuate the infrastructure and the

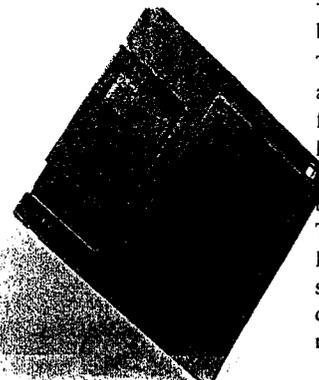
resource centers through a persistent collaboration. As a result of this project, individual researchers, NASA missions and other research projects have a clear mechanism for contributing to a national effort to improve scientific and technological literacy in the country. The establishment of the national SII enables additional museums, researchers, educators, industry, and regional districts to participate in, and augment, the network of public resources. A set of templates, guidelines and methodologies will be disseminated to encourage and facilitate participation in the SII.

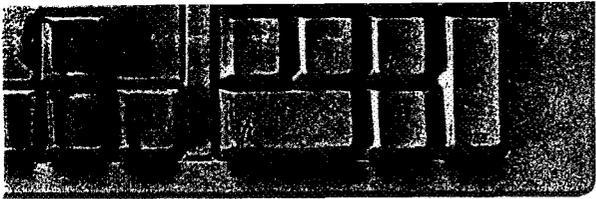
The SII collaboration is coordinating the creation of the education framework with projects such as Science Learning Network and others..

Science On-Line -- Earth and Space Science for the Classroom (SII Demonstration Project)

"Science On-Line (SOL) -- Earth and Space Science for the Classroom," the nine-month long demonstration project for the SII, joins the efforts of CEA, LHS and UCMP, with the Exploratorium, and the Adler Planetarium for the purpose of coordinating on-line resources that respond to the needs of K-12 teachers and students. The project is designed to demonstrate the utility of science resource centers for the K-12 community, and make certain that when schools finally gain access to the information superhighway, educators and students will find appropriate resources that respond to their particular needs.

The coordinated resources include on-line science exhibits and virtual museums, cutting-edge NASA images and data from space and Earth, and focus on the development of lesson plans which tap the unique and up-to-date resources of the Internet to catalyze innovative teaching techniques based on cooperative learning and hands-on activities. Teachers at each partner site receive training in the use of Internet tools and support in the creation of space and earth science lesson plans that take advantage of the unique capabilities of the Internet. The participating teachers also make the lessons available on Mosaic.





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Partner Institutions

Science Museums and Planetaria

- Adler Planetarium
- Boston Museum of Science (BMS)
- Exploratorium
- Lawrence Hall of Science (LHS)
- National Air and Space Museum (NASM)
- New York Hall of Science (NYHS)
- Science Museum of Virginia (SMVA)
- U.C. Museum of Paleontology (UCMP)

School Districts

- Acalanes Unified School District
- Berkeley Unified School District
- Davis Joint Unified School District
- Lafayette School District
- Lodi Unified School District
- Oakland Unified School District

Research Institutions

- Center for EUV Astrophysics/UCB
- Smithsonian Astrophysical Observatory
- Center for Earth and Planetary Studies / NASM
- NASA/Ames Space Sciences
- UCMP Research

Industry

- Earth Observation Satellite Company
- Pacific Bell (CalREN)
- Digital Equipment Corporation
- Dun and Bradstreet

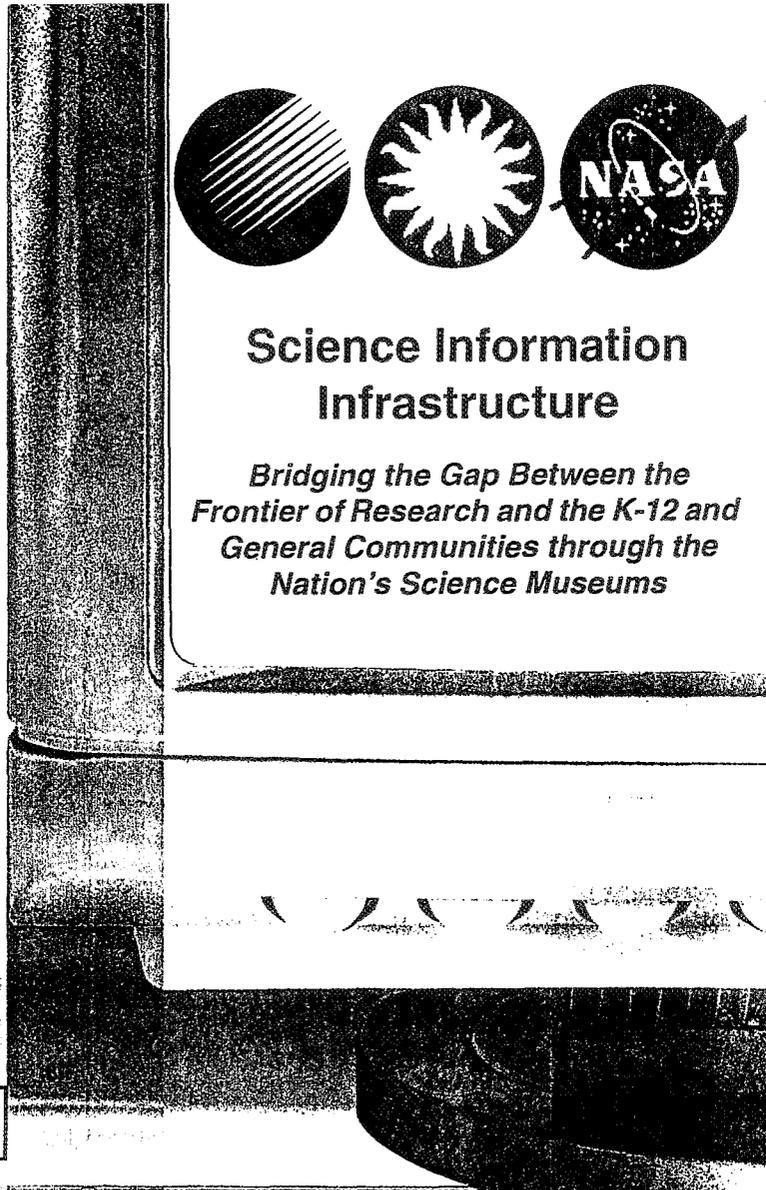
On-line World Wide Web Information on the SII:
<http://www.cea.berkeley.edu/Education/>

The SII is supported, in part, by a grant from NASA through the 1994 Cooperative Agreement Program for Public Distribution of Earth and Space Science Data and NASA's Astrophysics Division.



Science Information Infrastructure

*Bridging the Gap Between the
Frontier of Research and the K-12 and
General Communities through the
Nation's Science Museums*



University of California at Berkeley
Center for Extreme Ultraviolet
Astrophysics
and
Smithsonian Astrophysical
Observatory

Stanford Research Institute

Bob Kozma

*The Effect of Single and Multiple
Representations on Learning and
Understanding Chemistry*

The Effect of Single and Multiple Representations on Learning and Understanding Chemistry

Robert Kozma

**Center for Technology in Learning
SRI International**

**NASA Workshop
Tuesday, April 11, 1995**

Novices and Surface Features

Experts

- **have large well organized knowledge structures**
- **see large meaningful patterns**
- **represent problems at a deeper, more principled level**

Novices

- **have incomplete, disconnected knowledge structures**
- **see smaller patterns**
- **represent problems based on surface or "literal" features**

Problems Understanding Chemistry

Misunderstanding equilibrium

- **Systems are balanced or "equal"**
- **Systems come to a stop**
- **Lack knowledge of effects of temperature, concentration, pressure**

Problems with the Domain of Chemistry

- **Reactions are frequently confounded, colorless, odorless, too slow/fast**
- **Chemistry is molecular and rarely accessible to direct perception**
 - E.g. Color stops changing but reactions still occur**
- **Less of a phenomenological base than mechanics**

Problems with Chemical Symbol Systems

- **Arbitrary relationship with field of reference**
Nothing literally dynamic about \Leftrightarrow
- **Interference from other symbol systems**
Mathematics: $A + B = C$
Language: "NO"
- **Internal conflicts**
K: potassium, Kelvin, equilibrium constant
2 NO₂
"Balance" equation, equilibrium
- **Reliance on domain knowledge to understand symbolic expressions**

Design of Symbolic Environments

- **Design symbolic expressions with literal features that afford certain understandings: "perceptions that afford conceptions"**
- **Different representations of the same concept or principle may have different literal features which afford different understandings**
- **Use multiple representations and common literal features to link representations and compound learning**

Design of 4M:Chem

- **Multiple reps: Symbolic, Video, Graphs, Animations**
- **Linkages: Shared literal features, synchronicity**
- **Experimentation**

Hypotheses

- **A learner's understanding will correspond to the literal features**
- **An understanding based on multiple representations will have characteristics of each representation**
- **Shared features will be particularly memorable**

UM Study Lecture

Instructors

- **made direct reference about 70% of time**

Students

- **significantly increase understanding**
- **reduced misconceptions**

UM Study Laboratory

Mechanisms: Effects of a particular representation

Understanding equilibrium as a continuous process was directly affected by the use of the system, particularly the animations and their literal features:

**[The manual asks:] In this animation are monomers combining to form dimers and dimers associating to form monomers?
"Let's hit pause again, um.....I don't see anything dissociating, I just see well, oh wait, yes I do....okay, so I guess that would mean if the monomers are combining, yeah, I could say they're combining with each other and they click together and they become dimers and dimers every once in a while will come apart and form monomers. (Writes: yes)..."**

UM Study Laboratory

Mechanisms: Effects of multiple representations

Understanding the effect of temperature on equilibrium benefited from the coordination of the various representations:

"Stop and cool it and look at all this stuff, it's cool [video]. That means there should be more of the white dimers going all around [animation] and this should get small [graph, one line] and this right here [graph, second line] should get bigger and it reaches that negative degrees and it equilibrums [sic] and begins to condense so that means that the pressure of both of them's getting smaller...because it's maybe starting to go slower. It begins to condense..."

Current Study

Design

- **Community college students**
- **Intro chemistry course**
- **Four treatment groups:**
 - **video only (V)**
 - **graph only (G)**
 - **animation only (A)**
 - **multiple, linked representations (VGA)**
- **Use of narration**
 - **cue visual attention**
 - **support linkages**
- **"Equivalent" versions of the manual**
 - **predict-observe-explain approach**
 - **focus on surface features**
- **Pre-post-test**
 - **multimedia**

Results

- **Because of drop out rate, little can be said about video**
- **Both graphs and animations contributed to understanding**
- **In general, multiple representations seemed to interfere with rather than compound learning**
- **Graphs contributed to understanding of the distribution of species and the effect of pressure change on equilibrium**
- **Animations contributed to understanding of the characteristics of a system at equilibrium and the effect of temperature on equilibrium**

Equilibrium

Based on your observations of these species, what can you say about a system at equilibrium?

Video:

"I think [it is] a chemical reaction [that is] stable, meaning with more time its not going to change."

Graph:

"It takes on qualities at of both gases and the[y] form amounts [of] each at the same rate"

Animations:

"A system at equilibrium still has reactions where one substance forms another substance and vice versa but relative amount (ratio) of the substances stays the same."

VGA:

"Neither of the two are dominant"

Effect of Temperature

Is the sample that has been heated at equilibrium?

Video:

"Yes, because the color eventually stopped changing."

Graph:

"Yes, because the pressure remains constant."

Animation:

"Yes, since the relative numbers of NO_2 and N_2O_4 are not changing after heating is completed."

VGA:

"Yes, because when heated the light color became reddish brown."

Effect of Pressure

Describe the characteristics of this system once it has reached equilibrium at a lower pressure.

Video:

"Nothing would happen. The color would stay the same."

Graph:

"Higher NO_2 , lower N_2O_4 until equilibrium reached."

Animation:

"Still reacting, faster molecules, NO_2 dominant."

VGA:

"The color would not change."

Conclusions

- **Findings provided some support for the affordances of literal features**
- **Does not support the effectiveness of multiple representations**
 - **may be too much information**
 - **features may not be apparent**
 - **links may not be apparent**
 - **video may dominate**
- **Use of social interaction to identify features and support understanding**
- **More structure in analyzing and linking features and integrating representations.**
- **More structure in guiding learning.**

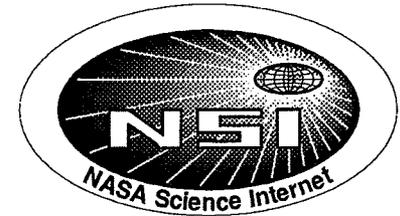
**National Research and
Educational Network
Ames Research Center**

Milo Medin

Internet Evolution and Education



**NASA Science Internet Project Office
Ames Research Center
Distributed Systems Division**



Internet evolution and education

Milo Medin

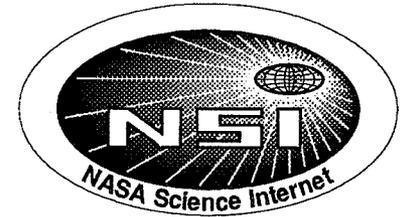
**Ames Research Center
medin@nsipo.nasa.gov**

**IITA K-12 Workshop
4/11/95
Moffett Field, CA**

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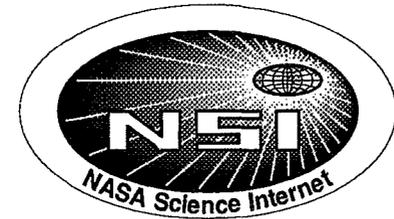


New technology introductions and education

- **Goals are to increase performance and decrease cost**
- **Improve ability to manage the network, and deploy capability in a shorter timeframe**
- **New commercial services that can impact education positively**
 - **ATM - Used to provide higher speed backbone services instead of point to point circuits, though still expensive**
 - **FR - Interworked FR is distance insensitive, and can interface to ATM services**
 - **SMDS, FNS, etc... can lower cost and reduce number of components**
 - **ISDN - can provide higher speed dialup services at reasonable cost, though availability remains limited**
 - **Cable TV (?) companies could radically alter last mile marketplace**



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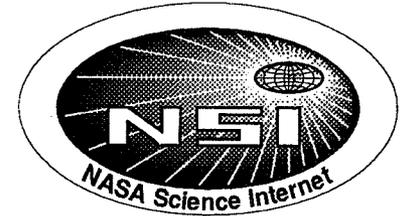


Commercial IP network issues

- **Cost-effectiveness still a problem, but will probably change in the future - market is so big right now, strong discounting is not required for more sales than can be dealt with**
- **Regional networks that used to subsidize education with commercial accounts are no longer doing this, or are being driven out of business**
- **Commercial network organizations often are much more close lipped about network problems and internals, greatly complicating network troubleshooting**
- **Competition may decrease system wide interoperability**



**NASA Science Internet Project Office
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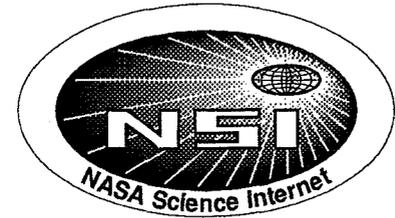


NSF transition basics

- **Current NSFnet backbone costs \$14/Million a year for 18 NSF funded DS-3 sites, provisioned through ANS**
- **Existing contract extension (2nd one) ends in April of 95**
- **Funding for regional network attachments will be transferred to regionals with decreasing funding over 4 years (25% cut each year)**
- **Regionals applied to NSF for “inter-regional connectivity” funding**
 - **0 stayed with ANS**
 - **6 went to Sprintlink service (not all at DS-3)**
 - **10 went to MCI net**
- **NAP’s used to connect regional networks’ NSPs**
- **NAP’s are policy neutral - bilateral peering relationships required**



**NASA Science Internet Project Office
Ames Research Center
Distributed Systems Division**

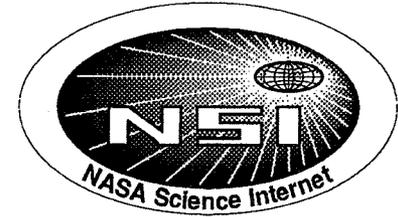


NSF transition basics (cont)

- **3 regional serving NSP's must attach at the three priority NAP's**
 - **CA NAP - Pacific Bell ATM service (Newbridge) in San Ramon, CA**
 - **ORD NAP - Ameritech ATM service (GCNS-2000) in Chicago, IL**
 - **NY NAP - Sprint colocated FDDI facility in Pensauken, NJ**
 - **Optional DC NAP - MFS ATM service in Tyson's Corner, VA**
- **NAP service sold commercially, but no guarantee of traffic exchange**
- **Multiple NAP providers support multimedia bridging for low speed services**
- **LEC's regulated and cannot provide IXC services**
- **Routing Arbiter present at all NAP's to "aid" peering between NSP's attaching to NAP's**



**NASA Science Internet Project Office
Ames Research Center
Distributed Systems Division**

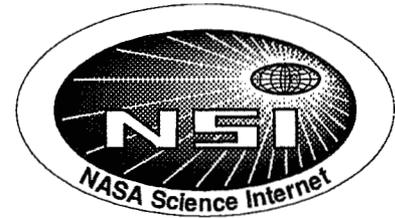


NSF transition basics (cont)

- **vBNS experimental network, supporting OC-3c access to 4 NSF supercomputer centers, and the 3 NAP's for \$10M/year**
- **vBNS service not allowed to be used by supercomputer centers for generic network transport**
- **vBNS is a scheduled service - not up all the time**
- **NSF to entertain proposals for "meritorious high bandwidth connectivity"**
- **NSF's connections program is still in place, providing funding for connectivity to new educational sites**
- **Support for naming and addressing services provisioned through the InterNIC to continue**



**NASA Science Internet Project Office
Ames Research Center
Distributed Systems Division**

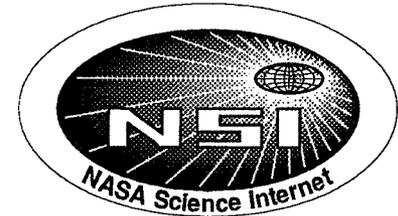


Medium term view (1-2 yrs)

- **NAP's are probably dead due to political and technical issues (Sprint NAP may well be used)**
- **Big NSP's may well declare war on smaller NSP's through use of settlements (usage based charges for traffic exchange)**
- **Significant troubleshooting complexity will be added, and suboptimal routing will take place, probably leading to additional requirements for high reliability networks**
- **Many regional network organizations, esp. those that service rural areas may go out of business, and buy connectivity as collectives**
- **Routing may gradually spiral out of control leading to increased balkanization**



**NASA Science Internet Project Office
Ames Research Center
Distributed Systems Division**

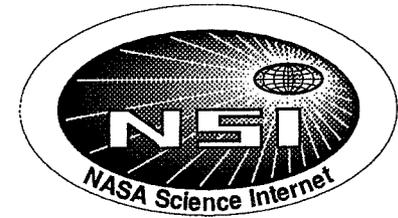


Can the NII/Internet do the job for education?

- **In many cases, it's the only game in town for network infrastructure**
- **T1 class requirements will likely to continue to be met**



**NASA Science Internet Project Office
Ames Research Center
Distributed Systems Division**

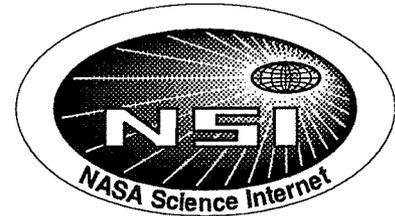


Can the Internet do the job for education? (cont)

- **As more and more commerce gets done over the Internet, reliability issues will become much more visible**
- **The Internet will be accommodated by the NII, even if not based on it, it's just too big to ignore**
- **The real question will be if we can continue to leverage overall network requirements to provide better support for scientists**



**NASA Science Internet Project Office
Ames Research Center
Distributed Systems Division**



Questions to be addressed

- **NSFNet transition and future efforts, and commercial impacts**
- **Technology introductions and effects on K-12 networking**
- **Legislative issues**

**Educational Technology &
Evaluation
NASA Headquarters**

Rick Smith

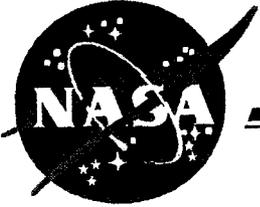
Spacelink



IIITA Education Workshop

April 11, 1995

Rick Smith



Science Comm. WG: Background

Development & utilization of emerging computer communication technologies & tools is vital for effective science communications

- **NASA's customer base has diverse and specific information needs (e.g. 9th grade teacher of Earth System Science)**
- **Explosive, grass roots growth of NASA information servers, including those on the World Wide Web (WWW), has resulted in a "thousand points of light"**
- **Public access to science data over the internet has become an Agency priority, as illustrated by the recent High Performance Computing & Communications (HPCC) Cooperative Agreement Notices and improvements to NASA Spacelink**
- **The promise of the National Information Infrastructure is not yet available to many NASA customers (e.g. the K-12 education community)**



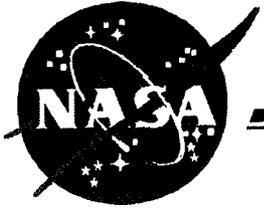
SCWG Findings

Coordination Policy:

- **There is no formal Agency-wide policy concerning NASA information or analysis tools being made available over the Internet (possible function of the “CIO”)**
- **Lack of a coordinating structure results in information holes as well as redundancy**

Location of Relevant NASA Information and Tools:

- **The many sources of NASA information and tools are widely distributed and difficult to locate (information overload)**
- **Information is typically not organized in customer friendly structures (NASA-centric, not customer-centric)**



SCWG Findings (continued)

Equitable and Universal Access:

- In many cases information and tools are now being made available only on World Wide Web servers, making them difficult to access for those with low speed Internet access and inaccessible to customers without Internet access (creating “have Vs. have less Vs. have not”).
- Policies permitting access to such NASA servers must avoid the appearance of competing with private sector providers of Internet access.

Electronic Publishing:

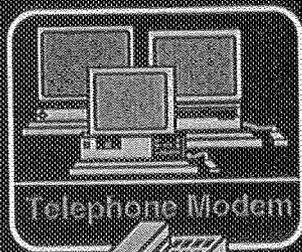
- Electronic publishing has the potential of significant cost savings versus hardcopy, can provide wider dissemination, and allows “interpreters” to easily integrate NASA information into other products



Spacelink Upgrade Background

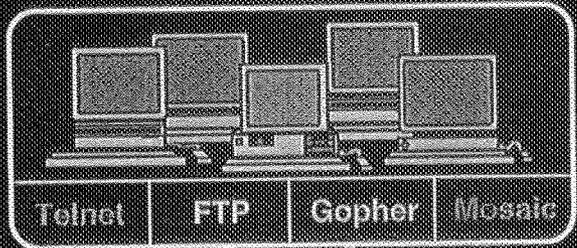
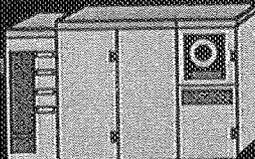
- Previous system had over 35,000 active users, 35% dial-in, and was often overloaded
- Upgraded system offers full internet connectivity as well as enhanced dial-in capacity and limited toll-free access
- WWW, Gopher, FTP, & telnet interfaces to the repository are available, with additional services to authorized educator accounts (email, on-line conferences, education related newsgroups, Internet access)
- Hardware:
 - Sun SPARCserver 1000
 - Modems compatible W/ more users' modems
 - CD-Rom drives
 - Expanded processing, storage & user capacity
- Software:
 - Access to Spacelink Electronic Library
 - VT-100: Modem & Telnet
 - World Wide Web
 - Gopher
 - Anonymous FTP
 - Educator Accounts (Spacelink Teacher Resource Center)

Space Link Connection Methods



Telephone Modem

Internet
Service Provider

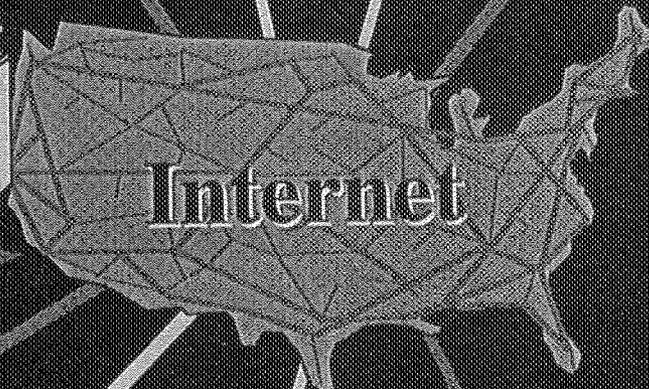


Telnet

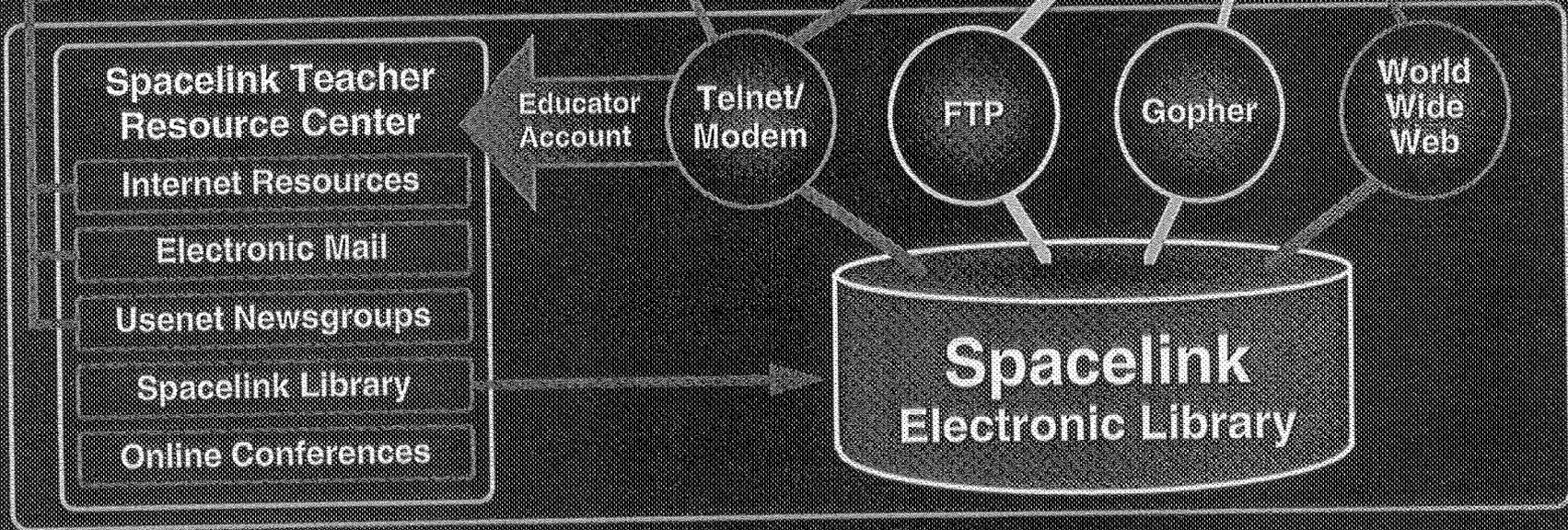
FTP

Gopher

Mosaic



Internet





Educator Accounts

EDUCATIONAL
TECHNOLOGY
&
EVALUATION

Only individuals who have established an educator account have access to the STRC. This requires obtaining an “authorization packet” and a simple on-line registration procedure.

- **One-time access code required**
- **One simultaneous login per account**
- **User will not get a shell prompt at any time**
- **Modems are shared by educators & guests from across the USA**
 - **10 modems currently used for 800 number access**
 - **10 modems currently used for direct dial access**
- **Telnet is the preferred route for educator account access**
- **2 common types of authorization packets:**
 - **For toll-free modem access: “blue sheets”**
 - **For telnet access: “green sheets”**



STRC Toll-Free Access

- **Who Can Be Authorized?**
 - Anyone who has an authorization packet (blue sheet)
 - Recommended for teachers only
 - Recommended for teachers without Internet access
- **Authorization Packets**
 - 200 authorizations per Center first year
 - Center education staff distributes authorization packets
 - Staff monitors usage & recommends expansion plan
- **Future Plans**
 - Mirror sites
 - Local Center phone numbers



Educator Registration Questions

Personal Account Information

After you have completed this form, you will be given an opportunity to change any of your responses.

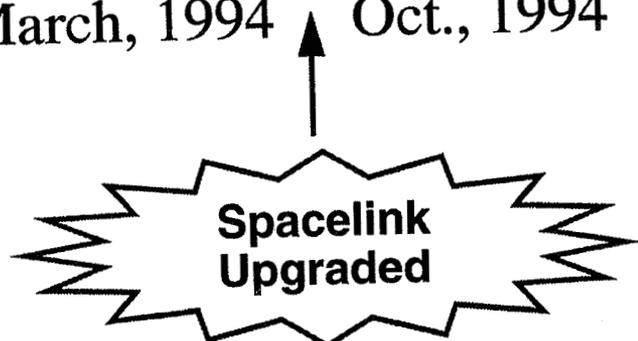
First Name	*[Jay]
Middle Name	[]
Last Name	*[Hawk]
Daytime Area Code & Phone Number	*[555-555-5555]
Educational Institution Name	*[University of Kansas]
Street Address (1)	*[20 Naismith Drive]
Street Address (2)	[]
City	*[Lawrence]
Country	US {a list will appear}
State or Province	Kansas
Zip or Postal Code	[55555]
Position(s)	Educator
Subject(s)	Technology
Students per Week	100-200

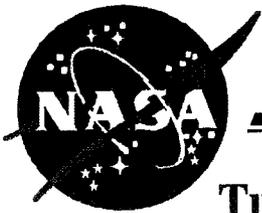
* - These fields are required for account creation.



User Sessions

	March, 1994	Oct., 1994	March 1995
FTP Calls			18,702
Gopher Calls			18,345
Guest Calls via modem			4,530
Guest Calls via telnet			60,187
STRC Calls via 800-number modem			3,159
STRC Calls via local modem			483
STRC Calls via telnet			1,714
WWW Calls			41,847
Total Calls	39,300	55,780	148,967
Average Calls per Day	1,268	1,800	4,805





Educator Accounts by Source

NASA Spacelink Accounting Report

EDUCATIONAL
TECHNOLOGY
& EVALUATION

Tue Feb 7 10:23:40 CST 1995

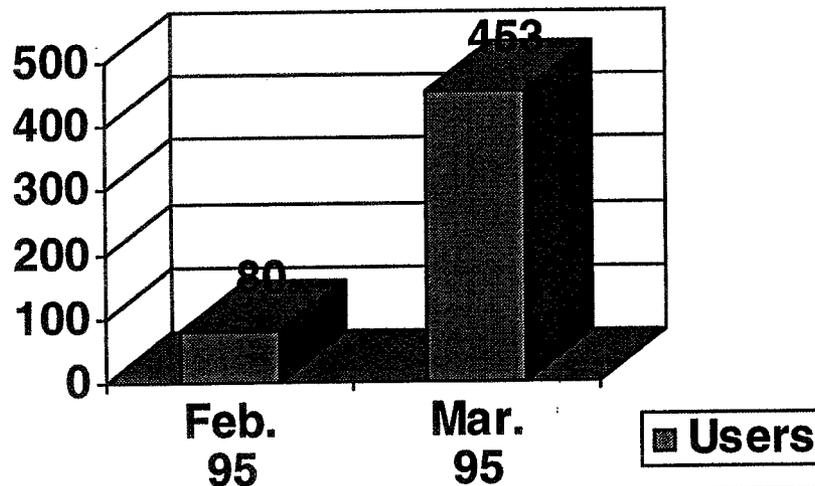
By batch...survey of 80 users:

- 2 Huntsville Area
- 14 Initial 200 for Goddard
- 6 Initial 200 for HQ
- 6 Initial 200 for JPL
- 1 Initial 200 for Kennedy
- 4 Initial 200 for MSFC
- 47 Initial 200 for Spacelink

Tue Apr 4 14:25:22 CDT 1995

By batch...survey of 453 users:

- 3 300 Internet for HQ
- 9 Hunstville Area 2nd batch
- 71 Huntsville Area
- 11 Initial 200 for Dryden
- 46 Initial 200 for Goddard
- 27 Initial 200 for HQ
- 14 Initial 200 for JPL
- 5 Initial 200 for Johnson
- 6 Initial 200 for Kennedy
- 6 Initial 200 for Langley
- 7 Initial 200 for Lewis
- 51 Initial 200 for MSFC
- 88 Initial 200 for Spacelink
- 9 Initial 200 for Stennis
- 25 Initial 200 for Tri-State
- 39 Internet Access
- 7 NSTA Convention
- 29 Second batch for Headquarters





Educator Accounts by States

EDUCATIONAL
TECHNOLOGY
&
EVALUATION

NASA Spacelink Accounting Report

Tue Feb 7 10:23:40 CST 1995

By state...survey of 80 users:

12 AL 1 AR 11 CA

7 DC

3 FL 2 IA 2 ID 1 IL

1 IN 2 LA

10 MD 1 MI

1 MO 2 MS 1 ND

1 NE 1 NH

2 OH 6 OK 4 PA

1 SC 1 TX

5 VA 1 WI

1 WV

Tue Apr 4 14:25:22 CDT 1995

By state...survey of 453 users:

AL 124 AR 4 AZ 1 CA 34

CO 6 CT 3 DC 28 DE 1

FL 14 GA 3 IA 7 IL 5

IN 4 KS 7 KY 1 LA 8

MA 4 MD 31 ME 2 MI 2

MN 2 MO 7 MS 22 ND 1

NE 4 NH 2 NJ 4 NM 1

NY 11 OH 10 OK 10 PA 20

RI 1 SC 2 TN 25 TX 11

UT 1 VA 11 VI 2 VT 4

WA 1 WI 9 WV 3

“...the low numbers don't reflect lack of teacher interest in Spacelink--
they reflect desire of NASA education officers to distribute a limited
resource over a long period of time.”

(Formal distribution began in late January 1995)



Information Delivery - March 1995

EDUCATIONAL
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& EVALUATION

Public Library:

	<u>documents</u>	<u>directories</u>	<u>total units</u>
Served via FTP	33,528	62,266	95,794
Served via Gopher	179,327	330,897	510,244
Served via WWW	154,143	286,266	440,409
Subtotal	<u>367,268</u>	<u>679,429</u>	<u>1,046,427</u>

Teacher Services:

WWW Browser (Internet documents retrieved)	n/a
E-mail Messages (sent = 9,280 received = 20,873)	30,153
Newsgroups (articles presented)	160,638
Conferences (units of activity)	4,284
Subtotal	<u>195,075</u>

(Approx. 75,000 Files Delivered in March 1994)



Spacelink TRC Screen 1

EDUCATIONAL
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EVALUATION

NASA Spacelink's Resources for Educators

Tue Apr 4 09:32:31 CDT 1995

Please choose a service level for this call. To change service levels, you must disconnect and call again.

- 1) **Spacelink Teacher Resource Center (STRC)**
Recommended for use by teachers only. In addition to providing access to regular Spacelink files, the STRC provides mail and news services, online conferencing, and a gateway to a wide range of Internet resources. Any use of this feature by minors should be carefully supervised.
- 2) **Spacelink Electronic Library**
Safe for use by students. Provides access to ALL of the files that reside on the NASA Spacelink system with full view and download capabilities. This option does not permit users to use mail, news or conferencing options. This option does not permit users to explore the Internet.
- 3) **Disconnect now.**

Enter the number of your choice {1, 2 or 3}:



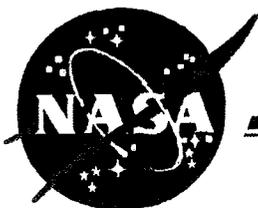
Spacelink TRC Screen 2

EDUCATIONAL
TECHNOLOGY
& EVALUATION

NASA Spacelink Teacher Resource Center User Agreement

My name is Rick Smith, and I am the person registered for this NASA Spacelink educator account. I agree to use my account in a professional manner and I agree that NASA is not responsible for anything I may encounter on the Internet.

I signify my agreement by entering the word "yes" here: yes



Spacelink TRC Main Menu

EDUCATIONAL
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EVALUATION

NASA Spacelink

SPACELINK TEACHER RESOURCE CENTER MAIN MENU

Welcome to NASA Spacelink's services for professional educators. In addition to the Spacelink Public Electronic Library, this area contains features available only with a registered Spacelink teacher account. For instructions and assistance press "H" for help.

- * Spacelink Public Electronic Library
- * Internet Resources & Search Tools
- * Electronic Mail & USENET Newsgroups
- * Spacelink Online Conferences

- * Spacelink User Directory
- * Personal Account Maintenance

Commands: Use arrow keys to move, '?' for help, 'q' to quit, '<-' to go back
Arrow keys: Up and Down to move. Right to follow a link; Left to go back.
H)elp M)ain G)o F)iles O)utput D)ownload /=search [del]=history Q)uit



Spacelink Electronic Library

EDUCATIONAL
TECHNOLOGY
& EVALUATION

NASA SPACELINK

NASA Spacelink is a collection of NASA information and educational materials. It is provided by the NASA Educational Affairs Division.

Subject Areas on Spacelink:

- * About Spacelink
 - * Educational Services
 - * Instructional Materials
 - * NASA News
 - * NASA Overview
 - * NASA Projects
 - * Spacelink Frequently Asked Questions
 - * Spacelink Hot Topics
-
- * Keyword Search - Search all text documents on Spacelink



Keyword Search

To search the Spacelink Electronic Library for topics of interest, enter a search string as described below. If a 'fill-in' box does not appear, enter 's' to search.

Search String Examples:

frog;egg - Semicolon for documents containing both words.

frog,egg - Comma for documents containing either word.

frog egg - Space for the word frog followed by egg.

< frog > - For an exact match on the word frog with spaces on each side. Use to eliminate a match such as Mr. Frogel.

This is a searchable index. Use 's' to search

Arrow keys: Up and Down to move. Right to follow a link; Left to go back.

H)elp M)ain G)o F)iles O)utput D)ownload /=search [del]=history Q)uit



Spacelink TRC Main Menu

NASA Spacelink

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H)elp M)ain G)o F)iles O)utput D)ownload /=search [del]=history Q)uit



Other Online NASA Resources

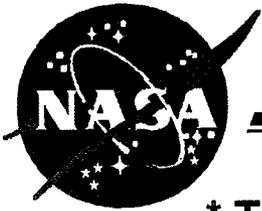
EDUCATIONAL
TECHNOLOGY
& EVALUATION

This section contains links to Internet resources that may be of interest to Spacelink users.

NASA Resources:

* **NASA Home Page** - Contains links to NASA Field Center home pages and other aerospace information.

- + **NASA Headquarters**
- + **Ames Research Center**
- + **Dryden Flight Research Center**
- + **Goddard Institute for Space Studies**
- + **Goddard Space Flight Center**
- + **Jet Propulsion Laboratory**
- + **Johnson Space Center**
- + **Kennedy Space Center**
- + **Langley Research Center**
- + **Lewis Research Center**
- + **Marshall Space Flight Center**
- + **Space Telescope Science Institute**
- + **Stennis Space Center**
- + **Wallops Flight Facility**



Other Online Resources (NASA & More)

EDUCATIONAL
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- * **The Galileo Homepage** - provides the latest information about the progress of the Galileo spaceprobe on its way to a December 1995 rendezvous with Jupiter.
- * **JPL Image Library** - contains images from Jet Propulsion Laboratory projects such as Cassini, Galileo, Magellan, and Voyager.
- * **K-12 Internet Project - Education and Lifelong Learning** is the basis for the K-12 Internet Project. This project works in cooperation with the NASA Education Office to help educators across the country make effective classroom use of the many NASA projects and data sets available over the Internet.
- * **Live From Antarctica** - is designed to allow students and teachers the opportunity to experience what life is like in the coldest place on the planet, Antarctica. It will allow you to ask questions of the scientists in Antarctica, view pictures, and study data.



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E-mail & Usenet News Menu (Pine)

EDUCATIONAL
TECHNOLOGY
&
EVALUATION

PINE 3.91 MAIN MENU

Folder: INBOX 38 Messages

- ? HELP** **Get help using Pine**

- C COMPOSE MESSAGE** **Compose and send a message**

- I FOLDER INDEX** **View messages in current folder**

- L FOLDER LIST** **Select a folder to view**

- A ADDRESS BOOK** **Update address book**

- S SETUP** **Configure or update Pine**

- Q QUIT** **Exit the Pine program**

333



E-Mail & Usenet News Folder List

EDUCATIONAL
TECHNOLOGY
&
EVALUATION

PINE 3.91 FOLDER LIST Folder: INBOX 17 Messages

Folder-collection (Local)

inbox saved-message

News-collection <News> (Remote)

spacelink.test	spacelink.educator-chat
spacelink.ask-nasa	spacelink.help
sci.aeronautics	sci.space.policy
sci.physics	sci.space.shuttle
K12.chat.elementary	rec.video.satellite

[Now in collection]

? Help M Main Menu P PrevFldr - PrevPage D Delete R Rename
O OTHER CMDS V [ViewFldr] N NextFldr Spc NextPage A Add



Sample Groups (cont.)

k12.ed.art

Arts & crafts curricula in K-12 education.

k12.ed.business

Business education curricula in grades K-12.

k12.ed.comp.literacy

Teaching computer literacy in grades K-12.

k12.ed.health-pe

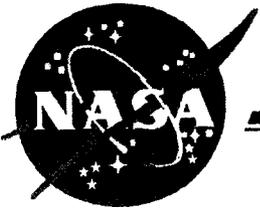
Health and Physical Education curricula in grades K-12.

k12.ed.life-skills

Home Economics, career education & school counseling.

k12.ed.math

Mathematics curriculum in K-12 education.



Spacelink TRC Main Menu

EDUCATIONAL
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Online Conferencing

EDUCATIONAL
TECHNOLOGY
&
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- **Special Guest Conferences**
(Transcripts Available for Review)
- **User to User Conferencing**
- **Group Conferencing**



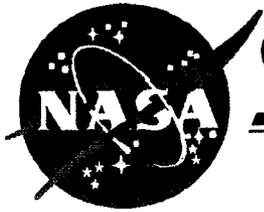
Online Conferencing

SPACELINK ONLINE CONFERENCES

Welcome to NASA Spacelink's online conference facility. Please read the help section on this subject to learn what type of conferences are available and how to use them.

- * Spacelink Online Conferences
- * Invite Another User to Chat
- * Spacelink Conference Schedule
- * Online Help - It may be helpful to download and print help documentation for reference during your conference sessions.

Commands: Use arrow keys to move, '?' for help, 'q' to quit, '<-' to go back
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Online Conferencing Invite Someone to Chat

EDUCATIONAL
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&
EVALUATION

Enter your name below as you wish it to appear on the invitation: Jay Hawk

INVITE SOMEONE TO CHAT

You may invite other educators currently online to join you for a chat on Spacelink. Educators currently online:

cwby0000 husk6000

Spacelink can provide background information on any of these callers. Enter a username and press <RETURN> to see more information, or press <RETURN> to exit: cwby0000



Spacelink TRC Main Menu

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Personal Account Maintenance

EDUCATIONAL
TECHNOLOGY
& EVALUATION

- **Redirect Incoming Email to another host account**
- **Update user registration information**
- **Change password**

**NASA Code U
Ames Research Center**

Rose Grymes

Space Life Sciences

Space Life Sciences

Education → *K-12*

- Management and Coordination
- Major Programs
- New Initiatives
- Mission Science and Flight Payloads
- Leveraging for New Directions

Rose_Grymes@qmgate.arc.nasa.gov

K-12 IITA Workshop
ARC/4-11-95

Space Life Sciences Education K-12

Management and Coordination

- ARC, KSC, JSC
- InterCenter Cooperation
- Lead Center

K-12 IITA Workshop
ARC/4-11-95

Space Life Sciences Education K-12

Major Programs

- Science Training for Enhancing Leadership and Learning through Accomplishments in Research (STELLAR)
- Summer Teacher Enhancement Program (STEP)
- Human Physiology in Space
- Spacelab Frog Embryology Experiment
- Video Teleconferences for Secondary School Teachers
- Space Center Houston
- 'Seasonal' activities

K-12 IITA Workshop
ARC/4-11-95

Space Life Sciences Education K-12

New Initiatives

- Native American Education
- Long Distance Learning
- STELLAR Multimedia
- Bay Area Partner Schools
- BioBLAST
- WWW and Life Sciences Data Archive
- EPCOT

K-12 IITA Workshop
ARC/4-11-95

Space Life Sciences Education K-12

Mission Science and Flight Payloads

- FEE (SL-J)
 - egg development (amphibian)
- SLS-2
 - bones, plants (hydroponics), and calcium
- Shuttle/Mir
 - egg development (quail), plant science
- Neurolab
 - unicellular organisms, fruit flies, crickets, rats, humans

K-12 IITA Workshop
ARC/4-11-95

Space Life Sciences Education K-12

Leveraging for New Directions

- Shuttle/Mir and Native American Education
- STELLAR and BioBLAST
- WWW and Local Partner Schools
- 'Theme' WWW Pages
- CHAART

K-12 IITA Workshop
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Space Life Sciences

Education → K-12

- Management and Coordination
- Major Programs
- New Initiatives
- Mission Science and Flight Payloads
- Leveraging for New Directions

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Space Life Sciences Education K-12

Far West Laboratory

John Cradler & Clifford Block

Department of Education



HOTLIST -- WORLD WIDE WEB SITES FOR EDUCATORS

Prepared by Elizabeth Bridgforth

Far West Laboratory
<http://www.fwl.org>

SEDL Policy Resources on the Internet
http://diogenes.sedl.org/Policy_resources.html

National Technology Planning Center
gopher://tut.msstate.edu/11/Online_services/nctp/

**The World-Wide Web Virtual Library:
Subject Catalogue**
<http://info.cern.ch/hypertext/DataSources/bySubject/Overview.html>

U.S. Department of Education
<http://www.ed.gov/>

California World Wide Web Servers
<http://www.llnl.gov/ptools/california.servers.html>

Worldwide WWW Information
<http://wings.buffalo.edu/world/>

Library of Congress Records
<gopher://gopher.tc.umn.edu/11/Libraries/>

Exploratorium Home Page
<http://www.exploratorium.edu/>

National Performance Review Home Page
<http://www.npr.gov/>

Regional Educational Laboratories
<http://www.nwrel.org/regional-labs.html>

Scholastic Home Page
<http://scholastic.com:2005/>

**University of Illinois Education Learning
Resource Server**
<http://www.ed.uiuc.edu/>

HotList Of K-12 State-Regional Sites
<http://toons.cc.ndsu.nodak.edu/~sackmann/state.html>

The Rice School
<http://chico.rice.edu/armadillo/Rice/index.html>

FedWorld Beta Home Page
<http://www.fedworld.gov/>

Pathways to School Improvement
<http://www.ncrel.org/ncrel/sdrs/pathways.htm>

THOMAS: Legislative Information
<http://thomas.loc.gov/>

TENET Web
<http://www.tenet.edu/> >

MODEL-NETS Information
http://education.lanl.gov/Model_Nets/introduction.html

Eisenhower National Clearinghouse
<http://www.enc.org/>

**Online Internet Institute (B. Bracey NSF
Proposal)**
<http://riceinfo.rice.edu/armadillo/OII/>

Consortium for School Networking
<http://cosn.org/people/lyman/edprojects.html>

The Foundation Center
<http://fdncenter.org/>

**Simon & Schuster Information
Superlibrary**
<http://www.mcp.com>
<http://www.prenhall.com>

Newport-Mesa USD
<http://www.nmusd.k12.ca.us>

**California General Election (multiple
languages)**
<http://www.elections.ca.gov/>

ABAG Online
<http://www.abag.ca.gov/index.html>

Dinosauria
<http://ucmpl.berkeley.edu/exhibittext/dinosaur.html>

Robotic Tele-Excavation
<http://cwis.usc.edu/dept/raiders/>

**TEAMS-Telecommunications Education
for Advances in Mathematics & Science**
<http://nic.lacoe.edu/>

Patch American High School - DoDDS
<http://192.253.114.31>

**American Educational Research
Association (AERA)**
<http://www.asu.edu/aff/aera/home.html>

WWW Virtual Library of Education
<http://www.csu.edu.au/education/library.html>

The Jason Project
<http://seawifs.gsfc.nasa.gov/scripts/jason.html>

California Telementors' Home Page
<http://www.shasta-co.k12.ca.us/www/telementors/mentor.html>

Online Educator
<http://www.cris.com/~felixg/OE/OEWelcome.html>

EdWeb-Corporation for Public Broadcasting
<http://edweb.cndir.org:90/>

The White House
<http://www.whitehouse.gov/>

National Science Foundation
<http://www.nsf.gov/>

**National Technical Information Service -
FedWorld**
<http://www.fedworld.gov/>

The Federal Role in Bringing Education into the National Information Infrastructure

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Prepared for the Hearing on the Federal Role in Funding Technology in Education, by John Cradler, Far West Laboratory for Educational Research and the Council for Educational Development and Research.

One of the most important issues facing Congress is to work with business, education, and the states to enable the nation's schools to better prepare students for a technological workforce and to ensure that education has a place on the National Information Infrastructure. This document provides background and important information for national leaders concerned about education, the information infrastructure, and related issues for the Federal Government.

1. Why are technology and telecommunications important for education?

A review of current research and evaluation findings from studies (1993) has determined that the integration of technology and telecommunications into education...

- Improves attitude and confidence—especially for 'at-risk' students.
- Provides instructional opportunities otherwise not available.
- Increases and expands learning opportunities.
- Increases mastery of vocational and work force skills.
- Significantly improves student problem-solving skills.
- Improves writing skills as a result of using telecommunications.

Another review of technology and reform conducted by the Council for Educational Development and Research (1995) concludes that for technology to be effectively applied in schools...

- Schools should not support a technology design that does not empower learning.
- Schools must connect technology to powerful learning designs.
- Schools must, from the outset, plan on connecting their technologies to the NII.

Other studies show that the Federal government has already played a significant role in supporting and leveraging effective uses of technology in education. The Office of Educational Research and Improvement (OERI) has funded many studies and developmental projects and programs that have and continue to help states implement and procure local funding for technology in education. Far West Laboratory (FWL) and the South West Laboratory for Educational Research completed major OERI studies on distance learning. These studies showed that distance learning generally is a very cost-effective strategy for bringing, previously unavailable, quality instruction to rural areas of the country. The studies provided ongoing feedback to the developers of the programming to ensure alignment with high academic standards, interesting programming to meet needs of diverse learner populations, and provided information needed to inform states about ways to adopt, adapt, and provide local funding to sustain these resources.

The Regional Educational Laboratories in collaboration with the federal and state governmental agencies and business and industry are expanding efforts to conduct applied research and evaluation needed to support high quality local applications of technology in education. The Improving Americas Schools Act (IASA) provides needed incentives and guidelines to promote the expansion of research and evaluation needed to keep education and policy makers informed about the present and rapidly emerging benefits of technology to enhance teaching and learning in the United States.

3. Do information technologies contribute to needed education reform?

We know that technology is rapidly emerging as a critical component of education. Research has consistently shown the benefits of distance learning and telecommunications. For example, Far West Laboratory for Educational Research and Development, in San Francisco, studied the impact of Educational Technologies from 1984 to 1991, has conducted extensive research on the California Model Technology School Projects, and has recently completed studies of the TEAMS Star Schools Program and the Hughes Galaxy Classroom Distance Learning Program. Currently FWL is conducting a comprehensive state by state analysis of state educational technology plans and legislation. Findings are as follows:

Technology alone does not have a significant effect on teaching and learning. . . it is a tool that when used with tested and instructional practices and curriculum can be an effective ingredient to foster change. Examples of the many findings from federally funded studies show that for technology applications are effective when

- teachers integrate technology into curriculum and instruction
- technology offers opportunities for students to solve problems and construct solutions.
- teachers and administrators jointly plan for the use of technology.
- government promotes applications of technology and development of software and video programs that meet educational content standards.
- policy leaders and administrators at all levels of government and business work together to promote the planned use of technology to support teaching and learning

2. To what extent is telecommunications access a priority for education?

The NCC-TET, representing a consensus of over 85 national professional education, business, and trade associations, developed 19 requirements for education and the National Information Infrastructure (1994), which are summarized as follows:

Access Requirements

- Ensure that all learners have affordable and equitable access to the NII.
- Ensure that the NII is accessible in a variety of learning environments.
- Develop a variety of sustained public and private partnerships and funding.
- Make public and private information resources available.

Application Requirements

- Coordinate NII-related education activities conducted by Federal departments and agencies.
- Develop and disseminate NII guidelines for education.
- Identify and disseminate effective education and training applications.
- Integrate applications of the NII into education reform.
- Develop quality education and training applications.
- Conduct research on the education applications.
- Promote professional development and technical assistance.
- Support on-going evaluation of the effectiveness and impact of the NII.

Technical Requirements

- Emphasize interactive, broadband transmission of interactive voice, video, and data.

- Provide seamless interconnection among networks.
- Guide the development of voluntary standards to promote interoperability.
- Ensure that the NII is easy to use.
- Develop “navigation” systems for locating resources on the NII.
- Support user collaboration.
- Create adequate security measures for network resources.

The Council of Chief State School Officers (CCSSO), under cooperative agreement with the National Telecommunications and Information Administration (NTIA) of the US. Department of Commerce just released a report on telecommunications and the National Education Goals through it’s “USE IT” project. USE IT makes recommendations for the federal role in education and the NII drawn upon the expertise of key individuals from education, government, and private industry, as follows:

- Education agencies at all levels must support development and use of distance-learning to achieve the National Education Goals.
- The telecommunications industry, distance-learning service providers, and regulatory agencies must support and develop distance-learning delivery systems that are compatible and interoperable.
- Federal government should promote public/private partnerships for distance learning and support regional and statewide applications of distance learning as an integrated national resource.
- Federal regulatory agencies must develop policies that ensure affordable rates for the educational uses of telecommunications resources.
- Federal and state agencies, in cooperation with the private sector should develop new resources for investment and capital development for distance learning.
- National authorities should undertake awareness and outreach activities to inform educators, business and industry, and the public of the value and importance of distance learning to achieve the National Education Goals.

4. What is the current reality regarding access and use of technology in schools?
Recent surveys show that we are developing a nation of education ‘haves’ and ‘have nots’ with respect to educational access and use of the information highway.

The National Center for Education Statistics (1995) reports the following:

- Overall, 35 % of public schools have access to the Internet but only 3 % of all instructional rooms (classrooms, labs and media centers) in public schools are connected to the Internet.
- Funding is the major barrier most often cited in the acquisition or use of advanced telecommunications in public schools.
- Seventy-five percent of public schools have computers with some type of telecommunication capabilities (i.e., local area networks or wide area networks).
- Smaller schools with enrollments of less than 300 are less likely to be on the Internet than schools with larger enrollment sizes. Only 30% of small schools reported having Internet access, while 58% of schools with enrollments of 1,000 or more reported having Internet access.

An American Electronics Association (1995) survey concludes:

- The NII in schools would benefit curriculum content, increase computer skills for students, increase student motivation, provide greater opportunities for students for independent investigation and research, and increase access to information for educators.

- The NII would equalize opportunities for economically disadvantaged and disabled students.
- In order for the NII to be successfully implemented in schools, sufficient funds and equipment, adequate training of educators on the availability and use of information technologies, and inexpensive access to telecommunications is essential.

A recent report from the White House Office of Educational Technology and Policy (OSTP) reported that less than one percent of the amount expended for R & D in technology-related defense training is expended for similar purposes in education. This statistic is also commonly reported for business and industry in comparison to education. This suggests an important reason that schools are as FCC Chair Reed Hundt would say:

"there are thousands of buildings in this country with millions of people in them who have no telephones, no cable television and no reasonable prospect of broad band services. They're called schools."

Many other leaders of this country are making similar observations about the nation's schools. The Speaker of the House, Newt Gingrich recently stated that all students should have access to the internet and that all persons should possess a laptop computer.

5. What can the federal government do to help ensure that teachers and learners can access and benefit from the information highway?

There is little doubt that the federal government should play a strong and active role in regarding education and the NII. As this report documents, there has been much attention to this issue and in every case, findings generally suggest that the federal government should provide the policies to ensure education access along with necessary research and development to offer the models and guidance needed by states and localities for the successful design and application of technology in a variety of learning environments. To some extent the Federal role in supporting technology in education has already been defined and recently put in statute with the Goals 2000 and the Improving Americas Schools Act (IASA). This legislation established:

- National policy and planning leadership with the U.S. Office of Educational Technology
- National educational technology R & D partnerships between business and education through the recently announced "Challenge Grants"
- Regional staff development and assistance for effective technology integration
- Grants for the local, planned application of technology to support teaching and learning
- Distance learning programs, instructional video development, and others

The design of these programs was guided by extensive study and research with a great deal of public input from the states. In fact, much of the language was derived from state policies that have proven themselves over time. These programs incorporated in this legislation were authorized and funded for FY 1995. However, the proposed rescissions may eliminate the opportunity for these programs to be implemented and would cut other programs with already established effectiveness. If this happens, it is likely that many of these concepts will again be introduced in new legislation. In fact, some members of congress are already considering legislation that would re-invent these programs.

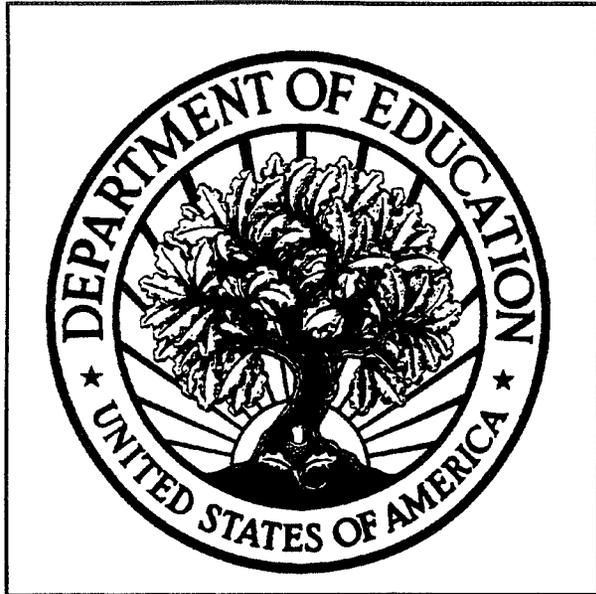
Rather than rescinding the already minimal appropriation for educational technology, it is suggested that Congress increase appropriation to the amounts authorized. Furthermore Congress should introduce and support telecommunications policies and legislation that provide incentives and special consideration for including education as one of the most critical components of the NII. There is more than enough evidence to justify a strong federal role in ensuring that all citizens have

access to information and education on the National and Global Information Highway. It is clear that the states alone cannot make this happen.

References

- The National Information Infrastructure: Requirements for Education and Training.* National Coordinating Committee on Technology in Education and Training (1994)
- Advanced Telecommunications in U.S. Public Schools, K-12.* National Center for Education Statistics (1995)
- Networks for Goals 2000 Reform: Bringing the Internet to K-12 Schools,* Southwest Educational Development Laboratory (SEDL)
- Report on the Effectiveness of Technology in schools, 1990-1994,* Software Publishers Association (1994)
- Towards Linking Both Sides of the Desk.* The American Electronic Association and the Center for Telecommunications Management, University of Southern California (1995)
- Plugging In: Choosing and Using Educational Technology.* Council for Educational Development and Research (1995)
- Summary of Current Research and Evaluation Findings on Technology in Education.* Far West Laboratory (1993)
- United States Education and Instruction through Telecommunications (USE IT).* Council of Chief State School Officers, (1995)
-

For additional information regarding the studies and other telecommunications research and policy research, contact John Cradler at Far West Laboratory for Educational Research at 415-565-3016 or send requests to jcradle@fwl.org



U.S. Department of Education

Technology Initiatives

The mission of the United States Department of Education is to ensure equal access to education and to promote educational excellence throughout the nation. Through its policies and programs, the Department supports technology as a means to this end. This document provides a brief overview of Department initiatives in educational technology - grant opportunities, information, materials, sources of assistance, and on-line resources. Contact names and telephone numbers are included so that you can easily get additional information on any item.

LEADERSHIP

National Plan

As described in Title III of the Improving America's Schools Act (IASA), the Secretary will present to Congress a national, long-range plan for the use of technology in education in September 1995. The Office of Educational Technology is conducting extensive dialogues with educators, experts, representatives of state, local, and other federal government agencies, the private sector, and the public in preparation. Four overarching issues that are key components of the plan are infrastructure and financing, professional development, content and software, and access and equity. For information, contact Linda Roberts, 202-401-1444.

Support of State and Local Technology Planning

The Goals 2000 legislation creates the state grant program into which most Goals 2000 funding goes. Most state and local education agencies are currently developing plans for educational improvement that address such issues as achievement, standards, assessment, teacher preparation, professional development, parental involvement, and system management. In addition to planning for educational improvement, states are planning for technology integration. Federal funding is available for both Goals 2000 educational improvement and technology planning. The Department is providing technical assistance to states to help them resolve difficulties in planning and implementing educational technology. For information on Goals 2000, contact Tom Fagan, 202-401-0039.

Secretary's Conference on Educational Technology

Secretary Richard W. Riley has asked State school superintendents to assemble a five person team of educators, policy makers, and technology experts to convene in Washington, DC. The conference focuses on how to implement educational technology, and features state-of-the-art demonstrations of classroom applications; panel discussions on infrastructure and financing, professional development, content and software, and access and equity; and opportunities for participants to share successful strategies. In addition, the Department solicits information and advice from participants as input for the National Long-Range Plan for Educational Technology that will be presented to Congress in September 1995. For information on your state's team and the results of the conference, contact your State's technology coordinator or consult the Department's World Wide Web and gopher sites (described below).

National Center for Education Statistics Survey

During the fall of 1994, NCES conducted a fast response survey to gather information on the availability, access, and uses of telecommunications in public elementary and secondary schools. The results of this provide baseline information about access to and use of telecommunications for instruction. For information, contact Gerald Malitz, 202-219-1364.

Research and Development

The Department's Office of Educational Research and Improvement (OERI) address the issues of technology's impact on teaching and learning, among others. In an interagency collaboration, four high-priority areas have been initially identified: (1) research on learning and

cognitive processes to improve the understanding of the learning process and how technology can best support that process; (2) new models for evaluating learning and learning productivity; (3) development of high-quality, affordable learning tools and environments for use in a variety of settings including schools, workplaces, and homes; and (4) demonstrations of innovative technology and networking applications on how the NII can be used for advanced instructional systems. For information, contact Carol Lacampagna, 202-219-2064.

GRANT PROGRAMS

National Challenge Grants for Technology in Education

Authorized in Title III of IASA, the Department will offer Challenge Grants to geographical or virtual community-based consortia to help students achieve high content and performance standards. Consortia must include at least one school district with students below the poverty level or those with the greatest need for technology, and may include other schools and businesses, state and local government agencies, libraries, museums, colleges and universities, telephone, telecommunications, software and cable companies and others. \$27 million will be available in 1995. For information on the Challenge Grants, contact Tom Carroll, 202-401-4394.

Star Schools

The Star Schools Program is a discretionary grants program that provides telecommunications equipment and programming to under-served students including those living in rural and urban areas to teach mathematics, science, foreign languages, literacy, vocational education, and other subjects. In addition, more than 50,000 teachers, administrators, parents, and policy makers have participated in staff development and community awareness activities produced via satellite, compressed video technology, fiber optics, videodisc, and microcomputer-based networks. Each year, the number of schools participating in live, interactive instructional programs offered via distance education nearly doubles. The Star School program also supports dissemination grants to establish clearinghouses of information about distance learning. \$30 million is available in 1995. For information, contact Cheryl Garnette, 202-219-2267.

Ready-To-Learn Television

Ready-To-Learn Television, authorized for \$7 million in 1995 in IASA, supports development of educational television and instructional video programming for pre-school and elementary school children and their parents. For information, contact Cheryl Garnette, 202-219-2267.

Special Education Technology Media and Materials

Funded at \$11 million in 1995, the Technology Media and Materials Program supports a variety of research dissemination to develop, examine, and market technology to serve children with disabilities. The program's purpose is to advance the use of innovative technology, media, and materials in improving educational results for children with disabilities. It is a discretionary grant program that holds several competitions annually to select awards in priority areas. For information, contact the Office of Special Education and Rehabilitative Services, 202-205-8123.

Public Library Construction and Technology Enhancement

This program, part of the Library Services and Construction Act (LSCA), provides \$18 million in grants to states for construction of public libraries; acquisition, remodeling, and alternation of existing buildings; purchase, lease and installation of equipment, including technology; meeting handicapped barrier standards; and purchasing historic buildings for use as libraries. SAILOR, a non-commercial Internet service run by the Maryland library system was developed under this program. Contact Neal Kaske, 202-219-1303.

TECHNICAL ASSISTANCE

Regional Education Laboratories

The Department of Education's Regional Educational Laboratories work in partnership with educators and policy makers to test, adapt, and incorporate research findings into improved programs for schools and their students. Several of the regional labs publish resource guides that include information on activities of communities in their region. Some Labs have made technology a particular focus; all labs will have access to the resources of the others. The Labs and resource guides can be an important source for local contacts. For information, contact Robert Stonehill, 202-219-2088.

Technical Assistance and Professional Development Consortia

Authorized in Title III of IASA, these consortia will provide states and local districts with advice about technology and training for educators in order to promote the effective implementation of technology. The intent is to build on existing resources and expertise in school districts, universities, research centers, federal labs, and the private sector to help local efforts to build telecommunications networks, train teachers, and integrate technology into the curriculum. \$10 million is available in 1995. For information, contact Catherine Mozer, 202-219-8070.

TECHNOLOGY OPPORTUNITIES IN OTHER PROGRAMS

Funds for technology continue to be available through Title I, Special Education, Bilingual/ ESL, adult education, library, research, professional development grants programs, the Fund for Improvement of Postsecondary Education, and the National Institute for Literacy. Some examples follow.

Title I

The Title I formula grants program, reauthorized in IASA, funds almost one-third of all software and hardware in schools; primary use is for basic skills instruction. \$6.7 billion is available in 1995. For information, contact the Office of Elementary and Secondary Education, 202-401-0113 or your State Education Agency.

Chapter 2

Under IASA, Chapter 2 block grants are folded into the Eisenhower program. \$345 million is available for 1995. For information, contact the Office of Elementary and Secondary Education, 202-401-0113 or your State Education Agency.

Vocational and Adult Education

Approximately \$252 million is available for purchase of software and hardware in 1995. For information, contact the Office of Vocational and Adult Education, 202-205-5451.

School to Work

Grants to districts can be used to design or adapt school curriculum to integrate academic and vocational learning with school and work-based

learning and to provide training to staff on new curricula, student assessment and guidance. This School-to-Work program is operated collaboratively by the Departments of Education and Labor; \$125 million is available in 1995. For information, contact the Office of Vocational and Adult Education, 202-205-5451.

Eisenhower Professional Development

Most of the current Eisenhower program funds are used for teacher training, including the use and integration of technology into mathematics and science curricula. In schools with more than 50% low-income families, the school can use all Eisenhower funds for hardware and software purchases. \$320 million is available in 1995. For information, contact the Office of Educational Research and Improvement, 202-219-1385.

ON-LINE RESOURCES

The U.S. Department of Education's public World Wide Web/ Gopher/FTP site

People with access to the Internet can tap a rich collection of education related information including general information about the Department, funding opportunities, descriptions of ED programs, directories of effective programs, directory of education-related information centers, full-text publications (including legislation), statistical tables, charts, and data sets, and pointers to public Internet resources at R&D centers, Regional Labs, ERIC Clearinghouses and other Education Department funded institutions. Internet users can access the information using a World Wide Web client such as NCSA Mosaic (URL= <http://www.ed.gov>), a gopher client (gopher to gopher.ed.gov or select North America -> USA -> General -> U.S. Department of Education), or an FTP client (FTP to ftp.ed.gov; log on anonymous). For information, send E-mail to inetmgr@inet.ed.gov

Additional On-line Resources

Other online resources include a Toll-Free Electronic Bulletin Board (Dial 1-800-222-4922), ED Board (Dial 202-260-9950), ERIC Clearinghouse on Information and Technology (ERIC/IT), ACCESS ERIC (Call 1-800-LET-ERIC), AskERIC (askeric@ericir.syr.edu), the Eisenhower National

Clearinghouse for Mathematics and Science Education Projects at Ohio State University (Call 614-292-1373), and the National Institute for Literacy (URL=<http://novel.nifl.gov>).

Gateway to ED

When completed, the new Gateway project will put all Department-produced information on-line so that anyone can get the whole collection of information at any time right on their desktops. Teachers, parents, researchers, and anyone else who wants information from our online libraries can have access to it. Our 1-800-USA-LEARN information number, our online services - INet, the EDWeb and Gopher sites, the National Education Dissemination System - and online projects we've funded such as AskERIC, make the Department even more accessible to the world. Even now, 10,000 people walk through the virtual front door of our online library every week.

TELECOMMUNICATIONS POLICY

The Administration supports giving the FCC and state regulatory commissions the authority to provide preferential rates for hooking up libraries, schools, and other educational institutions in order to ensure equitable access to knowledge and resources. The Secretary works closely with Congress and with Reed Hundt, Chairman of the FCC, to address policies pertaining to telecommunications rate structures for K-12 schools and other educational institutions.

Telecommunications providers and state public utilities commissions are also important partners in providing affordable access. There is tremendous variation in the telecommunications rates paid by schools in different states and even within states. The Department works with state and local governments to identify ways to ensure that educators get affordable access to the NII.

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IMPROVING AMERICA'S SCHOOLS ACT

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Prepared by John Cradler and Elizabeth Bridgforth

The reauthorization of the Elementary and Secondary Education Act, now known as *Improving America's Schools Act (IASA)*, has been enacted, providing over \$7 billion for education programs. The U.S. Office of Education maintains that "IASA will enable schools to provide opportunities for all students to learn with rigorous state content standards and challenging state performance standards". Educators should be aware of upcoming IASA funding opportunities and resources that will be available in the summer of 1995.

Emphasis of IASA. IASA emphasizes coherent systemic education reform, with Goals 2000 setting common standards for IASA and the recently authorized School-to-Work program. IASA addresses the need to raise academic achievement, increase opportunity to learn, improve professional development, increase community involvement, utilize instructional applications of technology, and improve assessment, and allow more local flexibility in the use of funds.

Title I -- Helping Disadvantaged Children Meet High Standards. Title I requires the state to submit a plan in consultation with "local educational agencies, teachers, pupil services personnel, administrators, other staff and parents. This plan will help guide the development of district plans.

Subgrants to school districts. State IASA funds will go to LEAs based on a formula. Similar to the Chapter I system, school districts must file approved plans with the state to receive their subgrants. Title I includes language requiring a biennial adjustment of poverty estimates to more accurately reflect rapidly changing demographics. \$6,698.3 billion appropriation.

Even Start Family Literacy Programs. This program helps break the cycle of poverty and illiteracy and improve educational opportunities of low income families by integrating early childhood education, adult literacy, and parenting education into a unified literacy program. Several state programs are models of the support parents need to get involved in their children's education and help themselves educationally. \$102 million appropriation.

Education of Migratory Children. Important to high growth states, the migrant services eligibility period was reduced from six years to 36 months. Schools will continue to address the unique needs of migrant students in schoolwide programs. \$305.4 million appropriation.

Prevention and Intervention Programs for Children and Youths who are Neglected or Delinquent, or At-risk of Dropping Out. States are eligible to receive funds to meet the needs of delinquent and at-risk youth. State plans must be

developed in accordance with other programs, such as Goals 2000. \$39.3 appropriation.

Title II -- Eisenhower Professional Development Program. Title II grants will fund state and local professional development to support overall reforms, with the first \$250 million nationally earmarked for professional development in math and science. Funds will provide for a Professional Development Demonstration Project for model programs to better prepare teachers for new standards and assessments, as well as as the National Clearinghouse for Mathematics and Science Education and the National Teaching Training Project. \$320.3 million appropriation.

Title III -- Technology for Education. The Act establishes the U.S. Office of Educational Technology to provide national planning leadership and assist in state applications of technology.

National Challenge Grants for Technology in Education. National Challenge Grants will be competitively awarded to consortia of education agencies, business, and community agencies to develop, adapt, or expand existing and new applications of technology. \$27 million appropriated.

Regional Technical Support and Professional Development. Grants will be awarded to regional educational entities such as the regional educational laboratories and or consortia of

such entities to provide technology resource dissemination, professional development, and technical assistance. \$10 million appropriation.

Star Schools Program. Grants will continue to serve multistate areas with instructional programming and professional development via telecommunications. The IASA expands and enhances distance learning instruction in mathematics, science, foreign languages, and other subjects such as vocational education. \$30 million appropriation.

Ready to Learn Television. This program will award grants to develop instructional television programming and supporting resources to increase parental involvement in preparing children for school. \$7 million national appropriation.

Title IV -- Safe and Drug-Free Schools and Communities. LEAs shall develop a plan based on a needs assessment for drug and violence prevention. Seventy percent of state funds are to be distributed to LEAs based on an entitlement, with the remaining 30% distributed to areas of high need. \$481.9 million appropriated.

Title VI -- Innovative Education Program Strategies. This program (formerly Chapter 2) will support local education reform efforts consistent with Goals 2000 and focus on local professional development activities, instructional materials and assessments. The state share of funds has been reduced from the current 20% to 15%. \$347.3 million appropriation.

Title VII -- Bilingual Education, Language Enhance, and Language Acquisition Programs. Competitive grants will be awarded to districts or consortia of districts to develop and implement bilingual education programs, enhance or expand programs, and establish or improve schoolwide or district-wide bilingual education efforts. Priority is to be given to programs designed to ensure proficiency in English and another language for all students. The U. S. Department of Education will establish a national clearinghouse to collect and disseminate data on bilingual education programs. \$245.2 million appropriated.

Title X -- Programs of National Significance. This title provides for a number of grants programs, to include the following:

Gifted and Talented Children. Grants will be provided to states and districts to fund activities such as model programs, professional development, and the development of rich and challenging curricula. \$9.5 million national appropriation.

Civics Education. This grants program will fund state instructional programs in civics, government, and the law. \$4.4 million national appropriation.

21st. Century Community Learning Centers. Schools or consortia of schools are eligible for grants to develop or expand projects for the education, health, social service, and cultural needs of a rural or inner-city community. \$750 thousand appropriation.

Title XII -- School Facilities Infrastructure Improvement Act. Grants will provide funds to LEAs for the repair, renovation, and construction of schools or other academic facilities, with a priority on schools with a high percentage of Title I students. \$100 million appropriation.

Title XIII -- Support and Assistance Programs to Improve Education.

Comprehensive Assistance Centers. A network of regional interstate assistance centers will be established to support states and districts in implementation of IASA. Current technical assistance centers will be funded until the new system is phased in by 1996. \$44.5 million appropriation.

National Diffusion Network (NDN) The NDN will continue to identify and disseminate nationally validated programs and education reform strategies to school districts. \$14.4 million appropriation.

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*Article featured in January, 1995 issue of *Thrust for Educational Leadership* by the Association for California School Administrators.

SUMMARY OF CURRENT RESEARCH AND EVALUATION FINDINGS ON TECHNOLOGY IN EDUCATION

JOHN CRADLER, FAR WEST LABORATORY

The following is a summary of findings of research and evaluation studies derived from several sources including: state technology plans, national policy documents, a Far West Laboratory study on state technology programs, the *Report on the Effectiveness of Technology in Schools from 1990-1994*, and a review of model technology schools. The areas outlined in this document are: A) the major outcomes consistently shown for students and teachers determined to result from technology, B) technology development and applications to support teaching learning, C) local, state, and national factors to support effective technology applications, and D) considerations for an expanded R & D agenda for educational technology.

A. Outcomes for students and teachers related to technology applications

1. Student Outcomes: The effectiveness of technology tends to vary as a function of the curriculum content and instructional strategy delivered by the technology. When content and strategies are determined to meet accepted education standards, research shows that technology:

- Increases performance when interactivity is prominent.
- Increases opportunities for interactivity with instructional programs.
- Is more effective with multiple technologies (video, computer, telecommunications etc.).
- Improves attitude and confidence—especially for ‘at risk’ students.
- Provides instructional opportunities otherwise not available.
- Can increase opportunities for student-constructed learning.
- Increases student collaboration on projects.
- Increases mastery of vocational and work force skills.

- Helps prepare students for work when emphasized as a problem solving tool.
- Significantly improves problem solving skills of learning handicap students.
- Improves writing skills and attitudes about writing for urban LEP students.
- Improves writing skills as a result of using telecommunications.

2. Educator Outcomes: Research on the benefits of technology for teaching is generally positive with a shift from the more traditional directive to a more student-centered approach. Research shows that educator-use of technology results in:

- Less directive and more student-centered teaching.
- Increased emphasis on individualized instruction.
- More time engaged by teachers advising students.
- Increased interest in teaching.
- Interest in experimenting with emerging technology.
- Teacher preferences for multiple technology utilization.
- Increases administrator and teacher productivity.
- Increased planning and collaboration with colleagues.
- Rethinking and revision of curriculum and instructional strategies.
- Greater participation in school and district restructuring efforts.
- Business partnerships with schools to support technology.
- Increased education involvement with community agencies.
- Increases in teacher and administrator communication with parents.

B. Technology development and applications to support teaching learning

1. Technology development factors: Research shows that particular features of technology-based resources are critical for effective technology applications in education and should provide for or incorporate:

- Immediate adjustment of task difficulty in relation to student responses.
- Instant feedback of correctness of responses.
- Ease of use by students and teachers.
- Sustained interest and use by students.
- Simulations of tasks not possible in the classroom or from books.
- Student control of pacing the educational programming.
- Opportunities for individualized problem solving.
- Opportunities to use multiple technologies.
- Built in assessments and procedures to matched technology resources with learner needs.
- Field testing of technology-based resources with a variety of students in a variety of settings.
- Involvement in the development of educational technology programs.
- Alignment with curriculum frameworks and existing instructional resources.

2. Technology application factors: The following are general considerations that research and evaluation studies document as important features to include in the application of technology-based resources. These studies suggest that technology should provide for or promote:

- Instruction that cannot be easily accomplished without the technology.
- Guidelines for teachers on how and when to integrate the technology into instruction.
- Expansion or enhancement of the curriculum.
- Integration into to current and emerging curriculum standards and guidelines. (interoperability)

- Access to technology and educationally relevant programs.
- Ease of adaptation of technology into a variety of learning environments from school to home.
- Ease of use and of high interest in any environment.
- The use of the technology within the regular classroom or learning environment.
- Adults that can promote meaningful student-use of technology.
- Adapted uses of technology with diverse student populations.
- Involvement of teachers and administrators in the design and implementation of educational technology R & D.

C. Local, state, and national factors to support effective technology applications

1. Local teacher support factors: Research consistently supports specific school and district level program characteristics that enable teachers to effectively utilize technology. Such factors generally include:

- Teacher-awareness of effective technology applications.
- Time for teachers to plan, learn about, and implement technology applications.
- A social network of other technology-using teachers.
- Availability of teacher-mentors or other peer support.
- Involvement of principals and other administrators in the planning and training.
- Development of the knowledge to critique and select technology applications.
- Development of school and classroom level technology plans by and for teachers.
- Involvement of teachers in deciding classroom uses of technology.
- Teacher-access to technology while planning.
- Understanding of ways to integrate technology into education reform.
- Preparation of new teachers for effective integration of technology into teaching.
- Long term staff development to support integration of technology into instruction.

- Increased opportunity for staff development and technical assistance.
- Access to technology and telecommunications resources.
- Awareness of and access to educationally relevant technology-based programs.
- Equitable access to centralized information resources related to technology use.
- Teacher- and student-access to computers outside of school.
- Opportunities for educators to communicate with peers in other schools and at conferences.
- School and district administrators committed to the use of technology.
- The systematic conversion of high-performance training technologies to support education.
- Shifting the media and telecommunications industry from entertainment to "edutainment."

2. *State and federal program support factors:* Survey research and review of 20 state plans has documented particular state and federal program elements that promote effective technology use that include:

- Technology incorporated into existing and emerging education initiatives.
- Incorporation of technology applications into state curriculum frameworks and standards.
- Planning as a pre-requisite for receiving technology-based resources.
- Guidelines for local planning that promote funding allocations for staff development.
- A statewide technology in education clearinghouse with electronic distribution.
- Incentives for the development and validation of technology-based resources.
- Incentives for identification and dissemination of programs and practices that work.
- Funding for school and district technology use plans that meet local and state criteria.
- An interagency governance structure to secure resources across agencies for technology.

- Provisions for regional and local technology use training and technical assistance.
- A statewide interoperable electronic information highway accessible by all classrooms and learning environments.
- Both formative and summative evaluation of all programs.
- A process to communicate program accomplishments and problems to stakeholders.
- Informing policy makers about cost-benefits of technology applications in education.
- Technology uses incorporated into program review and assessment guidelines.
- Coordination of education, business, and other relevant governmental agencies.
- Business involvement in planning and implementing technology in education.

D. Considerations for an expanded R & D agenda for educational technology

Most studies are formative and summative evaluations of various existing technology applications in education. Little funding has been expended for in-depth R & D for education—especially grades K-12. So far the emphasis has been more on qualitative research and evaluation and less on development and validation. Development has occurred by industry but has not been connected to research. Before technology can have a long term impact on education it is necessary to have a strong R & D agenda that promotes development combined with the needed research to inform the education community and the education stakeholders about effective practices and products. The research should help to determine the extent to which these new practices and products related to technology promote needed education reform. An expanded R & D agenda is important and should focus on the following:

- User friendly and educationally relevant information databases for the National Information Infrastructure.
- Applications of technology to promote desired state and national education reforms.

- The use of telecommunications and distance learning for teacher staff development.
- Identification and dissemination of model technology programs, practices, and projects.
- Identification of occupational skills standards related to technology applications.
- Using technology to disseminate information resources that provide systemic reform.
- Integration of technology into National Education Reform (Goals 2000, ESEA Reauthorization, school to work, etc.)
- Development of effective educational software, multimedia, and video for school and home use.
- Study of the positive and negative consequences of technology on education and society.

R & D that addresses these and other priorities is critical if educators are to be knowledgeable about and effective use of technology to improve teaching and learning. Most educators believe that schools and teachers are not technologically equipped to prepare students for the 21 century. A strong R & D agenda with sustained financial support can help meet this national need.

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TECHNOLOGY PLANNING TO SUPPORT EDUCATION REFORM

INFORMATION AND RESOURCES TO SUPPORT THE INTEGRATION OF TECHNOLOGY INTO STATE PLANNING FOR EDUCATIONAL REFORM UNDER GOALS 2000

Prepared by John Cradler, Far West Laboratory

This document serves a brief guide to persons who are developing State education reform plans guided by and other initiatives. It provides an overview of a planning process, suggested components for a plan, and a listing of available resources for developing and implementing a State technology plan. The contents are arranged as follows:

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|---------------------------------|------------------------|
| I. Background | IV. Plan Components. |
| II. Pre Planning Considerations | V. Planning Resources |
| III. The Planning Process | VI. Planning Checklist |

I. BACKGROUND

Goals 2000 promotes technology in education. The *Goals 2000: Educate America Act* offers a national vision and strategy "to infuse technology and technology planning into all educational programs and training functions carried out within school systems at the State and local level." (Public Law 103-227) The intent in *Goals 2000* is that technology will provide a vehicle to expand and enhance learning opportunities for all students. Section 317 of *Goals 2000, Improving Student Achievement Through Integration of Technology into the Curriculum*, sets forth the minimum planning requirements for your State's technology plan.

Goals 2000 offers both an opportunity and a challenge for educational reform by targeting the effective application of technology to support teaching and learning. The Act affords an opportunity for the State to redesign and improve its current technology plans, programs, and resources. The challenge for you, as a State planner, is to engage the State educational leadership along with local communities to design and implement a plan that uses technology to help students to achieve high standards.

Goals 2000 funding allocations for technology. Each State is allocated between \$307,607 and \$9,550,364 to develop a *Goals 2000* State Improvement Plan to enhance elementary and secondary student learning and staff development in support of the National Educational Goals and State content and student performance standards. Additional funding has been allocated for the development of State technology plans, with

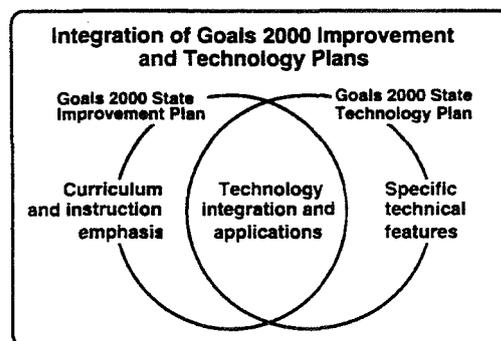
allocations ranging from a minimum of \$75,000 to a maximum of \$390,688 per State.

First year funding must allocate 60% to school districts in the form of subgrants with the remaining 40% for your State to develop the State Improvement Plan. It is anticipated that second year funding will be significantly increased with 90% of the funding distributed to school districts through competitive subgrants. Subgrant funds are for professional development and/or local initiatives to support your State's reform plan. Since subgrants are a source of funding for the integration of technology at the local level, developers of technology for the State Improvement Plan should consider building technology into their subgrants program.

Resources to support Goals 2000 planning. *Goals 2000* established the Office of Educational Technology, which is helping to coordinate resources for State and local technology planning. The Regional Educational Laboratories and various professional education organizations are also working in consultation with the Office of Educational Technology to provide direct assistance to State educational agencies for *Goals 2000* planning.

II. PRE PLANNING CONSIDERATIONS

Planning to plan or getting ready to develop the plan is necessary. One of the most important things to keep in mind during each step of the *Goals 2000* planning process from the vision to the revision is the integration of technology into curriculum reform. The following illustrates the integration of the technology plan and the State Improvement Plan.



The success of your plan is a function of the commitment level made by your plan's stakeholders to carry out the plan's implementation. For this reason, you will want to actively involve all agencies and organizations that will be directly and indirectly involved in implementation to ensure that the plan promotes and facilitates interagency coordination.

1. Establish a Goals 2000 technology task force. The first step is to form a task force to collaborate with relevant State agencies and organizations to develop the State technology plan.

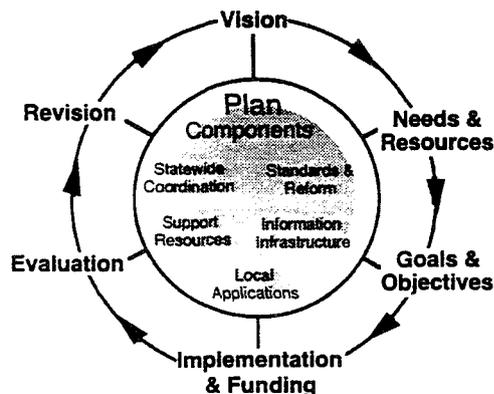
2. Promote collaboration between the Goals 2000 Technology Task Force and the State Panel. The Goals 2000 State Panel and the technology task force need to jointly identify how technology resources will support and integrate the vision and objectives of the overall educational reform through the State Improvement Plan.

Other preliminary considerations are:

1) involvement of existing public and private technology planning groups; 2) identification of all relevant technology/telecommunication plans and programs; 3) provision of staff and resources to assist in plan development and implementation.

III. The Planning Process

Specific planning steps should be applied to the development of each plan component. This may be viewed as a fluid process allowing for ongoing review and revision in your plan as needs, technology and resources change. The graphic below illustrates the relationship of the planning process to possible plan components and is followed by a brief discussion of the planning steps.



A. VISION

Your State's educational technology planners will want to establish a vision that coordinates with and enhances the vision of your State Improvement Plan. Your educational technology plan vision and related objectives should be flexible to accommodate changing national and local reforms coupled with new and emerging technologies.

1. Use the National Education Goals to help guide the vision. The guiding feature of *Goals 2000* is the eight National Education Goals. The technology task force may wish to consider ways that technology can support each of the National Goals as applied to the State.

2. Consider technology's role in education reform and Goals 2000. In developing your vision consider uses of technology to enhance systemic reforms suggested in the *Goals 2000* Act and by your State *Goals 2000* Panel.

3. Review already established visions for technology. The National Institute of Standards and Technology (NIST) and the U.S. Department of Education recently suggested visions for technology and the national information infrastructure (NII) that may serve as examples for States to consider.

4. Review research on technology in education. Be aware of current and emerging research on effective applications of technology to consider in developing the vision.

B. NEEDS AND RESOURCES ASSESSMENT

An assessment of the State's current needs for educators, students, and the community, as well as available technological resources, is necessary to establish relevant objectives for the technology plan. This information will also help you determine the resources and funding to consider in the design of the plan.

1. Assess needs for technology and related resources to support instruction. A variety of methods including surveys, focus groups, town meetings, and review of existing State and local plans and programs along with input from existing planning groups can provide input for the needs assessment.

2. Assess resources to support the use of technology in education. Identify existing technology/telecommunication as well as training and technical assistance resources needed to meet the established needs.

3. Conduct an analysis of needs vs. resources to support technology. Carefully determine the discrepancy or “gap” between “what is” and “what should be” in terms of technology-based resources to help meet the needs of educators and learners in the State and guide the objectives of the plan.

C. OBJECTIVES

The analysis of State needs and resource assessments should provide the information you need to develop your plan's objectives towards realizing the vision for educational technology in your State. In addition to objectives that result from your State's unique needs, your technology plan will also need to consider the objectives specified in *Goals 2000* and then integrate these objectives with those being established for the State Improvement Plan.

1. Adapt the technology objectives in the Goals 2000 Act to your plan. Address the objectives specified by the *Goals 2000* Act for the technology plan and relate these to your plan as appropriate.

2. Develop objectives to support statewide and local planning and needs. It is important to develop objectives directly relevant to the statewide and local needs, as well as those that will directly and indirectly support the educational goals and objectives of the State's *Goals 2000* Improvement Plan.

D. IMPLEMENTATION AND FUNDING

Establish an action plan for the implementation of each component of your plan. This usually involves activities such as the staffing of State and regional offices, agencies and programs; establishment of ongoing State advisory committees; notification of stakeholders; allocation of existing funding; and identification of long and short term funding to support the plan.

1. Establish Benchmarks and timelines for the plan's implementation. Establish “benchmarks and timelines” for the technology plan that are

closely coordinated with, or incorporated into the *Goals 2000* State Improvement Plan.

2. Prepare a statewide technology plan budget. Establish a funding estimate and a schedule for the development and implementation of each component of the plan.

3. Develop a funding strategy for the plan. Propose both short and long term funding sources for your statewide technology plan. These may range from business donations to special legislation or the leveraging of existing education budgets to support the plan.

E. EVALUATION

The most commonly reported reason for the elimination or reduction of technology-based programs is the inability to offer convincing evidence that such programs directly impact improvement in student learning. Evaluation results are usually necessary to convince boards and legislatures to allocate funding for technology.

1. Prepare a comprehensive statewide evaluation strategy for the technology plan. The State technology plan should suggest both a method for the assessment of each plan component and an overall evaluation across programs. The plan for evaluating the technology plan should be designed within the context of the overall evaluation of the State *Goals 2000* education reform plan.

2. Design a process for ongoing evaluation for the plan implementation. Continuously assess your progress in both implementation of each plan component and meeting the objectives of the plan.

3. Plan for an assessment of the statewide and local impact of the plan. Assess the impact of the plan implementation on student achievement and aggregate achievement information for schools. Assessment methods should closely relate to the objectives of the plan.

4. Establish a procedure for reporting evaluation findings. The outcome evaluation can be critical in justifying the continuation or expansion of the program. It is likely that a report on the progress and impact of the plan within the context of the overall *Goals 2000* State Improvement Plan to the U.S. Department of Education will be required.

F. REVISION

Effective plans must be implemented as planned, but must also be flexible and adjustable to changes in the education system, the community, and the students for which the plan is intended to serve. Coordinating agencies must constantly monitor implementation, outcomes, and benefits of each element of the plan. Use this information to inform adjustments in your plan.

1. **Establish a process for revising the plan as needed.** Establish and implement a process through which the plan will be reviewed and periodically updated to meet changing needs.
2. **Identify factors to guide revisions of the plan.** Factors or criteria to consider in plan implementation review and revision include adequacy of funding, equity of access, new technological developments, statewide coordination, quality and impact of resources, changes in the State Improvement Plan and the changing needs of students.

IV. STATE TECHNOLOGY PLAN COMPONENTS

This section suggests possible components for your State technology plan and is based on both a review of existing State technology plans and the educational reform guidelines found in *Goals 2000*. This is not intended to serve as a template, rather it suggests possible areas of emphasis for your *Goals 2000* technology plan. These suggested components are listed in the box below and are described in the following pages. The plan components you identify should be coordinated and connected and not implemented in isolation or as a set of separate tasks.

A. Statewide Coordination

The most often reported barrier to statewide technology implementation is a lack of State level coordination among and between the agencies with local needs and resources of education, and the various community agencies, and businesses. What follows are suggested ways to facilitate the successful coordination of the agencies involved in the implementation and revision of your technology plan.

1. **Establish a coordinated statewide structure for integration of technology into other educational programs.** A structure that reflects a coordinated effort to integrate and implement the educational technology plan as part of the *Goals 2000* State Improvement Plan is strongly advised.

2. **Provide for coordination with other agencies and organizations.** You may wish to consider establishing a State coordinating council to implement your plan with a coordinated strategy that minimizes fragmentation of technology resources. Effective coordination often involves all instructional departments within the department of education and other agencies as appropriate.

B. STANDARDS AND REFORM

Technology should be viewed as a tool for educators and a resource that is built into the curriculum and instructional delivery system. Technology should increase opportunities for students to meet high standards while serving as a catalyst for education reform.

1. **Utilize technology to promote high performance standards.** Consider ways to address applications of technology to support State education goals, curriculum frameworks, and instructional strategies in a variety of learning environments.
2. **Link technology to the enhancement of student learning opportunities.** Technology can serve to increase student learning opportunities for those to whom quality education is not readily available from the school to the home.
3. **Apply technology to both assess and record student performance.** Technology-based assessments offer the potential to assess student work in ways that can simulate and link to real life experiences with a more direct relationship to the State's academic and occupational performance standards.
4. **Provide incentives for educational technology Research and Development (R&D).** Promote collaborative research and development on current and emerging applications of technology to implement educational initiatives supporting State and National Education Goals and standards.

5. Provide for dissemination of information about technology related resources. Clearinghouses to disseminate identified exemplary technology-based programs and practices can help guide educators in their efforts to effectively integrate technology into curriculum and instruction.

6. Plan for technology applications in preparing students for the workforce. New workplace skills demand that almost all workers make extensive use of technology. This puts a related demand on education to incorporate technology awareness and applications in the development of School-to-Work programs.

7. Apply the uses of technology to meet the needs of at-risk students. *Goals 2000* calls for the use of more challenging programs and adaptability of resources to meet the needs of students with special educational needs.

8. Adapt teacher certification requirements to address the educational applications of technology. Review your State teacher certification requirements to determine the extent to which they include instruction in the application of technology to support and enhance teaching.

C. SUPPORT RESOURCES

Most States provide for regional agencies such as county offices of education, intermediate service agencies, cooperatives, consortia, and schools of education in colleges to provide direct services and information resources to school districts and school sites. It is important to take advantage of these agencies and make them a major component in the delivery of technology related services to schools.

1. Provide staff development opportunities for the integration of technology into instruction. Technology is most effectively applied and integrated into instruction when its use is integral to both the preservice of new teachers and professional development for practicing teachers.

2. Provide ongoing technical assistance necessary to use technology and carry out the plan. Follow-up to staff development with technical assistance has been identified as the most critical requirement for the effective and sustained use of technology in education.

3. Promote business partnerships to support technology in education. Experience tells us that State and local partnerships with business and industry can serve to greatly expand access and use of technology in education.

D. INFORMATION INFRASTRUCTURE

It is important to ensure that your State's education system can interact with and take full advantage of the many and varied information resources and communications opportunities rapidly becoming available on the emerging National Information Infrastructure (NII). The following suggest possible actions to consider when developing or expanding your State educational telecommunications network.

1. Establish or adapt a statewide telecommunications infrastructure for education. Educators and learners are finding that access to telecommunications both as a way to communicate and obtain information serves as a unparalleled expansion of learning opportunities beyond the traditional classroom.

2. Establish user-friendly electronic access to educational information resources. Educators should be able to take advantage of the many educational databases are maintained at the National, State and regional level on such topics as *Goals 2000*, curriculum resources, grant opportunities, new instructional strategies, educational reform, exemplary math and science programs, and many others.

3. Consider utilization of distance learning and instructional television. Distance learning programs and ITV provide increased opportunities for high quality instruction and staff development and can be a cost-effective means to provide access to a wide variety of subject areas in rural or other areas which lack quality resources.

4. Establish measures to protect the security of resources and users on the network. Different levels of security should be established to allow material with varying degrees of sensitivity to be transmitted in the most effective manner. Balancing the need for security and the need for open and free access to information is becoming an important challenge.

5. Establish standards that promote interoperability of hardware and software.

Assuring interoperability in your technology plan will allow both hardware and software devices to “talk” with one another and insure their access to a variety of telecommunications environments. Ultimately, this will lower costs, support equity of access and eliminate what teachers frequently report as a major barrier to technology use.

6. Provide support for the procurement and use of hardware. Essential for the implementation of any technology plan is the use of regional and local resources to support equipment installation, maintenance, and repair of technology.

7. Establish or adapt a statewide system for the electronic transfer of information between education and community agencies.

Information that is electronically accessible when and where it is needed should be a high priority to effectively plan and access resources in the school and the community to serve the individual needs of students.

E. LOCAL APPLICATIONS

The *Goals 2000* Act states that “Each State improvement plan shall include strategies for ensuring that comprehensive, systemic reform is promoted from the bottom up in communities, local educational agencies, and schools, as well as guided by coordination and facilitation from State leaders.” Local applications of technology must be established to maximize opportunities for students to meet National, State, and local performance standards.

1. Describe local planning strategies for introducing technology into schools and other educational environments. Local planning is as critical as State planning and should involve teachers, parents, and administrators in the design of a school vision and plan that supports the local needs of students and staff. Such planning must extend directly into the classroom and other learning environments if it is to be relevant.

2. Consider guidelines for the local integration of technology into the Goals 2000 sub grants. The *Goals 2000* school/district sub grants provide an opportunity to implement your State technology plan as part of the overall local educational improvement plan.

3. Consider the use of technology in adult literacy programs. Collaborate with your State literacy resource centers, local educational agencies, adult and family literacy providers and public libraries to ensure that technology can be used by adults and family literacy providers after school hours.

4. Consider the use of technology to link community agencies with the school. Establish applications of technology to promote interagency communications, information access, and more efficient coordination of resources between schools and community agencies.

5. Utilize technology to increase parental interaction with local education resources. Technology provides an important vehicle to facilitate increased involvement of parents by connecting the home with the school and other educational environments.

BIBLIOGRAPHY

Cradler, John, *Planning to Integrate Technology into Teaching and Learning*, California League of Middle Schools, Irvine, CA, 1994.

Cradler, John, *Comprehensive Study of Educational Technology Programs in California Authorized From 1984-92*, Far West Laboratory, San Francisco, 1991.

Hawkins, J., *Technology and the Organization of Schooling*, Report, Bank Street College of Education, New York, 1993.

Means, Barbara, et. al., *Using Technology to Support Education Reform*, OERI, Washington DC, 1993.

The National Information Infrastructure: Requirements for Education and Training, National Coordinating Committee on Technology in Education and Training (NCC-TET), Washington DC, 1994.

Putting the Information Infrastructure to Work: Report of the Information Infrastructure Task Force Committee on Applications and Technology, NIST, Gaithersburg, MD, 1994.

V. Technology Planning Resources

The following documents and programs are currently available and may be of help in planning and implementing educational technology at the state, regional, and local levels.

1. Planning

THE KEY ELEMENTS OF EFFECTIVE STATE PLANNING FOR EDUCATIONAL TECHNOLOGY

Jones, Sue (1993)
Southern Regional Educational Board
592 Tenth Street, NW
Atlanta, GA 30318-5790
(404) 875-9211 FAX (404) 872-1477

TEACHING, LEARNING & TECHNOLOGY

Apple Computer, Inc.
20525 Mariani Avenue
Cupertino, CA 95014
(408) 996-1010

PLANNING FOR TECHNOLOGY APPLICATIONS IN EDUCATION

Cradler, J.D. (1994)
Far West Laboratory
730 Harrison St.
San Francisco, CA 94107-1242
(800) 622-4160

2. Goals 2000, Educational Reform, and Technology

USING TECHNOLOGY TO SUPPORT EDUCATION REFORM

U.S. Department of Education
Means, Barbara; Blando, John; et. al. (1992)
U.S. Government Printing Office
Superintendent of Documents
Mail Stop: SSOP
Washington, DC 20402-9328
(202) 783-3238 FAX (202) 512-2250

TOOLS FOR CHANGE: RESTRUCTURING TECHNOLOGY IN OUR SCHOOLS

Scrogan, Len (1993)
Institute for Effective Educational Practice
637-B S. Broadway, Suite 302
Boulder, CO 80303

CURRICULUM GUIDELINES FOR ACCREDITATION OF EDUCATIONAL COMPUTING AND TECHNOLOGY PROGRAMS

Thomas, Lajeane, et. al (1993)
International Society for Technology in Education
1787 Agate Street
Eugene OR 97403-1923
(503) 346-4414

3. Policy Statements

THE NII AGENDA FOR ACTION

Clinton, William
Executive Office of the President
1600 Pennsylvania Avenue, NW
Washington, DC 20500
(202) 456-7035

PUTTING THE INFORMATION INFRASTRUCTURE TO WORK:

Report of the Information Infrastructure Task Force,
Committee on Applications and Technology
National Institute for Standards and Technology
Building 225, B164
Gaithersburg, MD 20899

THE NATIONAL INFORMATION INFRASTRUCTURE: REQUIREMENTS FOR EDUCATION AND TRAINING.

Cradler, John and Yrchik, John (1994)
National Coordinating Committee on Technology in
Education and Training (NCC-TET)
P.O. Box 4437
Alexandria, VA 22303
(703) 351-5243
iste@seas.gwu.edu

IMPROVING STUDENT PERFORMANCE THROUGH LEARNING TECHNOLOGIES

Council of Chief State School Officers (1991)
CCSSO
One Massachusetts Ave, NW, Suite 701
Washington, DC 20001
(202) 336-7003

TRANSFORMING EDUCATION: OVERCOMING BARRIERS

David, Jane and Goren, Paul (1993)
National Governors' Association
444 North Capitol Street
Washington, DC 20001-1512

EDUCATIONAL TECHNOLOGY: NEA SPECIAL COMMITTEE REPORT

Gary Watts
National Education Association
1201 16th Street, N.W.
Washington, DC 20036
(202) 822-7747

4. Distance Learning and Instructional Television

PROFILE OF RESOURCES OF THE 1992-94 STAR SCHOOLS PROJECTS AND THEIR ADMINISTRATIVE AGENCIES

Cradler, J.D., Cassidy, Sheila; and Bridgforth, Elizabeth; (1994).

Distance Learning Resource Network
Far West Laboratory
730 Harrison
Street San Francisco, CA 94107-1242
(800) 622-4160

DISTANCE LEARNING PRIMER

Education Satellite Network
Missouri School Boards Association
2100 I-70 Drive Southwest
Columbia, MO 65203-4865
(314) 445-9920
(800) 243-3376

DISTANCE LEARNING PLANNING AND IMPLEMENTATION KIT

Far View
Pacific Mountain Network
1550 Park Avenue
Denver, CO 80218-1661
(303) 837-8000

NATIONAL DISTANCE LEARNING CENTER (NDLC)

University of Kentucky Owensboro Community College
400 New Hartford Road
Owensboro, KY 42303
(502) 686-4556
(502) 686-4555 modem dial-up

5. Support Resource Agencies

REGIONAL EDUCATIONAL LABORATORIES AND RESEARCH CENTERS

Appalachia Educational Laboratory

Serves KY, TN, VA, WV
Carolyn Carter
(800) 347-9120

Far West Laboratory

Serves AZ, CA, NV, UT
John Cradler
(415) 565-3000

Mid-continent Regional Educational Laboratory

Serves CO, KS, MO, NE, ND, SD, WY
Linda Brannan
(303) 337-0990

The Regional Laboratory for Educational Improvement of the Northeast and Islands

Serves CT, ME, MA, NH, NY, PR, RI, VT, U.S.
Jeff Sun, Virgin Islands
(800) 347-4200

North Central Regional Educational Laboratory

Serves IL, IN, IA, MI, MN, OH, WI
Gil Valdez
(708) 571-4700

Northwest Regional Educational Laboratory

Serves AK, ID, MT, OR, WA
Don Holznagle
(800) 547-6339

Pacific Regional Educational Laboratory

Serves American Samoa, Commonwealth of the Northern Mariana Islands, Federated States of Micronesia, Guam, Hawaii, Marshall Islands, Palau
Kathy Busick
(808) 532-1900

Research for Better Schools

Serves DE, DC, MD, NJ, PA
Keith Kershner
(215) 574-9300

SouthEastern Regional Vision for Education

Serves AL, FL, GA, MS, NC, SC
Mark Wayne-Hart
(800) 755-3277

Southwest Educational Development Laboratory

Serves AR, LA, NM, OK, TX
Dave Foster
(512) 476-6861

NATIONAL CENTER FOR TECHNOLOGY PLANNING

Larry Anderson, Director
Department of Technology & Education
Mississippi State University 39762
(601) 325-2281 Lsa1@ra.msstate.edu.

CALIFORNIA COMPUTER SOFTWARE AND INSTRUCTIONAL VIDEO CLEARINGHOUSES

Stanislaus County Office of Education (Video)
801 County Center Three Court
Modesto, CA 95355-4490
(209) 525-4993
CSU Long Beach (Software)
1250 Bellflower Boulevard
Long Beach, CA 90840-1402
(310) 985-1764.

NATIONAL DIFFUSION NETWORK

To identify your State Facilitator contact the NDN at:
Office of Educational Research and Improvement
U.S. Department of Education
555 New Jersey Avenue, NW
Washington, DC 20208-5645
(202) 219-2134

CENTER FOR CHILDREN AND TECHNOLOGY

Margaret Honey
 Center for Children and Technology
 610 West 112th Street
 New York NY 10025
 (212) 875-4560
 Internet: mhoney@edu.org

CENTER FOR EDUCATIONAL LEADERSHIP AND TECHNOLOGY

John Phillip
 Center for Educational Leadership and Technology
 165 Forest Street
 Marlborough, MA 01752
 (508) 624-4877 FAX (508) 624-6565

WESTERN INTERSTATE COMMISSION FOR HIGHER EDUCATION

Richard W. Jonsen, Director
 Post Office Drawer P
 Boulder, CO 80301-9752
 (303) 541-0200

PACIFIC MOUNTAIN NETWORK

Mary Lou Ray
 Vice President, Learning Services
 1501 Park Avenue
 Denver, CO 80218-1661
 (303) 837-8000

6. Professional Organizations

THE CONSORTIUM FOR SCHOOL NETWORKING (CoSN)

William Wright, Acting Director
 1250 24th Street, NW, Suite 300
 Washington, DC 20035
 (202) 466-0533

NATIONAL EDUCATION ASSOCIATION (NEA)

John Yrchik
 1201 16th Street, NW
 Washington, DC 20036
 (800) 827-6364

COUNCIL OF CHIEF STATE SCHOOL OFFICERS (CCSSO)

Frank Withrow, Director of Technology
 Council of Chief State School Officers
 1 Massachusetts Avenue, N.W., Suite 700
 Washington, DC 20001
 (202) 408-5505

INTERNATIONAL SOCIETY FOR TECHNOLOGY IN EDUCATION (ISTE)

Dennis Bybee
 ISTE
 1787 Agate Street
 Eugene, OR 97403-1923
 (503) 346-4414

COALITION OF ACADEMIC SUPERCOMPUTER CENTERS

Sue Fratkin
 Fratkin Associates
 2322 20th Street, N.W.
 Washington, DC 20009
 (202) 265-5410

NATIONAL SCHOOL BOARDS ASSOCIATION

Cheryl Williams, Director of Technology Programs
 Institute for the Transfer of Technology to Education
 1680 Duke Street
 Alexandria, VA 22314
 (703) 838-6213

7. On-Line Resources

U.S. DEPARTMENT OF EDUCATION INSTITUTIONAL COMMUNICATIONS NETWORK (INet)

INet Project Manager
 U.S. Department of Education
 Office of Educational Research and Improvement
 555 New Jersey Avenue, NW, Room 214
 Washington, DC 20208-5725
 (202) 219-1547
 modem (800) 241-4638
 gopher.ed.gov

EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) and ASKERIC

ERIC Clearinghouse on Information and Technology
 Center for Science and Technology
 Syracuse University
 Syracuse, NY 13244-4100
 (315) 443-3640
 askeric@ericir.syr.edu

AMERICA ONLINE

America Online
 8619 Westwood Center Drive, Suite 200
 Vienna, VA 22182
 (800) 827-6364

NEA ONLINE

NEA Starter Kit
 (800) 827-6364, ext. 7468

APPLELINK

Apple Computer
 20525 Mariani Ave.
 M/S 75-2C
 Cupertino, CA 95014
 Attention: Developer Programs
 (408) 974-3309

PBS LEARNING LINK

PBS ONLINE
 1320 Braddock Place
 Alexandria, VA 22314
 (703) 739-8464

SPECIALNET
GTE Education Services
GTE Place
West Airfield Drive
Dallas/Fort Worth Airport PO Box 619810
Texas 75261-9810
(800) 927-3000

8. Telecommunications and the National Information Infrastructure

CALIFORNIA NETWORK TECHNOLOGY PLANNING GUIDE

Teach, Carole, et. al. (1994)
California Department of Education
Educational Technology Unit
P.O. Box 944272
Sacramento, CA 94244-2720
(916) 657-5414

EDUCATIONAL TELECOMMUNICATIONS: THE STATE BY STATE ANALYSIS

Hezel Associates (1994)
Hezel Associates
1201 E. Fayette Street
Syracuse, NY 13210
(315) 422-3512

INFORMATION INFRASTRUCTURE SOURCE BOOK

Kahin, Brian, ed. (1993)
Yvonne Hickey
Office of Information Technology
Harvard University
1730 Cambridge Street, Rm 202 Cambridge, MA 02138
(617) 496-4077 FAX (617) 495-0715
yvonne@harvarda.harvard.edu

9. Research and Evaluation Studies, Reports, and Guidebooks

ANALYSIS AND TRENDS OF SCHOOL USE OF NEW INFORMATION TECHNOLOGIES

Becker, Henry (1994)
U.S. Government Printing Office Superintendent of Documents
Washington, DC 20402-9328; Mail Stop: SSOP
(202) 783-3238 FAX (202) 512-2250

TELEMENTORING: AN EXAMINATION OF THE POTENTIAL FOR AN EDUCATIONAL NETWORK

Wighton, David (1993)
ERIC Clearinghouse on Information and Technology
Center for Science and Technology
Syracuse University
Syracuse, NY 13244-4100
(315) 443-3640
askeric@ericir.syr.edu

ACCOMPLISHED TEACHERS - INTEGRATING COMPUTERS INTO CLASSROOM PRACTICE

Hadley, Martha; Means, Barbara; and Sheingold, Karen (1990)
Bank Street College of Education
Center for Children and Technology
610 West 112th Street
New York, NY 10025

REPORT ON THE EFFECTIVENESS OF TECHNOLOGY IN SCHOOLS 1990-1992

Sivin-Kachala, Jay And Bialo, Ellen
Interactive Educational Systems Design
Software Publishers Association
1730 M Street, N.W.
Washington, DC 20036
(202) 452-1600

10. Model Technology Programs

CALIFORNIA MODEL TECHNOLOGY SCHOOLS COLLABORATIVE

Marleen Allin
California Department of Education
Office of Educational Technology
P.O. Box 944272
Sacramento, CA 94244-2720
(916) 657-5414

FLORIDA MODEL TECHNOLOGY SCHOOLS

Dave Brittain
Bureau of Educational Technology
Florida Department of Education
Florida Education Center
325 West Gaines Street, Room B1-54
Tallahassee, FL 32399
(904) 488-0980

NORTH CAROLINA MODEL TECHNOLOGY SCHOOLS

Elise Brumback
Media and Technology Services
North Carolina Department of Public Instruction, 301 N. Wilmington Street
Raleigh, NC 27601-2825
(919) 715-1530

11. Funding Guides

EDUCATOR'S GUIDE FOR DEVELOPING AND FUNDING EDUCATIONAL TECHNOLOGY SOLUTIONS

Cradler, J.D. and Cordon-Cradler, Ruthmary (1994)
Educational Support Systems
1505 Black Mountain Road
Hillsborough, CA 94010
(415) 344-7046 FAX (415) 344-3604

**THE USDLA FUNDING SOURCE BOOK FOR
DISTANCE LEARNING AND EDUCATIONAL
TECHNOLOGY**

Krebs, Arlene (1993)
Box 5106
San Ramon, CA 94583
(510) 606-5150
(800) 829-3400

**DIRECTORY OF BUILDING AND EQUIPMENT
GRANTS**

Research Grant Guides
Department 3A
P.O. Box 4970
Margate, FL 33063
(305) 753-1754

FEDERAL REGISTER

Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402

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93022

REGIONAL EDUCATIONAL LABORATORY ELECTRONIC NETWORK PHASE II SYSTEM

250680

Pilot Test Plan Revised Feb. 18, 1994

From John Cradler, Far West Laboratory for Educational Research and Development
415-565-3018, jcradle@fwl.org

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I. Introduction and Purpose

Far West Laboratory in collaboration with the other regional educational laboratories is establishing a regionally coordinated telecommunication network to electronically interconnect each of the ten regional laboratories with educators and education stakeholders from the school to the state level. For the national distributed information database, each lab is working with mid-level networks to establish a common interface for networking throughout the country and include topics of importance to education reform as assessment and technology planning.

In the first year of the Laboratory Network Program (LNP), a Technology Task Force was formed to design and implement telecommunications systems to support the various collaborative activities of the group. Two phases were identified for development: an interim system providing services for a short period of one to two years, and a long-term system to provide service and flexibility over a much longer period. The Phase I system, R&D Line, is operated and primarily supported by SERVE. The Phase II system design is based on computer systems operated by many Laboratories, using the Internet and its protocols as the telecommunications basis. It is assumed that each Regional Laboratory will acquire an Internet connection, and that many of the Labs will provide services to constituents in their regions, as well as supporting the national network by hosting one or more common components such as databases.

The primary purpose of the pilot test is to ensure that the system supports communications between and among laboratory staff, supports collaborative work among labs, and supports laboratory staff in their technical assistance and collaborative work with their constituents. The Internet and its standard protocols are well-known and well-tested. The focus of this pilot test is on the ability of Labs to package, implement, and support systems based on those protocols which will support and enhance the ability of Lab staff to perform significant aspects of their work as noted in the purpose.

II. Audiences

The test plan will address a sampling of potential users within Laboratory staffs, from constituent organizations, and from other organizations and communities with which they are in contact. The sample will include professional persons from LEA, SEA, and federal organizational levels. The exact number and distribution of individual participants in any pilot activity will be determined and enlisted by the Lead Staff Member responsible for that activity, with the coordination and approval of the Task Force leadership.

III. Pilot Strategy

Hardware

Labs intending to provide services on the Internet which are components of the Lab national network will be called hubs. The hubs will acquire and install computer systems using the UNIX operating system. The systems will include sufficient main memory and disk storage to support user accounts and services planned for regional constituents, and the databases or other services which are part of the national network. Configurations will vary according to the nature of the regional plans.

Software

All hubs participating in the pilot will support on their UNIX systems the standard Internet protocols including Telnet, SMTP, FTP, NNTP, and MIME. They will also install and support Gopher and Free WAIS. Integrated application software packages which provide e-mail and other functions based on the standards are being investigated, and hubs will be required to install packages identified as useful in the pilot, or identified for testing during the pilot.

Labs are encouraged to include in their internal LAN plans the ability for electronic mail transferred through the Internet to be delivered to the recipient within their regular LAN-based mail system. That is, Lab staff should be able to send and receive e-mail over the Internet using the same procedures as on their LAN. Commercial software such as Microsoft Mail and CC Mail are typical examples, and several "mail gateway" packages are available depending on the LAN software selected.

Collaborative Groups

A set of specific software applications will be identified by a Task Force subcommittee and supported by hubs, which will be available to support the work of collaborative groups. These will include at least e-mail, file transfer, and news groups. The lead staff member assigned to each group will work with the group chair to determine the activities of the group during the pilot period, identify appropriate software, train the group members, and monitor and support their use of the system during the pilot. Labs participating in the activity are identified below, with the pilot lead lab first in the list. The Task Force representative from the lead pilot lab is the lead staff person responsible for that pilot activity unless delegated to another. The Eisenhower National Clearinghouse will also participate in science/math activities.

Databases

Each database will be installed on one pilot hub, where it will be maintained and access supported. In at least two cases a back-up copy will be installed on a second hub during the pilot. The transfer of database responsibility from one hub to another will also be tested. The lead staff person from that hub will be responsible for identifying specific audiences and selecting pilot users from those audiences, training users, and supporting them during the pilot. In cases where the database is the product of a collaborative group also in the pilot, coordination of information and activity may be needed, and the collaborative group may assist in selecting pilot users. Overall coordination and monitoring of database user distribution and activities will be carried out by the database subcommittee of the Task Force. Two organizations supporting databases to be included in the pilot are the Eisenhower Clearinghouse and the National Center for Adult Literacy.

Other Functions

Two additional functions are to be developed and tested in the pilot period: calendars and directories. Calendar capabilities are related to a deliverable in the work of the science/math consortia. Directories are identified in the long-range system design, but work on the capability is being done by AT&T under an NSF contract, and by OERI in its INET system. Consultation is needed before proceeding with development.

General Network Interface

A Gopher will be developed to support this function. Pilot activities include design, development, and testing. Content will be reviewed and approved by the Task Force. The Gopher will be installed on each hub computer and on a unique computer on the Internet.

User/Client Software Study

Investigation and testing of selected client software packages will proceed, led by SEDL and NEI. Two or three packages may be installed on selected hubs for examination during the pilot. Two packages which are close to being market-ready and are the best current choices for this purpose are The Guide and Panda. A third option constructed of freely available packages will be designed and tested by several Labs, using Mosaic as a center piece.

Evaluation

An evaluation plan and related procedures and instruments will be devised and implemented. A strategy will be included to provide an interpretation of data collected in the first few months which can be used in a mid-course review and modifications.

CSUS

Special Projects

MISSION STATEMENT

The mission of the CSUS Special Projects is to provide a structure and process to support families and individuals, including those with disabilities, to become responsible, productive, and socially involved citizens.

CAPACITY

This is accomplished through:

- ◆ Personnel development (preservice and continuing education)
- ◆ Technical assistance
- ◆ Direct services
- ◆ Research
- ◆ Demonstration
- ◆ Policy and product development
- ◆ Evaluation
- ◆ Dissemination

GUIDING PRINCIPLES

- ◆ Everyone has the right and responsibility to participate as a member of the global community.
- ◆ All children and youth have the right to determine what their future will be.
- ◆ Education and related services should be provided in community settings.
- ◆ Cultural competence and respect for individual differences is demonstrated in all activities.
- ◆ All endeavors of the CSUS Special Projects lead eventually to systems improvement.
- ◆ Transdisciplinary teaming is reflected in all activities.
- ◆ Outcomes are achieved within partnerships of families and professionals, business and industry, and communities through both public and private linkages.

THE PROGRAM EVALUATION STANDARDS

Sound evaluations of educational programs, projects, and materials in a variety of settings should have four basic attributes:

- Utility
- Feasibility
- Propriety
- Accuracy

The Program Evaluation Standards, established by sixteen professional education associations, identify evaluation principles that when addressed should result in improved program evaluations containing the above four attributes.

Dr. James R. Sanders, Chair
The Joint Committee on Standards
for Educational Evaluation
The Evaluation Center
Western Michigan University
Kalamazoo, Michigan 49008-5178
616-387-5895



Sage Publications, Inc.
2455 Teiler Road
Thousand Oaks, CA 91320
805-499-0721



JCSEE PR-1994
Approved by the American
National Standards Institute
as an American National
Standard. Approval date:
March 15, 1994.

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Utility

The utility standards are intended to ensure that an evaluation will serve the information needs of intended users.

- U1 **Stakeholder Identification** Persons involved in or affected by the evaluation should be identified, so that their needs can be addressed.
- U2 **Evaluator Credibility** The persons conducting the evaluation should be both trustworthy and competent to perform the evaluation, so that the evaluation findings achieve maximum credibility and acceptance.
- U3 **Information Scope and Selection** Information collected should be broadly selected to address pertinent questions about the program and be responsive to the needs and interests of clients and other specified stakeholders.
- U4 **Values Identification** The perspectives, procedures, and rationale used to interpret the findings should be carefully described, so that the bases for value judgments are clear.
- U5 **Report Clarity** Evaluation reports should clearly describe the program being evaluated, including its context, and the purposes, procedures, and findings of the evaluation, so that essential information is provided and easily understood.
- U6 **Report Timeliness and Dissemination** Significant interim findings and evaluation reports should be disseminated to intended users, so that they can be used in a timely fashion.
- U7 **Evaluation Impact** Evaluations should be planned, conducted, and reported in ways that encourage follow-through by stakeholders, so that the likelihood that the evaluation will be used is increased.

Feasibility

The feasibility standards are intended to ensure that an evaluation will be realistic, prudent, diplomatic, and frugal.

- F1 **Practical Procedures** The evaluation procedures should be practical, to keep disruption to a minimum while needed information is obtained.
- F2 **Political Viability** The evaluation should be planned and conducted with anticipation of the different positions of various interest groups, so that their cooperation may be obtained, and so that possible attempts by any of these groups to curtail evaluation operations or to bias or misapply the results can be averted or counteracted.
- F3 **Cost Effectiveness** The evaluation should be efficient and produce information of sufficient value, so that the resources expended can be justified.

Accuracy

The accuracy standards are intended to ensure that an evaluation will reveal and convey technically adequate information about the features that determine worth of merit of the program being evaluated.

- A1 **Program Documentation** The program being evaluated should be described and documented clearly and accurately, so that the program is clearly identified.
- A2 **Context Analysis** The context in which the program exists should be examined in enough detail, so that its likely influences on the program can be identified.
- A3 **Described Purposes and Procedures** The purposes and procedures of the evaluation should be monitored and described in enough detail, so that they can be identified and assessed.
- A4 **Defensible Information Sources** The sources of information used in a program evaluation should be described in enough detail, so that the adequacy of the information can be assessed.
- A5 **Valid Information** The information gathering procedures should be chosen or developed and then implemented so that they will assure that the interpretation arrived at is valid for the intended use.
- A6 **Reliable Information** The information gathering procedures should be chosen or developed and then implemented so that they will assure that the information obtained is sufficiently reliable for the intended use.
- A7 **Systematic Information** The information collected, processed, and reported in an evaluation should be systematically reviewed and any errors found should be corrected.
- A8 **Analysis of Quantitative Information** Quantitative information in an evaluation should be appropriately and systematically analyzed so that evaluation questions are effectively answered.
- A9 **Analysis of Qualitative Information** Qualitative information in an evaluation should be appropriately and systematically analyzed so that evaluation questions are effectively answered.
- A10 **Justified Conclusions** The conclusions reached in an evaluation should be explicitly justified, so that stakeholders can assess them.
- A11 **Impartial Reporting** Reporting procedures should guard against distortion caused by personal feelings and biases of any party to the evaluation, so that evaluation reports fairly reflect the evaluation findings.
- A12 **Metaevaluation** The evaluation itself should be formatively and summatively evaluated against these and other pertinent standards, so that its conduct is appropriately guided and, on completion, stakeholders can closely examine its strengths and weaknesses.

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Langley Research Center

Gary P. Warren

*Child Safety on the Information
Highway*

Child Safety on the Information Highway

Whatever it's called, millions of people are now connecting their personal computers to telephone lines so that they can "go online." Traditionally, online services have been oriented towards adults, but that's changing. An increasing number of schools are going online and, in many homes, children are logging on to commercial services, private bulletin boards, and the Internet. As a parent you need to understand the nature of these systems.

Online services are maintained by commercial, self-regulated businesses that may screen or provide editorial/user controls, when possible, of the material contained on their systems.

Computer Bulletin Boards, called BBS systems, can be operated by individuals, businesses, or organizations. The material presented is usually theme oriented offering information on hobbies and interests. While there are BBS systems that feature "adult" oriented material, most attempt to limit minors from accessing the information contained in those systems.

The Internet, a global "network of networks," is not governed by any entity. This leaves no limits or checks on the kind of information that is maintained by and accessible to Internet users.

The Benefits of the Information Highway

The vast array of services that you currently find online is constantly growing. Reference information such as news, weather, sports, stock quotes, movie reviews, encyclopedias, and airline fares are readily available online. Users can conduct transactions such as trading stocks, making travel reservations, banking, and shopping online. Millions of people communicate through electronic mail (E-mail) with family and friends around the world and others use the public message boards to make new friends who share common interests. As an educational and entertainment tool users can learn about virtually any topic, take a college course, or play an endless number of computer games with other users or against the computer itself. User "computing" is enhanced by accessing online thousands of shareware and free public domain software titles.

Most people who use online services have mainly positive experiences. But, like any endeavor - traveling, cooking, or attending school - there are some risks. The online world, like the rest of society, is made up of a

wide array of people. Most are decent and respectful, but some may be rude, obnoxious, insulting or even mean and exploitative.

Children and teenagers get a lot of benefit from being online, but they can also be targets of crime and exploitation in this as in any other environment. Trusting, curious, and anxious to explore this new world and the relationships it brings, children and teenagers need parental supervision and common sense advice on how to be sure that their experiences in "cyberspace" are happy, healthy, and productive. his new world and the relationships it brings, children and teenagers need parental supervision and common sense advice on how to be sure that their experiences in "cyberspace" are happy, healthy, and productive.

Putting the Issue in Perspective

Although there have been some highly publicized cases of abuse involving computers, reported cases are relatively infrequent. Of course, like most crimes against children, many cases go unreported, especially if the child is engaged in an activity that he or she does not want to discuss with a parent. The fact that crimes are being committed online, however, is not a reason to avoid using these services. To tell children to stop using these services would be like telling them to forgo attending college because students are sometimes victimized on campus. A better strategy would be for children to learn how to be "street smart" in order to better safeguard themselves in any potentially dangerous situation.

What Are the Risks?

There are a few risks for children who use online services. Teenagers are particularly at risk because they often use the computer unsupervised and because they are more likely than younger children to participate in online discussions regarding companionship, relationships, or sexual activity. Some risks are:

Exposure to Inappropriate Material

One risk is that a child may be exposed to inappropriate material of a sexual or violent nature.

Physical Molestation

Another risk is that, while online, a child might provide information or arrange an encounter that could risk his or her safety or the safety of

other family members. In a few cases, pedophiles have used online services and bulletin boards to gain a child's confidence and then arrange a face-to-face meeting.

Harassment

A third risk is that a child might encounter E-mail or bulletin board messages that are harassing, demeaning, or belligerent.

How Parents Can Reduce the Risks

To help restrict your child's access to discussions, forums, or bulletin boards that contain inappropriate material, whether textual or graphic, many of the commercial online services and some private bulletin boards have systems in place for parents to block out parts of the service they feel are inappropriate for their children. If you are concerned, you should contact the service via telephone or E-mail to find out how you can add these restrictions to any accounts that your children can access.

The Internet and some private bulletin boards contain areas designed specifically for adults who wish to post, view, or read sexually explicit material. Most private bulletin board operators who post such material limit access to people who attest that they are adults but, like any other safeguards, be aware that there are always going to be cases where adults fail to enforce them or children find ways around them.

The best way to assure that your children are having positive online experiences is to stay in touch with what they are doing. One way to do this is to spend time with your children while they're online. Have them show you what they do and ask them to teach you how to access the services.

While children and teenagers need a certain amount of privacy, they also need parental involvement and supervision in their daily lives. The same general parenting skills that apply to the "real world" also apply while online.

If you have cause for concern about your children's online activities, talk to them. Also seek out the advice and counsel of other computer users in your area and become familiar with literature on these systems. Open communication with your children, utilization of such computer resources, and getting online yourself will help you obtain the full benefits of these systems and alert you to any potential problem that may occur with their use.

Guidelines for Parents

By taking responsibility for your children's online computer use, parents can greatly minimize any potential risks of being online. Make it a family rule to:

Never give out identifying information D home address, school name, or telephone number D in a public message such as chat or bulletin boards, and be sure you're dealing with someone that both you and your child know and trust before giving it out via E-mail. Think carefully before revealing any personal information such as age, marital status, or financial information. Consider using a pseudonym or unlisting your child's name if your service allows it.

Get to know the services your child uses. If you don't know how to log on, get your child to show you. Find out what types of information it offers and whether there are ways for parents to block out objectionable material.

Never allow a child to arrange a face-to-face meeting with another computer user without parental permission. If a meeting is arranged, make the first one in a public spot, and be sure to accompany your child.

Never respond to messages or bulletin board items that are suggestive, obscene, belligerent, threatening, or make you feel uncomfortable. Encourage your children to tell you if they encounter such messages. If you or your child receives a message that is harassing, of a sexual nature, or threatening, forward a copy of the message to your service provider and ask for their assistance.

Should you become aware of the transmission, use, or viewing of child pornography while online, immediately report this to the National Center for Missing and Exploited Children by calling 1-800-843-5678. You should also notify your online service.

Remember that people online may not be who they seem. Because you can't see or even hear the person it would be easy for someone to misrepresent him- or herself. Thus, someone indicating that "she" is a "12-year-old girl" could in reality be a 40-year-old man.

Remember that everything you read online may not be true. Any offer that's "too good to be true" probably is. Be very careful about any offers that involve your coming to a meeting or having someone visit your house.

Set reasonable rules and guidelines for computer use by your children (see "My Rules for Online Safety" on last page as sample). Discuss these rules and post them near the computer as a reminder. Remember to monitor their compliance with these rules, especially when it comes to the amount of time your children spend on the computer. A child or teenager's excessive use of online services or bulletin boards, especially late at night, may be a clue that there is a potential problem. Remember that personal computers and online services should not be used as electronic babysitters.

Be sure to make this a family activity. Consider keeping the computer in a family room rather than the child's bedroom. Get to know their "online friends" just as you get to know all of their other friends.

This brochure was written by Lawrence J. Magid, a syndicated columnist for the Los Angeles Times, who is author of *Cruising Online: Larry Magid's Guide to the New Digital Highway* (Random House, 1994) and *The Little PC Book* (Peachpit Press, 1993).

Child Safety on the Information Highway was jointly produced by the National Center for Missing and Exploited Children and the Interactive Services Association (8403 Colesville Road, Suite 865, Silver Spring, MD 20910).

This brochure was made possible by the generous sponsorship of: America Online, CompuServe, Delphi Internet, e-World, GEnie, Interchange Online Network, and Prodigy Service.

My Rules for Online Safety

I will not give out personal information such as my address, telephone number, parents' work address/telephone number, or the name and location of my school without my parents' permission.

I will tell my parents right away if I come across any information that makes me feel uncomfortable.

I will never agree to get together with someone I "meet" online without first checking with my parents. If my parents agree to the meeting, I will be sure that it is in a public place and bring my mother or father along.

I will never send a person my picture or anything else without first checking with my parents.

I will not respond to any messages that are mean or in any way make me feel uncomfortable. It is not my fault if I get a message like that. If I do I will tell my parents right away so that they can contact the online service.

I will talk with my parents so that we can set up rules for going online. We will decide upon the time of day that I can be online, the length of time I can be online, and appropriate areas for me to visit. I will not access other areas or break these rules without their permission.

For further information on child safety, please call the National Center for Missing and Exploited Children at 1-800-THE-LOST (1-800-843-5678).

[Image] Return to CompuServe's Home Page

OUT TO
P.388

School Selection Criteria

Gynelle Mackson, Chairperson

Partner Schools

Program Characteristics

- Fulfilling NASA's IITA goals
- Improves upon existing infrastructure within partner school
- Significant NASA commitment (dollars, personnel, etc.)
- Formally open and competitive proposals
- Scalability

Criteria

- Administrative/Institutional support
- Technology Fit
- Educational Fit
- Demographic Fit
- Motivation Fit
- Resource Fit

IITA Teacher Enhancement

Program Characteristics

- **Wide-spread seeding of Internet Technology**
- **Oriented towards individual empowerment opportunities**
- **Implement a low cost networking/equipment solution**
- **Open and competitive proposal**

Criteria

- **Motivated educator**
- **No technology presence**
- **Reporting requirements**
- **Commitment to training**

Proposal should contain:

- **A letter of agreement detailing the precise contributions of all parties to the project**
- **A list of school staff who will participate**
- **Release time for teacher training, if appropriate**
- **Development of new curriculum or improvement of existing curriculum**
- **Expected improvement of teaching methods**
- **A plan for documenting, evaluating and disseminating the project results**

Proposal Requirements

- **Emphasize access for historically underserved populations**
- **Respond to known educational needs**
- **Support national standards for math and science education**
- **Have specific, measurable goals and objectives**
- **Have plans for phasing up or out once NASA support ends**
- **Meet NASA approval requirements**
- **Conform to available program resources**
- **Have the capability to meet project requirements**

Relative Criteria

- **Proposal specifically addresses how resources will be used**
- **Proposal reflects a strategic vision for developing technology use over the long term**
- **Proposal emphasizes collaboration and cooperation between proposer and other schools, the community, private sector, and/or local municipal institutions**
- **Proposal otherwise demonstrates a commitment from school staff and/or administration to the success of the project**

Coordination of Environmental Education Projects

Michael Keeler, Chairperson
Farzad Mahootian, Co-Chairperson

511-80
93026

Summary of Session Activities

Coordination of Environmental Education Projects

Chairperson: Michael Keeler,
Gonzaga College High School
keeler@jacks.gsfc.nasa.gov
202-336-7104

050682
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Introduction

The Cooperative Agreement Notice awarded a number of grants to projects related to environmental fields with and emphasis on education. As these projects mature and products become available it would be useful for the existing groups to collaborate and share information.

In this session we addressed four fundamental questions: What are the goals, objectives and practical opportunities for coordinating our projects? How can we improve awareness of, interest in, access to, and support the products of our work? How can we build relationships between projects for scientific, educational, technical and programmatic benefit? How can we evaluate the effectiveness of coordination efforts?

In this working session we produced answers to these questions and proposed a structure for future collaboration. Our group followed a prepared agenda (please see attached.)

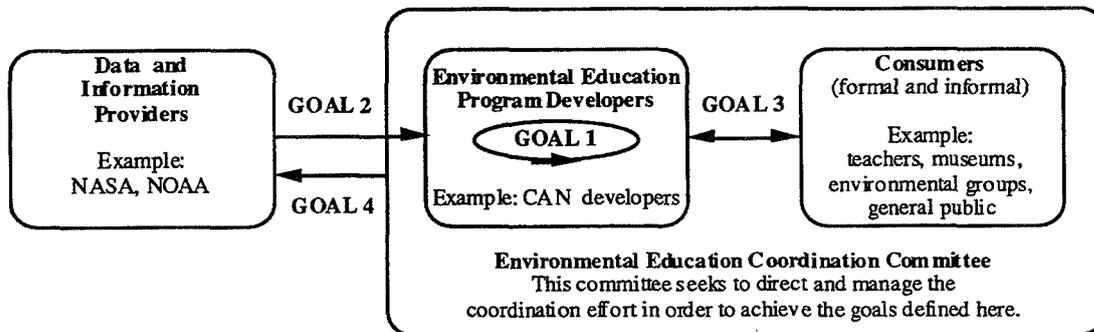
Results

Our group defined four goals which address the fundamental issues involved in coordinating environmental education programs. These goals are a product of our discussions and summarize our recommendations to the IITA K-12 Educational Workshop.

We organized the players in environmental education into four groups:

- Data and Information Providers, such as NASA and NOAA;
- Environmental Education Program Developers, such as the teams developing applications in the CAN: Public Use of Earth and Space Science Data Over the Internet.
- Consumers, such as teachers, students, museums, environmental groups and the public.
- Environmental Education Coordination Committee, which, in its first incarnation, included all attendees of our session.

Groups and Coordination Goals in Environmental Education



In order to organize these groups formally and above all facilitate dialogue among the players and groups, we defined the following four goals. We also proposed substantive tasks required to achieve each goal.

Goal 1: Coordinate Environmental Education Program Developers

- provide support for more frequent meetings (preferably at implementation sites)
- establish and maintain a database of programs, players, and products currently involved in development to facilitate problem-solving, match-making, and cross-fertilization of user groups.
- establish and maintain a database of existing (completed) environmental products

Goal 2: Targeted Organization of Data and Image Bases

- develop two levels of access to data and images for:
 - 1) Environmental Education Program Developers
 - 2) Consumers

Goal 3: Increase Access to Information about Programs to Consumers

- develop easy-to-use search and retrieval engines for database of programs, players, and products currently involved in development to facilitate problem-solving, match-making, and cross-fertilization of user groups.
- promote programs, products, and databases through NASA **and** commercial marketing venues, including NASA-Select, NASA booths at NSTA, NASA teacher workshops, TRCs

Goal 4: Communicate Developer and Consumer Needs to Data and Information Providers

- establish the Environmental Education Coordination Committee (EECC).
- provide support to enable the EECC to address the tasks defined for goal 1-3.
- provide support to enable the EECC to hold 3-4 meetings per year during major conferences in order to: a) promote these goals, b) broaden participation and input into the coordination process c) broaden support base (data pool) of Developers and Consumers
- provide funding and venue for annual report which will communicate Developer and Consumer Needs to Data and Information Providers

Finally, we finalized a list of Environmental Education Program attributes prepared by the session chair. These attributes are intended to facilitate the collection of data about Environmental Education Programs and the development of databases described in the tasks for Goal 1 and 3 above.

I have included this list of attributes in a more comprehensive questionnaire which we will circulate to Principal Investigators of known federally funded environmental education programs and existing programs and products currently in use, such as National Geographic's *Kidsnet* and TERC's environmental monitoring programs. This list appears below.

Providing Access to Environmental Education Programs

This worksheet will enable the Environmental Education Coordination Committee to build a database intended to enable people to learn about your program, its products, and who to contact to find out how to find out more. Please be as thorough as possible and help us improve the process for other developers of environmental education program developers.

I. Contact Information

If possible, please attach an organizational chart for your program and include the roles and responsibilities for participating people.

Principal Contact _____
Name _____
Title _____
Organization Name _____
HTTP Address _____
Street Address _____
City _____
State _____
Zip Code _____
E-mail Address _____
Telephone # _____

Other Contact _____
Name _____
Title _____
Organization Name _____
HTTP Address _____
Street Address _____
City _____
State _____
Zip Code _____
E-mail Address _____
Telephone # _____

Other Contact _____
Name _____
Title _____
Organization Name _____
HTTP Address _____
Street Address _____
City _____
State _____
Zip Code _____
E-mail Address _____
Telephone # _____

Please describe your program by placing an "x" next to the attributes which apply to your environmental education program. If there is a category which we have overlooked, please create a new category at the end. Any additional information and comments are welcome.

II. Program Description

Additional Information and Comments

Information Access:

HTTP Address
Gopher Address
FTP Address

Target Audience

K-4	----
5-8	----
9-12	----
Undergraduate	----
Graduate	----
Post-Doc	----
General Public	----
Other _____	----

Content Organization

Atmosphere	----
Hydrosphere	----
Cryosphere	----
Lithosphere	----
Biosphere	----
Space	----
Other _____	----

Academic Scope

Curriculum	----
Modules	----
Supplementary	----
Teacher Pre-service	----
Teacher In-service	----
Museum Exhibit	----
Other _____	----

Program Scope

School	----
Public	----
Private	----
District	----
State	----
Agency/Dept	----
Federal/National	----
Agency/Dept	----
User-group	----
Community	----
Coalition	----
Other _____	----

Program Funding Source -----
 Gov't -----
 Non-government -----
 Grant -----
 CA -----
 Contract -----
 Corporate -----
 Private -----
 Other _____ -----

Pedagogy
 Hands-on -----
 Student Directed -----
 Teacher Directed -----
 Inquirey-based -----
 Lecture -----
 Other _____ -----

Evaluation -----
 Student -----
 Teacher -----
 Mentor -----
 Other _____ -----

Other Catagory _____ -----
 _____ -----
 _____ -----
 _____ -----
 _____ -----

III. Product Description

(Using the attributes below, please describe the products of your environmental education program.)

Market -----
 Commercial -----
 Non-profit -----
 For-profit -----
 Public-Domain -----
 License req. -----
 Shareware -----
 Other _____ -----

Product Use -----
 Single-User -----
 Team/Group -----
 Collaboration -----
 Local -----
 Remote -----
 Other _____ -----

User Customization Features -----
 Multilingual -----
 Hearing Impaired -----
 Vision Impaired -----
 Other _____ -----

Coordinating Environmental Education Programs, 1995

Required Skill Level -----
 Novice -----
 Intermediate -----
 Expert -----
 Other _____ -----

Data -----
 Remote Sensing -----
 Level 1 -----
 Level 2 -----
 Level 3 -----
 Level 4 -----
 Temporal Resolution -----
 Spacial Resolution -----
 Campaign/Mission -----
 Parameter -----
 Instrumentation -----
 Local (Ground Truth) -----
 Instrumentation -----
 Hardware -----
 Software -----
 Other _____ -----

Software -----
 Data Visualization -----
 Systems Modeling/Analysis -----
 Data Analysis -----
 Image Processing -----
 CAD/CAM -----
 Simulations -----
 Virtual Reality -----
 Voice Recognition -----
 3-D Modeling -----
 Rendering -----
 Search Tools -----
 Browse Tools -----
 Artificial Intelligence -----
 Other _____ -----

Distribution/Pub Media -----
 Print -----
 Video -----
 Audio -----
 CD-ROM -----
 Laserdisc -----
 On-line -----
 WWW -----
 e-mail -----
 newsgroup -----
 list-serve -----
 gopher -----
 bbs -----
 f t p -----
 Other _____ -----

For more information contact: M. Keeler

keeler@jacks.gsfc.nasa.gov

Support Services

Help Desk -----
 e-mail -----
 telephone -----
 Mentoring -----
 FAQ -----
 Manuals -----
 Search Engines -----
 Knowledgebase -----
 Expert System -----
 Artificial Intelligence -----
 Other _____ -----

Other Category _____ -----
 _____ -----
 _____ -----
 _____ -----
 _____ -----

IV. User Infrastructure Requirements

(Using the attributes below, please describe infrastructure required to participate in your program and/or use your products.)

Software Applications

Data Visualization -----
 Systems Modeling/Analysis -----
 Data Analysis -----
 Image Processing -----
 CAD/CAM -----
 Simulations -----
 Virtual Reality -----
 Voice Recognition -----
 3-D Modeling -----
 Rendering -----
 Search Tools -----
 Browse Tools -----
 Artificial Intelligence -----
 Other _____ -----

Operating Systems

PC/Windows _____ -----
 MacOS _____ -----
 UNIX _____ -----
 Other _____ -----

Hardware and Peripherals

VCR -----
 Audio Tape player -----
 CD-ROM Drives -----
 Laserdisc Player -----
 Cable TV -----
 LAN -----
 Novel -----
 TCP/IP -----
 OS/2 -----
 Banyan Vines -----
 AppleTalk -----

For more information contact: M. Keeler

keeler@jacks.gsfc.nasa.gov

Coordinating Environmental Education Programs, 1995

Other _____	-----
Internet Connection	-----
Asynchronous	-----
PPP/Slip 14.4 kbps	-----
56 kbps	-----
1.544 mbps	-----
45 mbps	-----
155 mbps	-----
Other _____	-----

For more information contact: M. Keeler

keeler@jacks.gsfc.nasa.gov

Agenda

Introduction (10 Minutes)

Goals and Objectives (Hour 1)

What are the goals, objectives and practical opportunities for coordinating our projects?

Brainstorming
Collating
Actions

Program Descriptions (Hour 2)

Introduction
Prioritizing

Break

Products (Hour 1)

How can we improve awareness of, interest in, access to, and support of our work?

Brainstorming
Collating
Actions

Relationships (Hour 1)

How can we build relationships between projects for scientific, educational, technical, and programmatic benefit?

Brainstorming
Collating
Actions

Break

Evaluation (Hour 1)

How can we evaluate the effectiveness of our coordination effort?

Brainstorming
Collating
Actions

Wrap-up (Hour 1)

Indicators and Evaluation for NASA IITA K-12 Programs

*Shelley Canright Chairperson
Barbara Grabowski, Co-Chairperson*

Slides:

Notes:

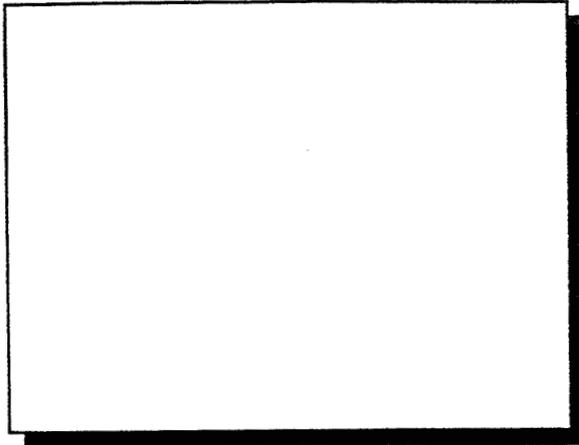
IITA K-12 Educational Workshop

**Indicators and Evaluation for
NASA IITA K-12 Programs**

Session One: Understanding Indicators and Indicator Systems

Presenters:

Shelley Canright, NASA, LaRC
Barbara Grabowski, Penn State University

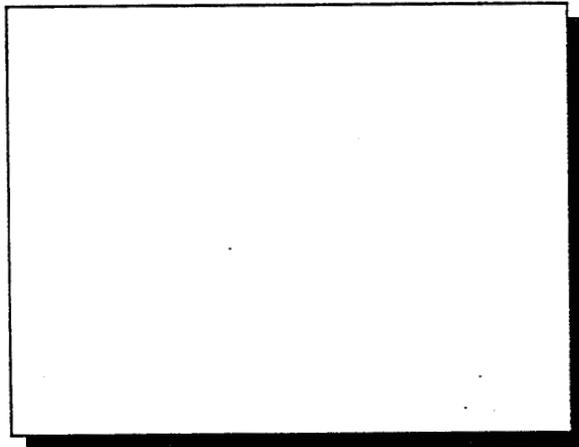


Definitions and Descriptions

Indicators -- in general

- a measure that conveys a general impression of the condition or nature of an underlying system being examined
- a statistic or statistics used to monitor the well-being of a system
- tells a great deal about the entire system by reporting the condition of a few particularly significant features of the system

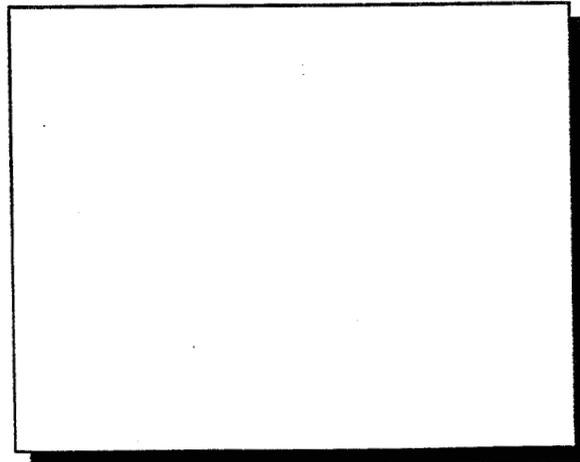
- National Research Council, 1994



Indicators -- In General

Let's think about these criteria--
There are many areas in life for which we say "it was a good indication!"
What are some examples of those areas?

-
-
-
-



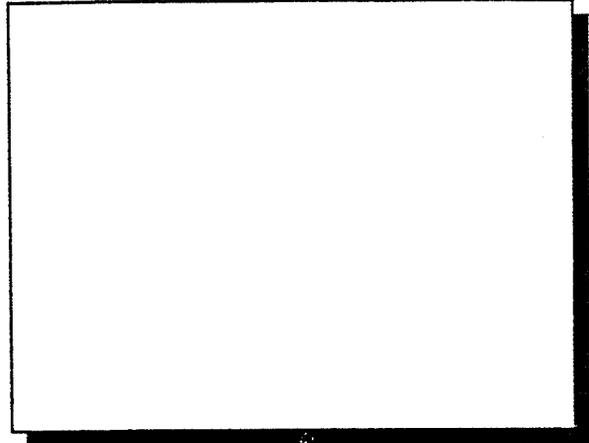
Slides:

Notes:

Indictors -- In General

There are goals for each of these general areas--
What are they?

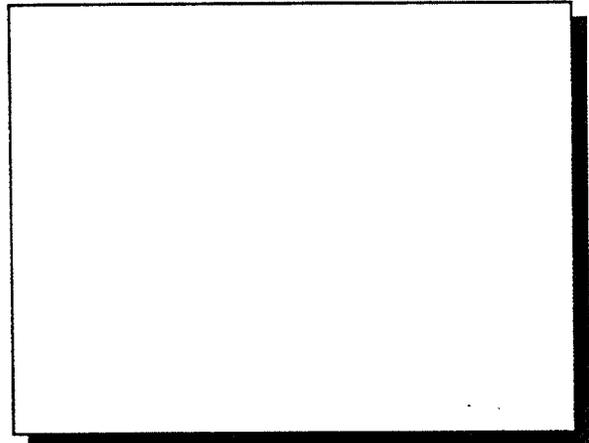
- the body--
- economy--
- automobile--
- automatic test equipment--
- this course!



Indicators -- In General

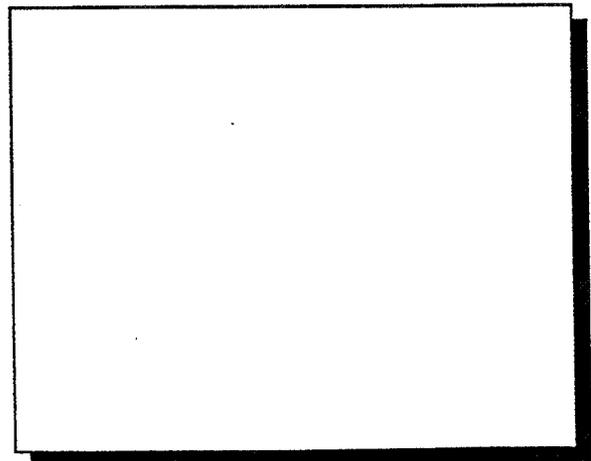
--So *why* have indicators?

--and, why is this important?



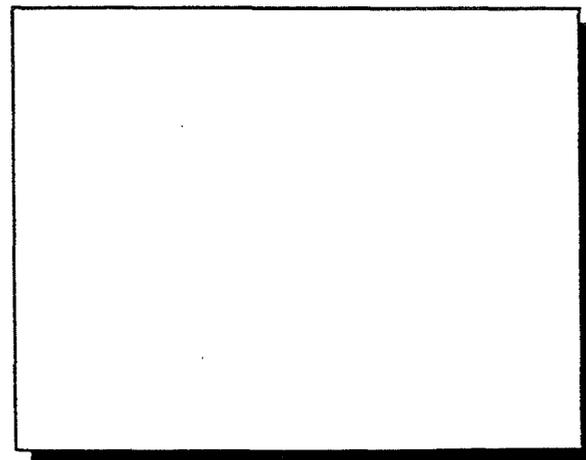
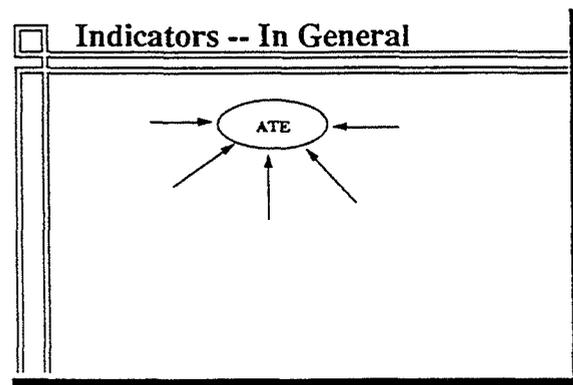
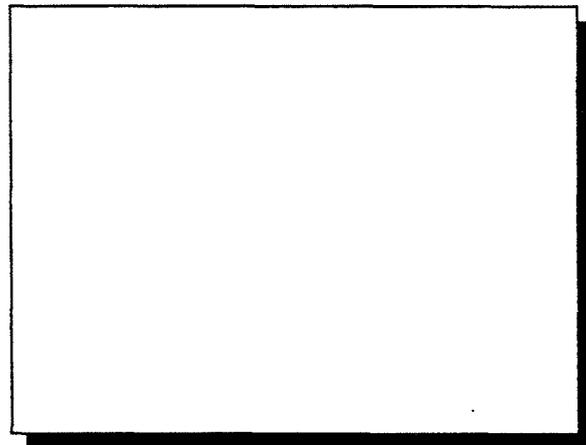
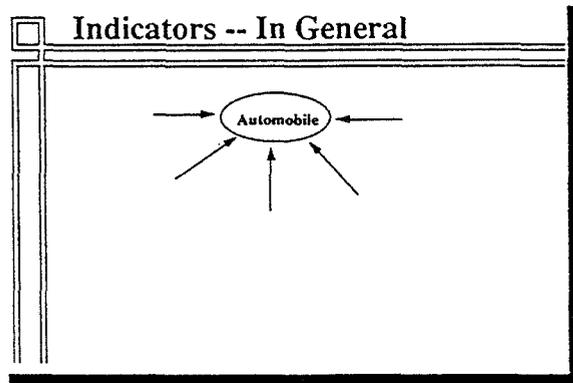
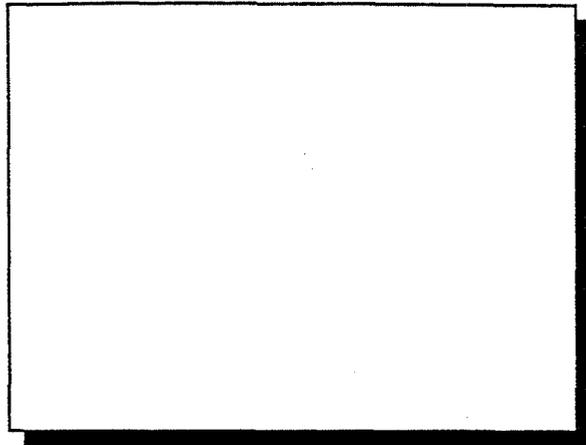
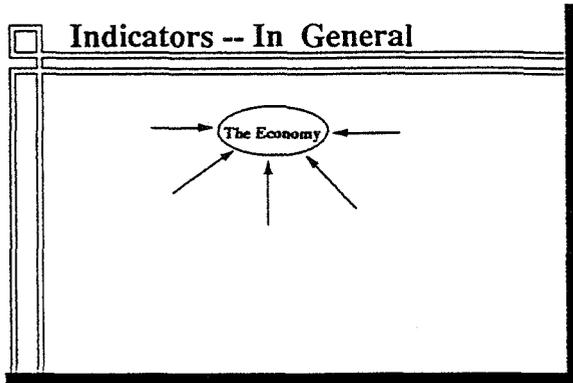
Indicators -- In General

What are the indicators of "health" for each area? Let's draw a picture...



Slides:

Notes:



Slides:

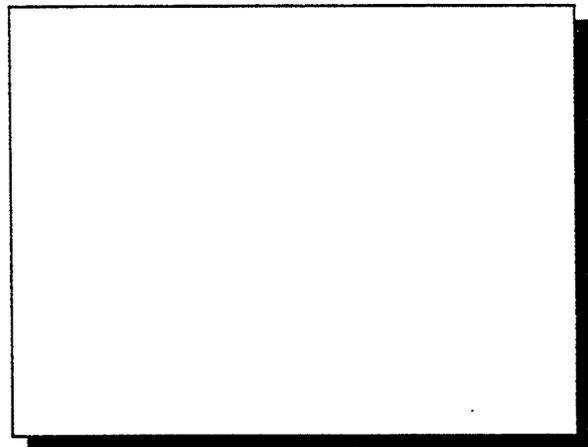
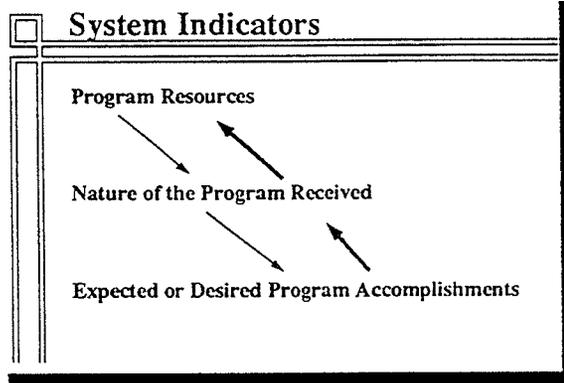
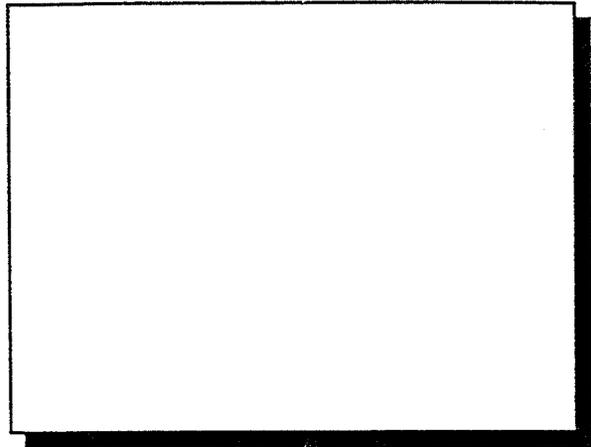
Notes:

What Are Indicator Systems?

--a collection of interrelated indicators that work together:

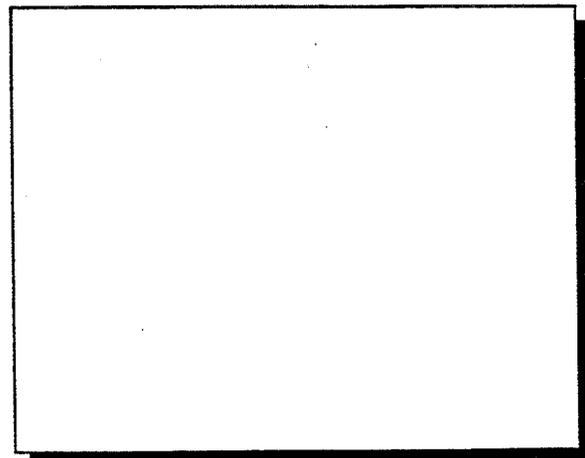
- input indicators
- process indicators
- outcome indicators

--based on a causal model of how individual components work together to "cause" an effect



How the System Works---

--Given the outcome indicators, what are the critical inputs and processes that would affect these outcomes?



Slides:

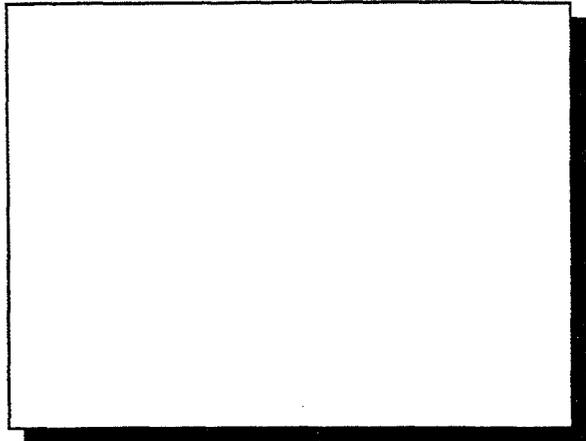
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System Indicators -- In General

Going back to the examples!

1. You have already noted the outcome indicators.

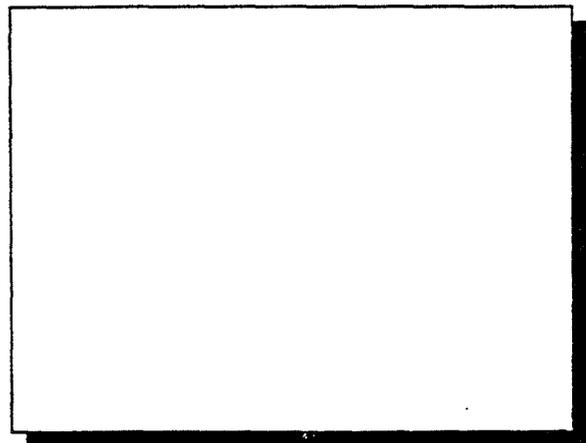
WHAT WERE THEY?



System Indicators--In General

2. What are the *process indicators* for each *output indicator* (the nature of the program to be received by the participants)?

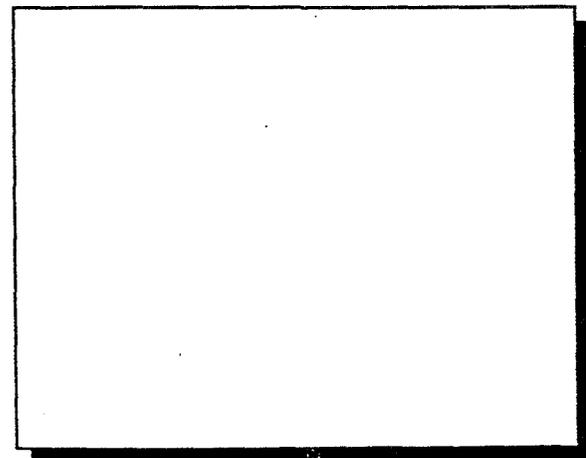
WHAT ARE THEY?



Indicators -- In General

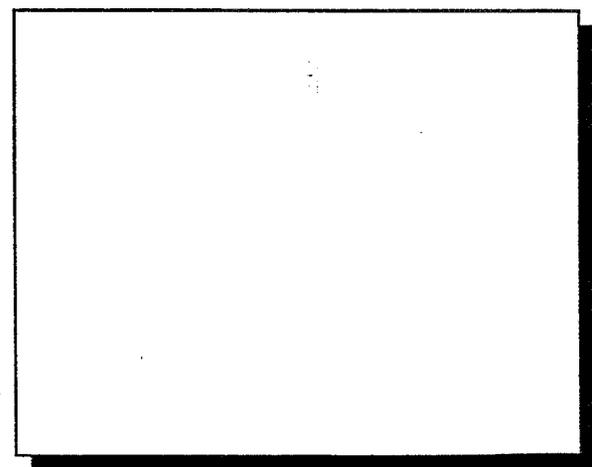
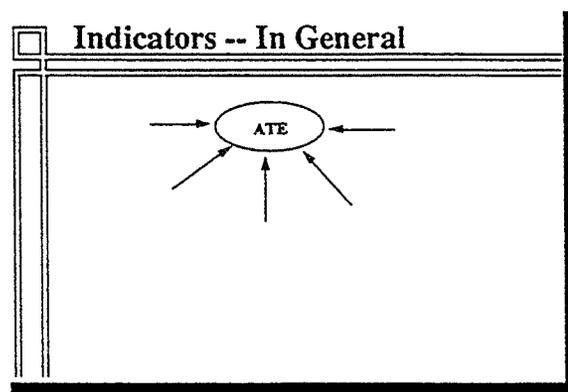
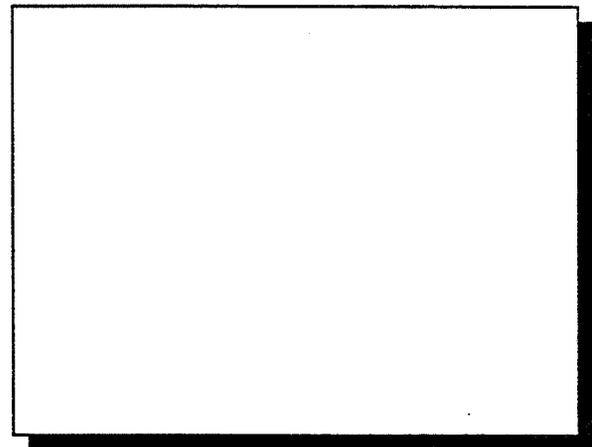
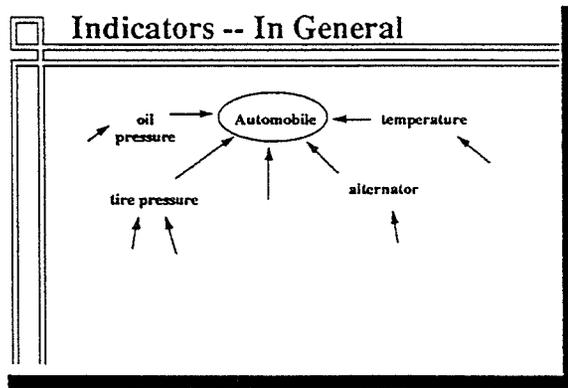
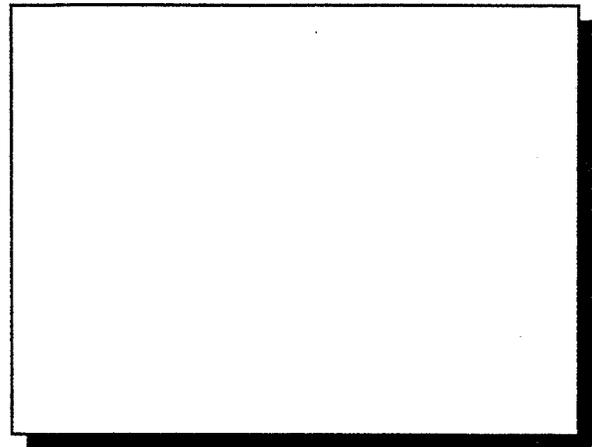
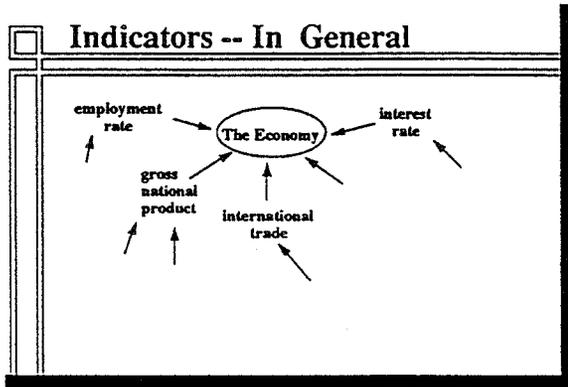
What are the process indicators for each outcome indicator?

```
graph TD; Body((The Body)); Chol[cholesterol level] --> Body; Body --> BP[blood pressure]; Body --> Temp[temperature]; BR[breathing rate] --> Body; HR[heart rate] --> Body; Body --> Temp; BR --> BR; HR --> HR; Temp --> Temp;
```



Slides:

Notes:



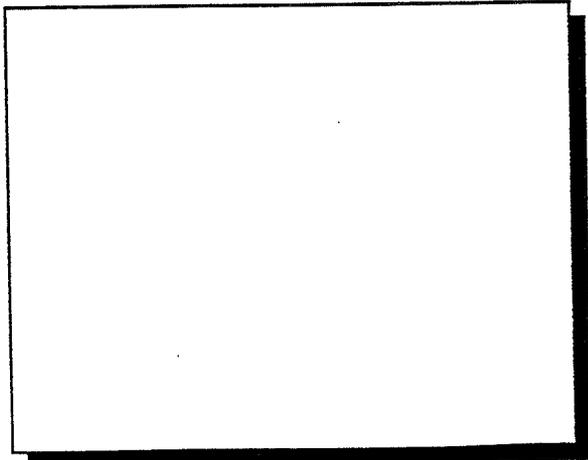
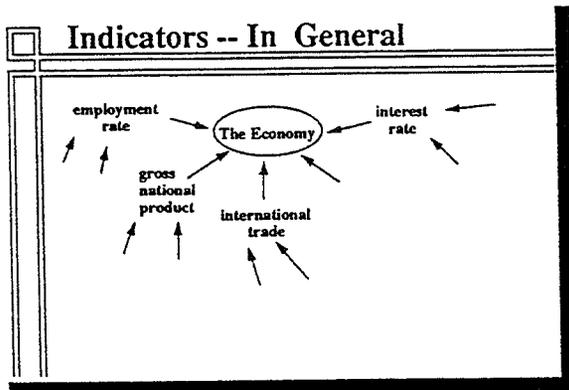
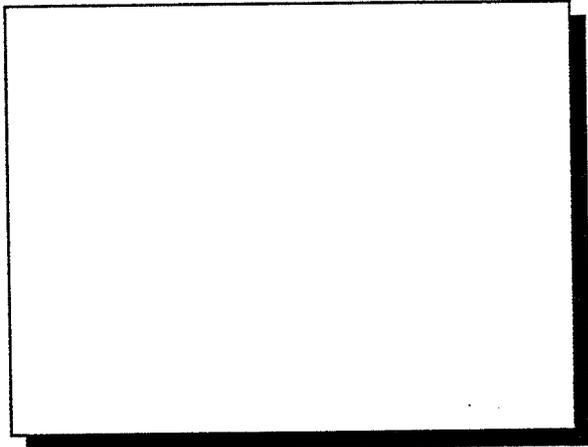
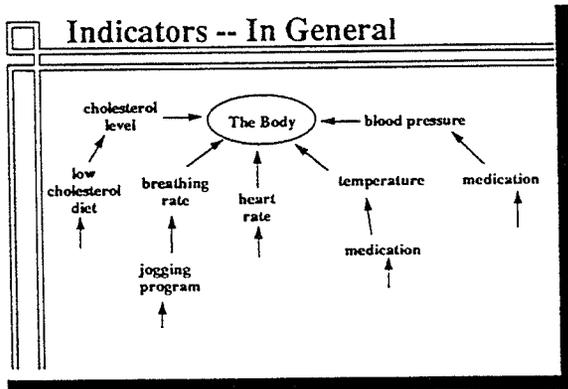
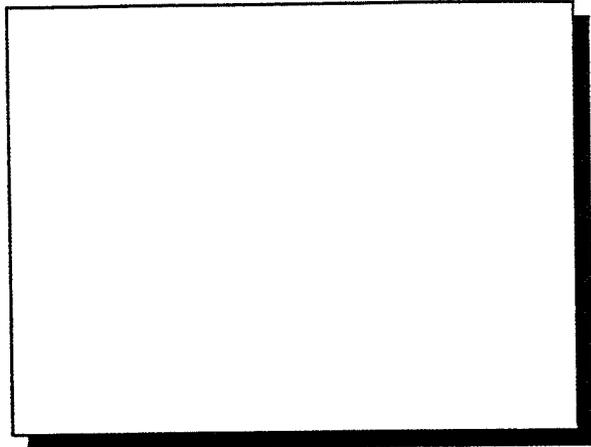
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Notes:

System Indicators--In General

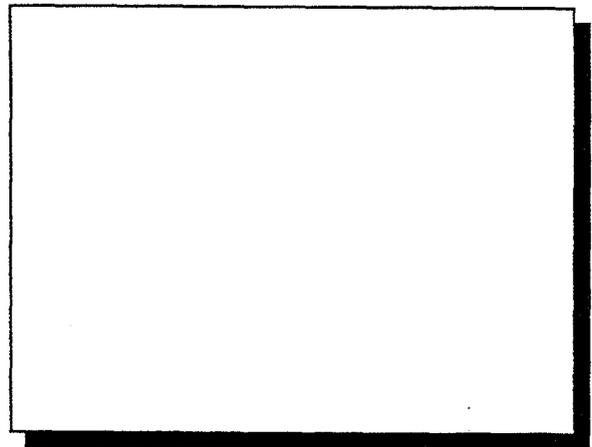
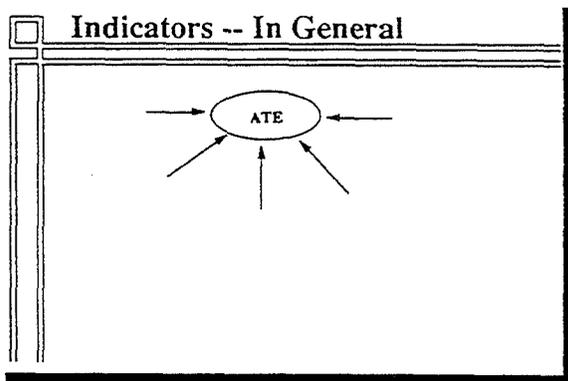
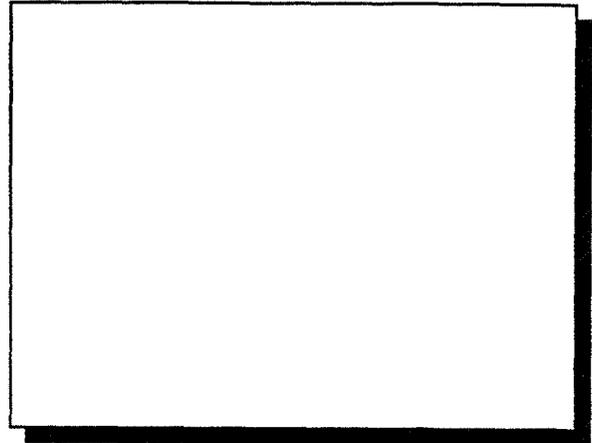
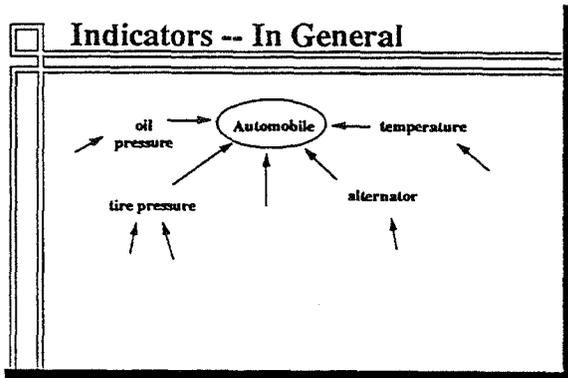
3. Finally, what are the input resources to the process indicators?

WHAT ARE THEY?



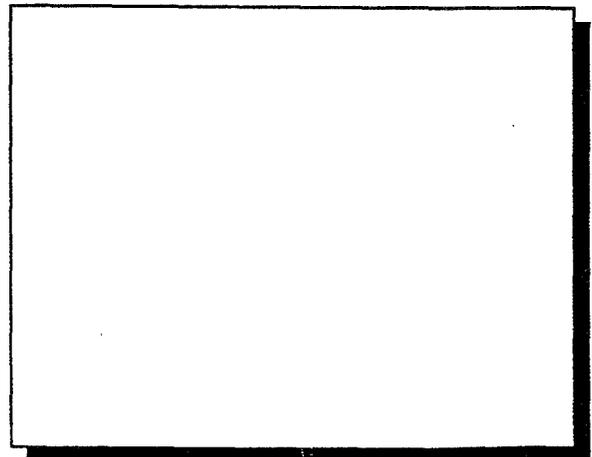
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Indicators and Isolated Statistics

<i>Indicators</i>	<i>Isolated Statistics</i>
followed over time	collected singularly
yardsticks	singular event
formative in nature (policy)	not used to make changes



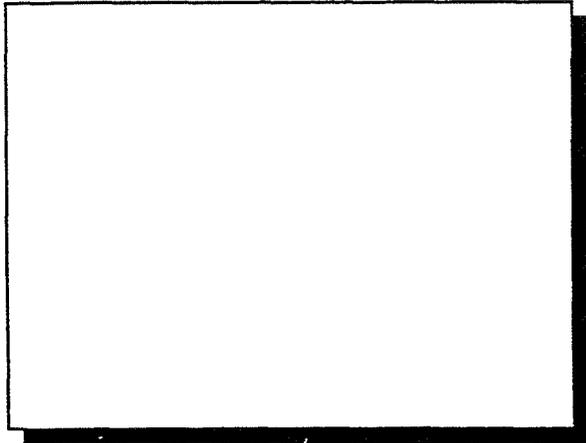
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Indicators and Evaluation

What are the differences?

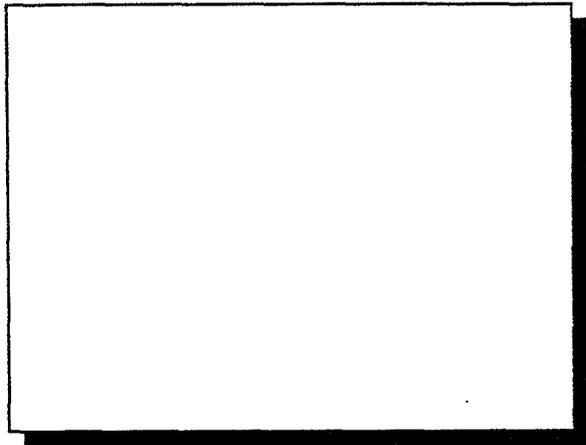
- indicators are inputs to evaluation
- evaluation provides a judgement of worth
- evaluation provides an understanding how the program operates to bring about particular indicator values
- evaluation used indicators and results in policy decisions



Indicators -- Specific to NASA

What are NASA indicators?

- statistics and other information to be collected from NASA educational programs
- collected to determine whether these programs are meeting their goals and objectives
- to eventually be used to determine policy



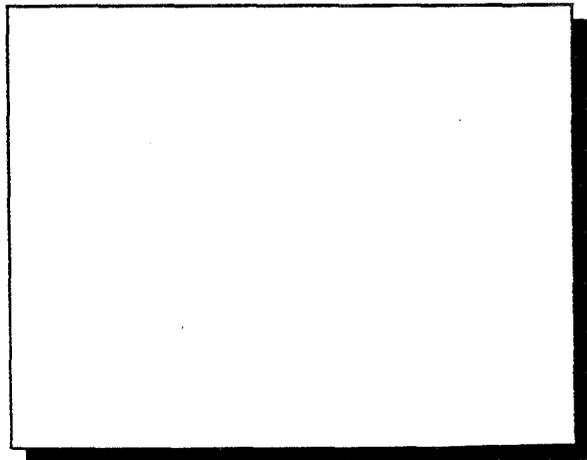
What's Next?

Indicators and Evaluation for
NASA IITA K-12 Programs

Session Two: Developing Indicator Systems

Presenters:

Shelley Canright, NASA, LaRC
Barbara Grabowski, Penn State University

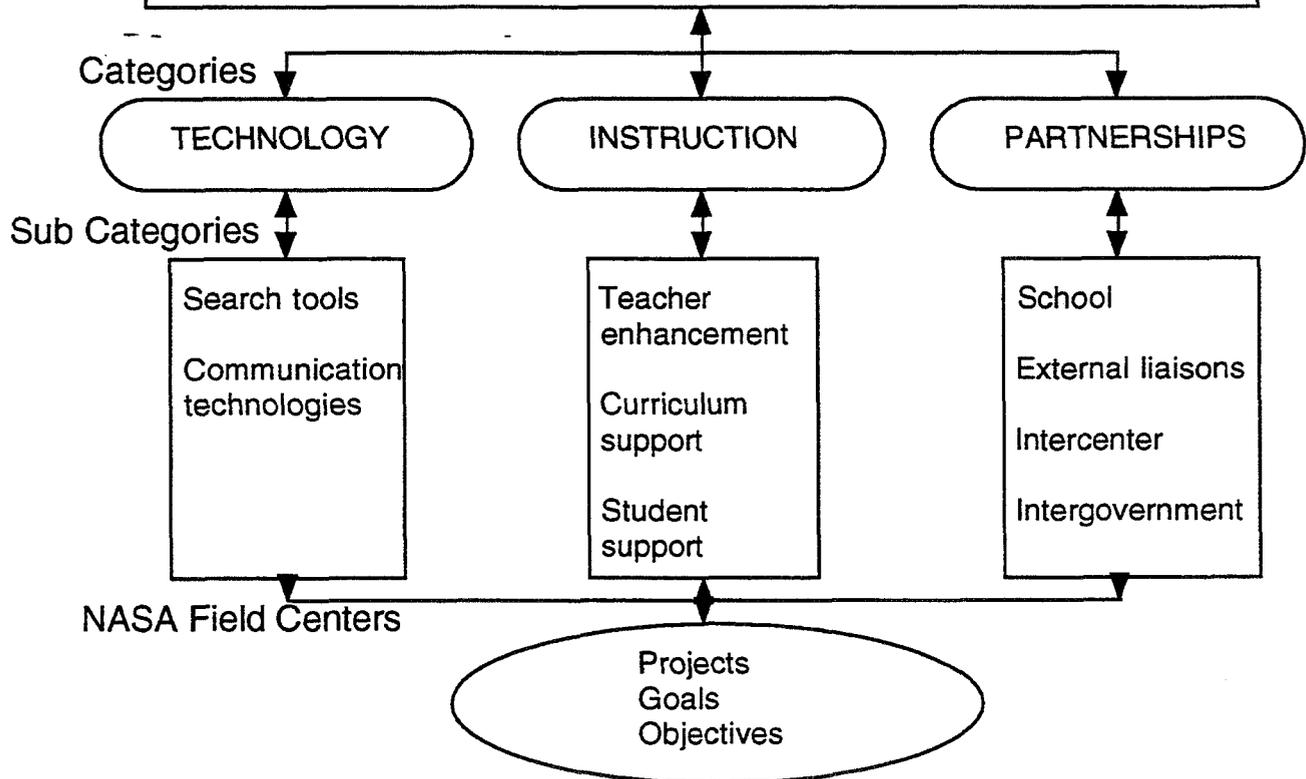


IITA K-12 Goal

To empower American educators and students to utilize the evolving National Information Infrastructure to meet their educational needs

Objectives

- Leverage nationwide NASA education programs
- Reach out to the broadest cross section of education community possible
- Impact early stages of education (elem. and middle school)
- Inspire students with NASA mission applications
- Enable students to become electronic information explorers
- Facilitate communication among separated communities
- Bring real NASA science to teachers and students



GOALS AND CATEGORIES OF NASA IITA K-12 EDUCATION PROJECT

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A. TEACHER ENHANCEMENT AND PREPARATION PROGRAMS

NASA EDUCATION WORKSHOPS FOR MATHEMATICS, SCIENCE, AND TECHNOLOGY TEACHERS (NEWMAST); NASA EDUCATION WORKSHOPS FOR ELEMENTARY SCHOOL TEACHERS (NEWEST)

Description

These two programs provide opportunities for K-12 teachers of mathematics, science, and technology to spend two weeks at a NASA center learning about aeronautics and space. Participants are selected by peer review from a contracting agent that assists NASA in administering the program. Each teacher receives a stipend that covers the costs of travel, housing, meals, and graduate credit. NEWMAST provides for approximately 100 secondary teachers, and NEWEST is a program designed to meet the needs of approximately 125 elementary teachers each summer. Teachers are provided with a wide variety of experiences, including research laboratory observations, presentations, and "shadowships." Individual and team projects are used to enhance the participants knowledge of space and aeronautics and to motivate the teachers to incorporate the summer workshop activities into their classrooms.

Targeted Audience

Selected elementary and secondary teachers.

Objectives

1. To recognize and involve outstanding elementary and secondary teachers.
2. To provide a leadership program for updating and renewing their backgrounds and skills in science, mathematics, and technology.

B. ELEMENTARY/SECONDARY CURRICULUM IMPROVEMENT PROGRAMS

EDUCATIONAL TECHNOLOGY, DISTRIBUTION AND DISSEMINATION OF EDUCATIONAL AND CURRICULUM MATERIALS, NASA SELECT, SPACELINK

Description

Dissemination and distribution of the myriad of NASA publications and curriculum materials involves a variety of programs, including the Teacher Resource Center Network previously reviewed. In addition, materials are distributed electronically via several services. The major program for this is NASA Spacelink, a computer information system for teachers and students. Spacelink is available directly through commercial telephone contact as well as on Internet. Curriculum materials, information about various mission programs, and current news about space programs can be downlinked on computer disc and/or printed out for direct use in the classroom. Occasional video conferences and presentations provided on NASA's television channel, NASA Select, also provide opportunities for educators to learn about materials as well as to develop their own videotape library.

Targeted Audience

Teachers and students.

Objectives

The objective of Spacelink and other electronic distribution systems is to provide an efficient method for educators to obtain NASA educational materials.

NASA'S Education Programs Goal and Objectives

TEACHER ENHANCEMENT

GOAL

Using the NASA mission, facilities, and resources, programs are designed to enhance teacher knowledge and skills that result in positive student outcomes

OBJECTIVES

For Teacher Preparation (Pre-Service) and Enhancement (In-service)

- Provide aerospace programs that introduce the application of mathematics, science and technology in student learning.
- Enhance teachers' capability to design lessons and experiences that use scientific inquiry to affect student learning.
- Encourage a "multiplier" effect to extend the benefits of the in-service program beyond the participants to other teachers and students.
- Provide access to and promote utilization of NASA related materials and information resources.
- Balance gender and increase ethnic diversity of program participants.
- Encourage collaboration between Schools of Education and scientific/technical faculties to develop innovative approaches to teacher preparation for student learning.

**NASA'S Education Programs
Goal and Objectives**

CURRICULUM IMPROVEMENT

GOAL

The development, utilization, and dissemination of science, mathematics, and technology instructional products based on NASA's unique mission and results.

OBJECTIVES

- Develop instructional products in support of national education standards that include teacher preparation and enhancement components and are based on NASA's unique mission and results.
- Disseminate NASA curriculum support products to targeted customers and facilitate their use in NASA education programs and externally implemented activities.
- Review existing products and replace dated materials with new products representative of NASA's unique mission and results.
- Support activities that facilitate an exchange of information among higher education curriculum developers, including review of existing courses to update them in accordance with NASA's unique mission and results.
- Support the development of interdisciplinary courses in science and technology, utilizing NASA's unique mission and results.

**NASA'S Education Programs
Goal and Objectives**

SYSTEMIC CHANGE

GOAL

Enhance capabilities of the educational community through individual and collaborative efforts with a range of partners and through infrastructure change.

OBJECTIVES

Use NASA personnel and resources to:

- Contribute to K-12 mathematics, science, and technology education by promoting the involvement of various community sectors.
- Enhance the participation of schools and organizations serving a significant number of underrepresented groups.

**NASA'S Education Programs
Goal and Objectives**

EDUCATIONAL TECHNOLOGY

GOAL

Provide products and services that facilitate the application of technology to enhance the educational process for formal education and lifelong learning.

OBJECTIVES

- Produce teaching tools (e.g., CD-ROM databases, live or taped video, computer software, multimedia systems, virtual reality) and strategies.
- Develop emerging technologies for, or apply existing technology to, education programs.
- Conduct research into new teaching and learning practices that are made possible using technology.

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IITA K-12 Educational Workshop

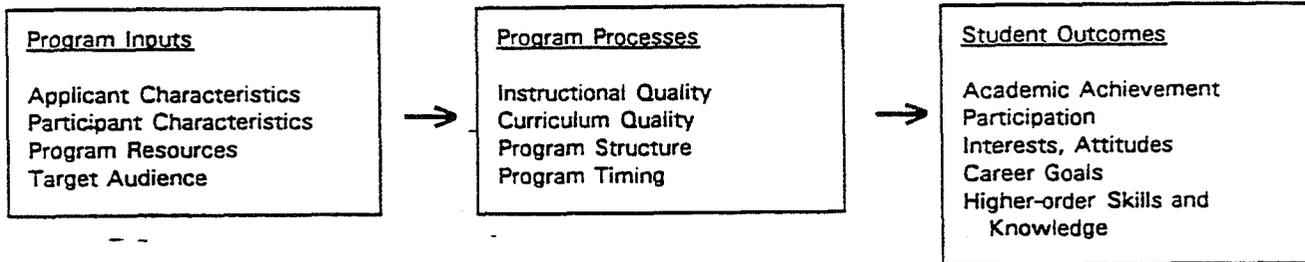
Indicator Systems and Evaluation

APRIL, 1995

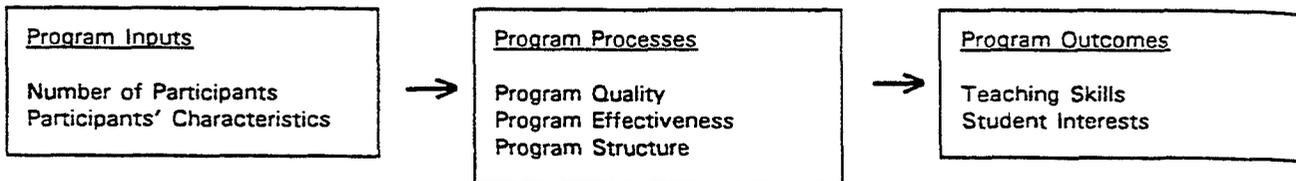
Shelley Canright, NASA LaRC
Dr. Barbara Grabowski, Penn State University

Participants in the workshop session were actively engaged in a hands-on, minds-on approach to learning about indicators and evaluation processes. The six-hour workshop was broken down into three two-hour sessions. Each session was built upon an instructional model which moved from general understanding to specific IITA application. Examples and practice exercises served to demonstrate and reinforce the workshop concepts. Each successive session built upon the previous session and addressed the major steps in the evaluation process. The major steps covered in the workshop included: project description, writing goals and objectives, determining program categories and overall goals and objectives for categories, determining indicators and indicator systems for specific projects, and methods and issues of data collection. The workshop served as a baseline upon which the field centers will build during the summer in undertaking a comprehensive examination and evaluation of their existing K-12 education projects.

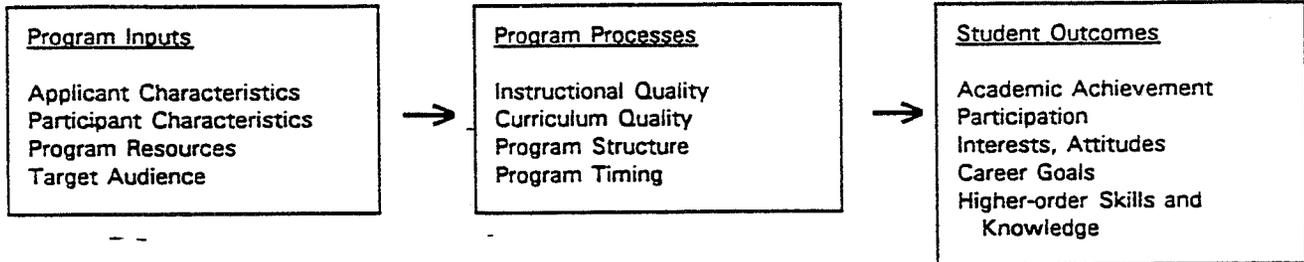
**INDICATOR SYSTEM FOR NASA'S
PRECOLLEGE STUDENT SUPPORT PROGRAMS**



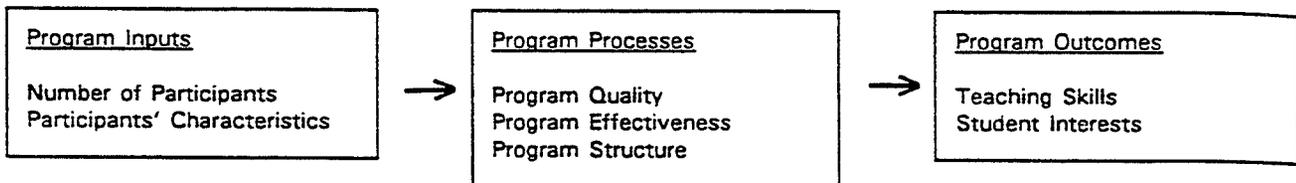
**INDICATOR SYSTEM FOR NASA'S
ELEMENTARY & SECONDARY PROGRAMS IN EDUCATIONAL TECHNOLOGY**



**INDICATOR SYSTEM FOR NASA'S
PRECOLLEGE STUDENT SUPPORT PROGRAMS**



**INDICATOR SYSTEM FOR NASA'S
ELEMENTARY & SECONDARY PROGRAMS IN EDUCATIONAL TECHNOLOGY**



**PRECOLLEGE PROGRAMS
INDICATOR SYSTEM FOR
TEACHER ENHANCEMENT AND PREPARATION PROGRAMS**

OVERALL GOALS

- Using NASA-related topics, increase teachers' content and pedagogical knowledge in mathematics and science.
- Using NASA-related topics, increase teachers' capability to design and implement more stimulating and engaging lessons and experiences for students.
- Provide a "multiplier" effect—that is, extend the benefits of the program beyond participants to other teachers.
- Increase student interest and achievement in mathematics and science.

RECOMMENDED INDICATORS

<u>Input Indicators</u>	<u>Process Indicators</u>	<u>Outcome Indicators</u>
<ul style="list-style-type: none"> • Teacher's Background • Teacher's School Environment and Student Population Served • Teacher Awareness of and Participation in Continuing Education Activities 	<ul style="list-style-type: none"> • Process of Selection of Participants • Program Characteristics • Program Content and Instructional Approach 	<ul style="list-style-type: none"> • Changes in Teacher Attitudes and Practice • Change in Teacher Science and Mathematics Knowledge • Multiplier Effect on Other Teachers • Change in Student Interest and Achievement in Mathematics and Science

**PRECOLLEGE PROGRAMS
 INDICATOR SYSTEM FOR
 ELEMENTARY/SECONDARY
 CURRICULUM IMPROVEMENT PROGRAMS**

OVERALL GOALS

- Create quality instructional materials and programs based on NASA's unique mission and resources.
- Use NASA-related instructional materials and resources to enrich and strengthen the mathematics and science curriculum.
- Increase student interest and achievement in mathematics and science.

RECOMMENDED INDICATORS

<u>Input Indicators</u>	<u>Process Indicators</u>	<u>Outcome Indicators</u>
<ul style="list-style-type: none"> • Background Information About Users • Intended Use of Materials or Program 	<ul style="list-style-type: none"> • Quality And Characteristics of Materials or Program • Distribution and Management Information 	<ul style="list-style-type: none"> • Utilization of Materials • Changes in Student Attitudes, Interest, and Achievement

**PRECOLLEGE PROGRAMS
 INDICATOR SYSTEM FOR
 ELEMENTARY/SECONDARY
 ORGANIZATION REFORM PROGRAMS**

OVERALL GOALS

Use NASA personnel and resources and enlist the participation of other important partners in order to:

- Strengthen mathematics and science education for all students.
- Increase teacher expertise and effectiveness in mathematics and science.
- Increase student achievement and persistence in mathematics and science.
- Increase the awareness and involvement of all community sectors in K-12 mathematics and science education.

RECOMMENDED INDICATORS

<u>Input Indicators</u>	<u>Process Indicators</u>	<u>Outcome Indicators</u>
<ul style="list-style-type: none"> • Participating Schools and Districts • Cooperating Partners • Demographics of Community or Region • Teachers' Background in Mathematics and Science • Major Issues and Problems Confronting Region or Community 	<ul style="list-style-type: none"> • Documentation of Process—Program Records, Finances, Publicity, Outreach 	<ul style="list-style-type: none"> • Implementation of Math/Science Curricula Based on National Standards • Changes in Teacher Preparation and Participation in Professional Activities • Change in Student Interest, Achievement, and Persistence in Mathematics and Science • Development of Community Informal Science Resources • Changes in Community Attitudes and Perceptions of Quality of Mathematics/Science Education

**PRECOLLEGE PROGRAMS
INDICATOR SYSTEM FOR
ELEMENTARY/SECONDARY STUDENT SUPPORT PROGRAMS**

OVERALL GOALS

- Provide research and enrichment experiences at NASA and related sites that will:
- Increase student interest, achievement, and persistence in mathematics and science.
 - Cultivate an awareness of career opportunities in mathematics, science, and engineering.
 - Encourage and retain in the pipeline those students already interested in careers in mathematics, science, and engineering.

RECOMMENDED INDICATORS

<u>Input Indicators</u>	<u>Process Indicators</u>	<u>Outcome Indicators</u>
<ul style="list-style-type: none"> • Characteristics of Applicants • School Environment of Applicants • How Students Became Aware of Program or Competition 	<ul style="list-style-type: none"> • Selection Process/ Criteria • General Characteristics of Program at NASA or Related Site • Quality of Program at NASA or Related Site 	<ul style="list-style-type: none"> • Changes in Student Interest, Attitudes, Educational Aspirations, Career Awareness/Plans • Student Achievement and Persistence in Mathematics and Science

IITA K-12 Education Project

11 Guiding Principles for Designing Indicator Systems

1. **Indicator systems should be closely linked to program goals.**
The system is to show whether programs are attaining their stated goals.
2. **Focus on *changes* in indicators.**
The principle of measuring change over time is critical to meaningful program evaluation and analysis; one-time, post program measures are rarely useful and should be avoided. Whenever possible, good baseline measures (or even prior data) should be obtained as a point of comparison for subsequent changes.
3. **Look for multiple program outcomes and "multiplier effects".**
Important to look for multiple effects in the OUTCOME indicators since programs often have multiple goals and no single measure adequately captures program outcomes.
Because of limited resources, a "multiplier effect" is important for extending program benefits beyond the direct group of participants.
4. **Frame outcome evaluations over an adequate time period.**
In designing program evaluations and assessments, it is important to measure outcomes over a sufficient time interval to assess whether the program produced a sustained change or only short-term effect.
5. **Indicator systems should be designed to measure undesired as well as desired changes.**
All indicator systems should be designed to reflect both positive and negative aspects of program outcomes.
6. **Separate measurement and evaluation from program delivery.**
Program staff should be closely involved in designing evaluation strategies and measures in order to assure that program interests are served. However, by utilizing independent evaluators and organizations with expertise in measurement to carry out the actual measurement and evaluation process, any appearance of self-interest is removed and the quality and credibility of the assessments should be higher.
Also important to establish a separate budget for designing and implementing indicator systems and program evaluation and to assure that this budget is adequate to permit activities that are of high quality.

- 7. Where possible, use comparisons to measure program impacts.**
To answer certain questions about program outcomes, some sort of comparison should be used -- comparison to a control group or to some absolute standard.
More frequently, program impacts can be assessed by comparing them with education data providing national benchmarks.
- 8. Match technique to purpose in measuring short term effects and long term program impacts.**
Assessment of the impact of programs in the short term may involve relatively inexpensive techniques such as pre- and posttests of program participants, focus groups, or completion of questionnaires.
Measurements of long term program impacts usually require longitudinal follow-ups of program participants. (Follow-up studies of program participants should also incorporate some sort of comparison group of non-participants whenever possible.)
- 9. Measurements should be uniform across delivery sites.**
By collecting uniform data for a program across delivery sites, it will be possible to aggregate data to determine the overall impacts of the program and also to disaggregate data to examine impacts at each specific site or impacts on subgroups of participants as defined by such characteristics as gender and race/ethnicity.
- 10. Consider the possibility of *sampling* rather than measuring ALL participants.**
It is important to utilize professional expertise to determine when sampling is appropriate and to design proper techniques for sampling, achieving high response rates, and analyzing the data.
There are trade-offs between the lower cost of sampling and the precision associated with the larger group.
- 11. Collect essential data that indicate whether programs are meeting NASA goals for enhancing diversity and serving special populations.**
Collect ALL essential information. For example, in teacher enhancement programs, not only should data on the gender and race/ethnicity of participating teachers be collected, but information should also be obtained about the race/ethnicity, socioeconomic status (SES), and other characteristics of the students and schools that these teachers influence. Information should be collected to show whether implemented programs have actually achieved the equity and diversity they claim, since some programs may not effectively reach the populations they target or may not have the desired impact on those groups.

Home Page Coordination

Steven Hodas, Chairperson

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HTML Workgroup Session

prepared by Steven Hodas

Purpose

To identify issues and design implementation strategies to better promote the NASA IITA K-12 project on the web and, in so doing, better serve our constituents.

Issues

The web has changed dramatically in the past year. There are many more users, both K-12 and others, and vastly more sites, both within and outside of NASA. The volume of information and the state-of-the-art of web publishing have advanced considerably, and expectations are much higher all around. At the same time the IITA K-12 program has greater needs than ever for its work to be presented in a coherent, comprehensive, and identifiable manner online. All told, it is much more difficult to be found—let alone to stand out—on the web today than it was one year ago.

The upshot of all this is that the bar has been raised, in terms of what constitutes an acceptable or outstanding presence on the web. The scattershot and haphazard approach that IITA centers have heretofore taken towards making their K-12 projects available online will no longer serve in this new environment.

Preceding questions of design and coherence are critical issues are those of comprehensiveness and "brand identity". First, all IITA K-12 projects must be accessible via the web to the greatest extent possible, even if the nature of the project means that its only web presence is a descriptive paragraph of text. Second, all IITA K-12 projects must be readily identifiable as such to the casual browser without having to wade through dense bureaucratic prose. Third, a clear overview of all IITA K-12 projects should be easily accessible from a single page.

After these questions are resolved and solutions implemented the discussion can move on to more subtle and difficult issues like coordination of content and design. Further, the questions raised about information comprehensiveness, accessibility, and design relate more widely to NASA educational information in general, which, in its current state, is too variable in quality and too widely scattered and poorly indexed to be of reliable utility for most users. It is thought that perhaps the questions and answers generated by the IITA K-12 effort to improve its webspace will be applicable to the larger NASA educational context.

Outcomes

Representatives of all IITA K-12 funded centers agreed to make comprehensive information about their projects accessible over the web as soon as possible, and most have done so. I have designed a one-stop IITA K-12 page (<http://quest.arc.nasa.gov/iitak12.html>) that pulls together information gathered from the centers and incorporates links to their sites so that those who want more in-depth information may easily get it.

To enhance "brand identity" I have designed a new IITA K-12 logo (visible on the home page) that is in the process of being converted into smaller buttons. These buttons will be placed as hot links at the bottom of every IITA K-12 related web page to serve as identifiers and to lead users to the one-stop overview should they so desire. Each center also agreed to title each of its web pages such that the words "NASA" and "IITA" appears at the beginning of each page title in some sensible manner. To date this has not been implemented by most centers, and what implementation there is has not been consistent.

Future Exploration

Participants agreed that two topics in particular bear further looking into. The first is the whole question of evaluation: what is the best way to judge the quality and the usefulness of our web efforts to our diverse constituencies. The second is more technical in nature and relates to keywords and indexing. The suggestion was made that it might be possible to comment in keywords on each page that describe its sponsorship and content. If such keywords were standardized across projects and if they are readable by web-crawlers and indexing robots then it should be somewhat easier for users to find what they are looking for without each center having to implement its own search engines for the purpose.

These and other issues will be explored in the coming months by informal collaboration among interested parties.

Facilitating Inter-Center Collaborations

Jennifer Sellers, Chairperson

OMIT TO
END

FACILITATING INTERCENTER COLLABORATIONS

IITA K-12 WORKING GROUP

APRIL, 1995

Chairperson: Jennifer Sellers (ARC/DC/Sterling Software)
Present: Steve Barba (JPL), Tom Clausen (ARC), Lee Duke (DFRC), Garth Hull (ARC), Beth Lewandowski (LeRC), Bill Likens(ARC), Malcom Phelps (HQ), Jeff Seaton (LeRC), Jennifer Sellers (ARC), Marc Siegel (ARC), Karen Traicoff (ARC)

MINUTES

Lee Duke began by reporting on an educational outreach meeting he had just attended with representatives from each of the four NASA aeronautics centers, ARC, DFRC, LaRC and LeRC. This Aeronautics Education Council has agreed to work with Geoff Haines-Stiles to produce a "Live From"-style program focusing on aeronautics. No details have been worked out yet.

Marc Siegel explained the way ARC's "Sharing NASA" projects work, using *Smart Filters* to keep experts' email addresses private. The *Smart Filters* are people who manage the email between experts and participants signed up to the mailing lists in any given "Sharing NASA" project. ARC is currently collaborating with DFRC in the "SRA-F18 Online" project. "TOPEX/Poseidon Online" is a current collaboration between JPL and ARC. Both projects are going fairly well and are laying important groundwork in how ARC can collaborate with other NASA centers in a "Sharing NASA" project. Marc will be following up with other centers this summer about that. ARC has enough experience in managing this type of online mentoring project that they would like to begin to pass lessons learned on to other centers to implement "Sharing NASA"-type projects in conjunction with projects at their own centers. People at the IITA centers are encouraged to contact Marc about setting up a project like this, and Spacelink staff was also mentioned as being among those who might like to implement this type of project. Someone at ARC will act as a consultant for the first project or two that a center wishes to implement. Additionally, ARC is looking to spread this type of project beyond NASA by collaborating with other agencies, for example, NOAA (the National Oceanographic and Atmospheric Administration) and with commercial vendors, for example, Intel.

Marc then discussed another kind of online mentoring that ARC is now trying in conjunction with the Mars project, and suggested that it might be a model for an aeronautics project. In this kind of online interaction, teachers are paired one to one with experts. The teachers are on a mailing list together. Each teacher, who in this case has a particular interest and also some expertise in Mars, agrees to answer questions that others may have relating to Mars. If no teacher on the list knows the answer, a teacher who is paired with an expert likely to have the answer volunteers to ask the

Mars expert and post the answer to the entire list. In this way, all teachers on the list can become experts themselves and acquire a large body of knowledge, both collectively and individually, on a subject of their particular interest. Additionally, the question-and-answer pairs will be archived so that the information will be available to other educators and students with Internet access. This is a new experiment for ARC, and they are not yet looking for partnerships with other IITA centers in this area.

Karen Traicoff explained ARC's "online Flight Community", a third kind of online mentoring project. In this case, a number of schools are identified. They belong to an FAA-sponsored consortium of magnet schools with some kind of aeronautics focus, from engineering to mechanical repair. The idea is to begin to get these schools active on the Internet, talking with one another and with experts in the field. A general mailing list for educators and experts is set up to be moderated. As the program grows, other lists may be set up. All postings will be archived for anyone on the Internet to access. Other IITA centers are asked to identify schools and experts that might participate in the mentoring.

Steve Barba wanted it known that he would very much like to work with other NASA centers in disseminating Project SPACE. Karen Traicoff (ARC) has already started a discussion with JPL about that. Other interested folks should probably contact Steve directly.

Lee Duke would like DFRC to work next year with JPL on a "Telescopes in Education" project for students with disabilities. He described the public schools for special needs students as doubly under-served in that they have a high concentration of poor students because affluent parents often send their students to private schools.

A meeting is planned at LaRC at the end of April for those IITA centers who work in the area of low cost networking to gather and share experiences. One or more white papers, which can be shared in the K-12 community, are expected to be generated. All IITA centers are invited to attend.

Garth Hull reported on an NSF project that addresses articulation issues, that is, issues around developing a base of knowledge on education and career paths for students. There will be a joint high school and community college venture in Little Rock, Arkansas. Garth will try to get more details on whether this is something for IITA centers to consider collaborating on.

Another possible collaboration with a group outside of IITA was brought up by Lee Duke. He would like to see the low cost networking information be disseminated to the medical community.

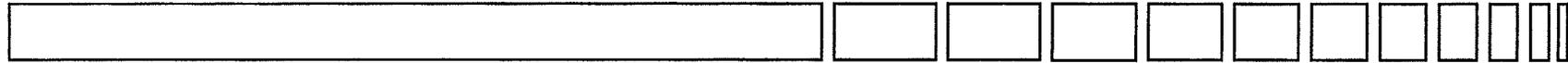
The final type of collaboration discussed at this meeting was sharing the outreach that ARC has been doing at national teacher conferences. It would be ideal if the center

closest to the national conference took the lead and other centers sent staff to describe their programs. The three national teachers conferences that NASA's Education Division covers are the National Science Teachers Association (NSTA), the National Council of Teachers of Mathematics (NCTM), and the International Technology Education Association (ITEA). [Note: when the chair presented these minutes during the wrap-up session on the final day of the IITA K-12 Workshop, Paul Hunter (HQ) reminded the centers that there are also many local conferences in which IITA centers can and should participate. A list of regional teacher conferences can be acquired from the Center Education Office.] Jennifer Sellers has the action to contact Pam Bacon in NASA's Education Division at headquarters to get the dates for next year's national conferences.

SYNOPSIS

The group then set down a simple process which IITA centers can use to implement collaborations. That process is as follows:

1. Centers interested in collaborating decide which center will act as the lead.
2. The lead center takes responsibility to discuss and define roles with the other center(s).
3. The lead center writes up the project, including the resources needed at the other center(s) and includes that information in the fiscal year proposal to management.
4. The other center(s) take responsibility to work with the lead center to define roles.
5. The other center(s) take responsibility to write up their portion only of the project and submit it in the fiscal year proposal to management.
6. The lead center takes responsibility to make sure that follow-up activities and evaluation are implemented, whether these are carried out at the lead center or the responsibilities are delegated to the other center(s).

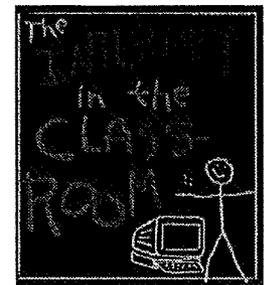


Connecting with NASA's people using networks

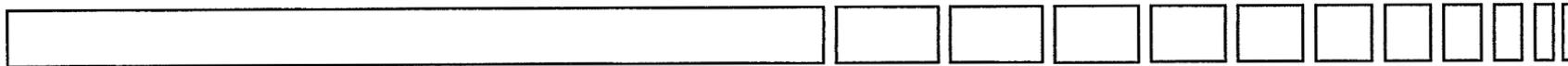
Marc Siegel

NASA Ames Research Center

msiegel@quest.arc.nasa.gov



NASA K-12 Internet Initiative: On-line Interactive Education



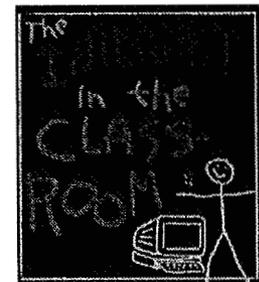
Video Tutorial Series

Outreach to national K-12 community

Internet server called quest.arc.nasa.gov

Internet support for NASA's education infrastructure

Online Interactive projects



Publications and Communications Strategy

Sandy Dueck, Chairperson

IITA K-12 Educational Workshop
Publications and Communications Strategy

April, 1995

Chairperson: Sandy Dueck, ARC

Support Material

The IITA K-12 Program produces a wide range of Internet related products and services that are distributed and tested across the board. Currently only 3% of the classrooms and 40% of the schools are connected to the Internet according to recent studies. For this reason teachers, students and administrators still rely on published hard copy information for the majority of their material.

The purpose of this session is to investigate two fields of interest

1. What hard copy publications does IITA K-12 want to target for distribution of its networking approaches, curriculum products and Internet services, and
2. Identify what we have learned that can best serve those in the user community.

Two deliverable will come out of this working session: one is a list of the periodicals that we intend to submit articles, and two is a list of subjects and lessons learned that we intend to publish.

Synopsis

IITA Publications and Communications Strategy

Hard-copy Publications:

- National Science Teachers Association
 - Science and Children - Elementary
 - Science Scope - Middle School
 - Science Teacher - High School
- Electronic Classroom
- Earth and Space (AGU) - Earth Quest, Earth Link (NOAA)
- Scholastic
- CIESEN
- Distance Learning
- National Geographic World
- National Geographic
- Air and Space (Smithsonian)

- Smithsonian magazine
- NASA - Educational Horizons (K-12), Science Information Systems Newsletter
- ISN
- Consequences (The Nature and Implications of Environmental Changes)
- Aspen Global Change Research Institute
- Odyssey
- Aztec
- National Science Foundation
- EPA
- Math Journal (National Council of Teachers in Math)
 - Arithmetic Teacher - K-12
 - Math Teacher - Secondary
- Physics Teacher
- Biology
- Earth Vision
- Sierra Club
- Audobon
- American History (New York Museum)
- Sky and Telescope
- Pacific Discovery (California National Academy of Science)
- Sierra (used to be Sierra Club Bulletin)
- Classroom Connection (newsletter)
- Student Connection (newsletter)
- Enhance (bringing teachers and technology together re: Internet)
- IEEE journals
- Wired
- Mother Earth News
- Technology Connection (magazine for school media and technology specialists)

Online Publications:

- Econet
- Ecolink
- EcoRama
- National School Testbed Network

Additional Contacts/Resources:

- State Education Departments
- International Society for Technology & Education

- RSPAC
- Spreading the gospel of K-12

Publications:

- Poll K-12 Project members on what they'd like to write about and their target audience (students, teachers, decision/policy makers)
- Send queries: listing subjects, asking what editors would be interested in
- Contact AGU Director of Education (EOS) - regular articles; a column
- Pick up articles from home pages and gear to special publications
- Maintain special area on Quest: listing available articles, publications, videos
- Publish a quarterly IITA/K-12 magazine, e.g., Mission to Planet Earth

Subject matter:

- Lessons learned—what works and what DOESN'T work
- Statistics
- Trends
- Things CURRENTLY available

Other methods:

- Link all K-12 home pages
- Annual video showing problems, solutions, lessons learned
- K-12 Network Support Center

K-12 lessons learned—what works...

- Infrastructure is required
- Curriculum development plays a big part
- Need to know how to do everything
- Administrative support is crucial
- Find interested teachers
- Training both teachers and mentors is essential
- Dedicated technical support to train teachers is a must
- Curriculum development is not only happening at the universities, it's also happening in the science museums
- Get education offices up to speed before going into schools
 - Rural school districts can become successful network contributors

and what doesn't...

- Believing everything you hear from school districts: PR should follow substance
- Sales vendors that act as consultants to schools are dangerous

What's needed:

1. Journal of Failures
2. Edit and distribute via Quest the Monthly Reports to NASA
3. Interproject information exchange (IITA/CAN), build off of what each other is doing
4. Build WAIS link for IITA/K-12 community

800 Accounts and Acceptable Use Policy

Mike DeFrenza, Chairperson

IITA K-12 Educational Workshop
800 Accounts and Acceptable Use Policy Synopsis
April, 1995

Chairperson: Mike DeFrenza, ARC

800 Accounts

General 800# access and online accounts will be transitioned to Spacelink. Ames will migrate all existing accounts to Spacelink in an orderly manner.

In special cases, as directly dictated by a project activity, Ames will issue 800# access and online accounts as required.

Acceptable Use Policy

A draft AUP will be issued to guide the AUP development of each Centers specific AUP requirements. The draft AUP will be distributed by May 31, 1995.

800# and Internet Accounts

**IITA K-12 Workshop
April 11-13, 1995
Mike DeFrenza
NASA Ames/Sterling**

Outline

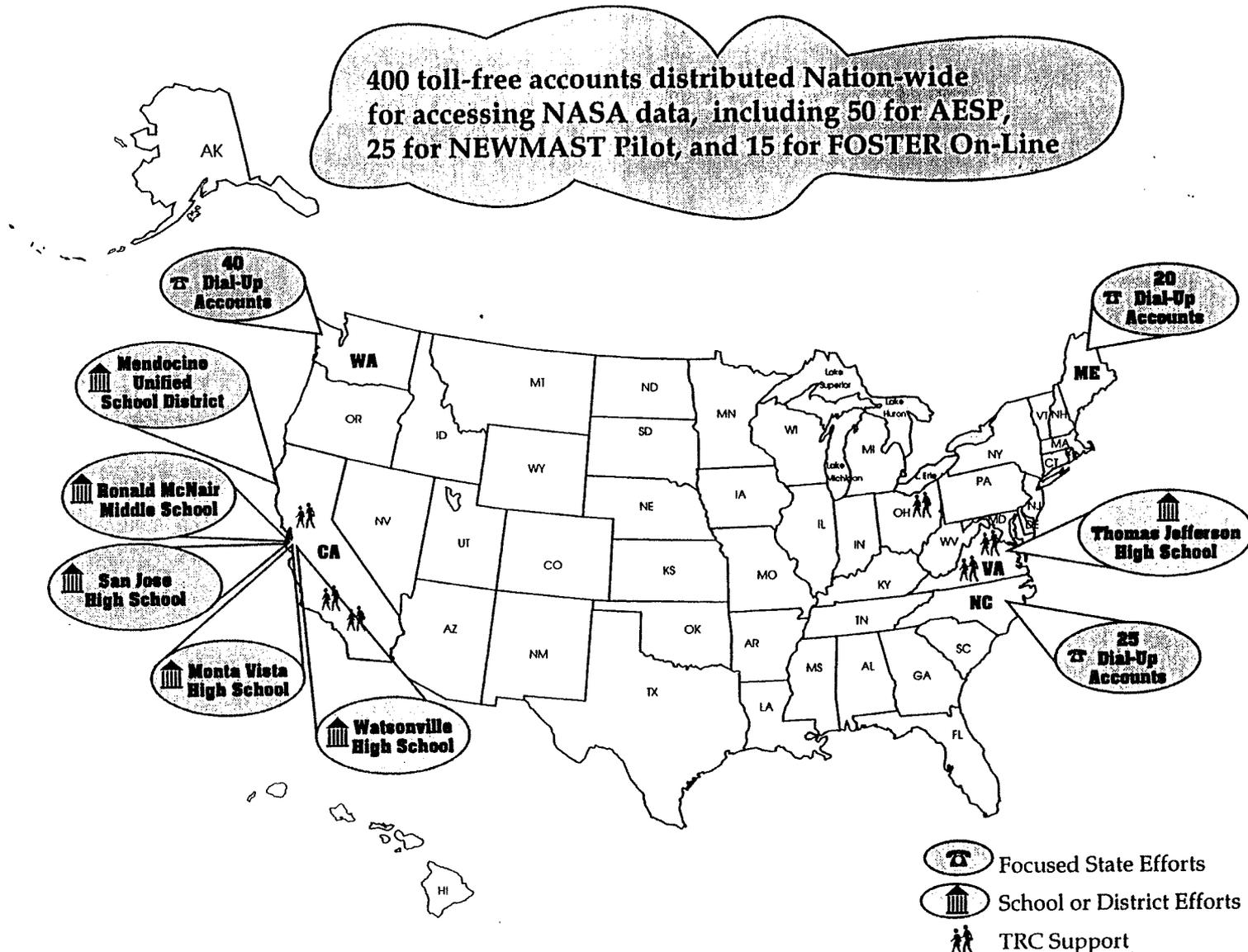
- **History (Ames perspective)**
- **Changes in the environment**
- **Potential alternatives for future activities**

History

- **K-12 dial up service is supported by an NSI/ local Ames service**
 - K-12 quickly became a major user of dial up service
 - Approximately 700 800# accounts active today
 - Internet accounts were offered via a K-12 resource (quest.arc.nasa.gov)
 - Majority of the accounts have terminal emulation capability only; no SLIP or PPP
- **200 dial up accounts are for 800# access to Spacelink**
- **100 dial up accounts for rural access to non-NASA servers**
- **Used the capability for targeted outreach and volunteers**

IITA/AMES K-12 Outreach

400 toll-free accounts distributed Nation-wide
for accessing NASA data, including 50 for AESP,
25 for NEWMAST Pilot, and 15 for FOSTER On-Line



Today's environment

- **Numerous commercial providers available**
 - \$10-30 per month depending upon access
 - Numerous POPs; generally a local call
- **Spacelink is providing 800# dial up services for their customers**
 - Many states have programs for their teachers
- **SLIP and PPP much more critical for useful Internet access**
- **Desire by Ames (NSI) to limit dial up service for K-12; future funding is an issue**
- **Targeted outreach opportunities still exists, but we are not actively seeking them**

Potential alternatives

- **Move accounts and dial up access to Spacelink offering**
- **Procure the services from a commercial provider (i.e., GLOBE Project approach)**
- **Limit/Increase dial up connectivity in the Project**
 - SLIP or PPP would be minimal offering
 - Need for targeted outreach and volunteers continues
- **Continue as is and pay the bill when it comes due**
 - Today 800# service is free to NSI/Ames
 - NSI/Ames provide equipment and support for minimal charge

Appropriate Use Policy

**IITA K-12 Workshop
April 11-13, 1995
Mike DeFrenza
NASA Ames/Sterling**

Appropriate Use Policy

- **AUP for network connectivity**
 - Same policy for dial up and leased line connectivity
 - For leased lines, included in Memorandum of Understanding
 - For dial up lines, part of registration process
 - NSI AUP and NSI Security Policy
- **AUP for Internet accounts**
 - Registration forms
 - Teacher agreements
 - Student agreements; parents also sign (used mostly for student volunteers)

GUIDELINES AS TO WHOM MAY BE REGISTERED FOR ID COMPUTER ACCOUNTS

Users should be engaged U.S. government business, research or actively involved in providing operations or system support for government owned or supported computer/communications equipment.

SPECIFIC INSTRUCTIONS FOR TEMPLATE FIELDS:

Type of Access Required:

Direct Dial-In: Will register you for the local 415 area-code telephone number
800 Number: Will register you for the 800 (toll-free) access number from anywhere in the U.S.
SLIP: Will give you SLIP access (via the 800 or 415 number) to Ethernet resources at NASA ARC.
APPLETALK Remote Access: Will give you remote access to Appletalk Resources (quickmail, printers, appleshare, etc.) Note: to use this service you MUST be running system 7.0 or above and have a 2400 baud or faster modem.

ACCOUNT POLICY

"Unauthorized use of the computer accounts and computer resources to which I am granted access is a violation of Section 799, Title 18, US. Code; constitutes theft; and is punishable by law. I understand that I am the only individual allowed to access these accounts and will not knowingly permit access by other's accounts without written approval. I understand that my misuse of assigned accounts, and my accessing other's accounts without authorization is not allowed. I understand that this/these system(s) and resources are subject to monitoring and recording. I further understand that failure to abide by these provisions may constitute grounds for termination of access privileges, administrative action, and/or civil or criminal prosecution."

_____ *Requestor's Initials*

This account is for your use to access the computer systems at NASA Ames Research Center. Restrictions upon your use of the Network are as follows: Use is restricted to Official U.S. Government Purposes Only, any other use is prohibited. Divulgence of computer access telephone numbers to any other person is a violation of security regulations and is prohibited by law.

I have read and understand the above statement of policy. I understand that failure to abide by the letter and spirit of this policy will result in the loss of my account.

Signature: _____

Date: _____

This individual does have a legitimate need to access this/these system(s) to perform authorized Government activities.

NASA Branch Chief's Name (printed): _____

NASA Branch Chief's Signature: _____ Date: _____ Org: _____

Registration for NASA Internet Student Account

Name:

School or Organization:

Home Address:

Home Phone:

Parent Name:

Parent Work Phone:

What type of account are you requesting? (check one box)

Full capability-You have no current Internet capability.

Terminal server only-Check this if you already have an existing home for Email, but there is a problem dialing up your Email server.

You are a:

US citizen

Permanent Resident Alien

Foreign National

The following four questions pertain to the equipment you will be using to access your internet account.

Telecommunications software:

Modem make/model:

Modem speed:

Computer/OS:

PARENTS: Please Read This Carefully

Your child is being given an account on a NASA Internet computer, to be used during the time he works with us on our projects. Internet usage will be not be supervised, nor will we be able to control access to material that is available on systems which are reachable from ours. This material may include documents, images, and discussions that some may find politically, socially, or sexually offensive.

By signing below you agree to instruct your child to behave in the manner stipulated in this and any accompanying documents. You agree to hold NASA blameless for any speech, action, behavior, or access that may result from your child's participation in this project.

You may have your child's account canceled at any time by calling the NASA K-12 Internet Support Center at 415.604.0766. The Center is open Monday-Friday from 1-5:00 pm Pacific time.

Unauthorized use of these computer accounts and their resources is a violation of Section 799, Title 18, U.S. Code, and constitutes theft and is punishable by law. I understand that I am the only individual allowed to access this account and will not knowingly permit access by others without

studreg.0994

445

written approval. I further understand that failure to abide by these provisions may constitute grounds for termination of access privileges, administrative action, and /or civil or criminal prosecution. I certify that all of the information provided on this form is correct to the best of my knowledge.

By signing below, each of you assert that you have read, understood, and accepted each of the provisions of this agreement. You also acknowledge that you have read the two included documents (*Welcome to Your NASA Internet Account* and *Password and Network Security Issues*) and agree to abide by the guidelines they detail.

Student Signature

Date

Parent Signature

Date

Please mail this form to:
K-12 Internet Support
Teacher Resource Center
NASA Ames Research Center
T-025
Moffett Field, CA 94035

GUIDELINES FOR USING YOUR NASA INTERNET ACCOUNT

In acquiring an account on the NASA network, one of the premier research and education networks in the world, you become a member of a very special organization. This document is meant to familiarize you with some of the responsibilities that come with this privilege, and to secure your agreement to abide by certain rules and policies.

Although we have tried to phrase things in plain English, please remember that this is a formal agreement between us, and that violation of any of its provisions is grounds for the termination of your account. If there is anything that is not clear to you, please call the NASA K-12 Internet Support Center at 415.604.0766 for clarification before signing. The Center is open Monday-Friday from 1-5:00pm Pacific time.

Your Responsibilities as a NASA Account Holder

You are being considered for a NASA Internet account so that you may assist the K-12 Internet Initiative with its work, and we expect that you'll use your account only for this purpose. If you'd like to explore the net for recreational or other educational purposes (as we hope you will), we encourage you to get an account from one of the many low-cost or free public-access providers around the country. We can provide information on this if you're interested.

The NASA network is government-owned and operated, financed with public money. As an account holder on a NASA system you have a responsibility to use NASA resources wisely, and to maintain its security. The following are some examples of activities that may not be engaged in from a NASA account:

Using the network for any illegal activity whatsoever. This includes but is not limited to unauthorized use of copyrighted materials like certain computer programs, graphics, or newswire articles; traffic in obscene material; and threatening or harassing other network users.

Using the network for financial or commercial gain.

Gaining or attempting to gain unauthorized access to network resources.

Disrupting network operations.

Deliberately wasting network resources, including bandwidth, storage, and CPU cycles.

Conducting "experiments" that have the potential to disrupt network operations.

Vandalizing data.

Compromising the privacy or security of other users.

Using someone else's account.

Sharing your account, password, id, or telephone access numbers with anyone else, any time, for any reason.

NASA maintains strict network security. If you attempt to breach it in any way, you will be identified and prosecuted. Some of the activities listed above, in addition to being violations of our network use policy, may also be violations of Federal, State, or local laws. We will report any suspected illegal activities to the appropriate authorities for investigation.

In order to maintain NASA security, activity in your account is subject to monitoring by the system administrators and security personnel. Under such circumstances, the contents of your files may be inspected and your keystrokes monitored. In general, inspection and monitoring will only take place if there is good reason to suspect that your account is being used for illegal or inappropriate behavior. Nevertheless, it is in your interest not to conduct any activity on the network that you would not want revealed to a system administrator.

Your Responsibilities as a Net Citizen

The Internet is more than a collection of files, or a means to send e-mail. It's a thriving culture of twenty million people, bigger than many countries! Like any culture, the net has a set of customs and manners that have developed over time to make life more enjoyable, more productive, and more secure for its citizens. As a member of this community you have a responsibility to learn, abide by, and support what are sometimes called "net values" or "netiquette". There are far too many, and too subtle, nuances of net values to explore here (see the New Users directory on the gopher at quest.arc.nasa.gov), but we can provide some broad guidelines:

With 30 million people from all over the world (half of all users are outside the US) the Internet is home to lots of people with very different backgrounds, values, ideas, and ways of expressing themselves. While this diversity is one of the things that makes the

net such an interesting place, it also means you should take special care to avoid giving or taking offense too easily. Everybody's got opinions on everything, and a lot of them may differ from yours. Treat other people with the respect with which you'd like you to be treated, even when you disagree.

There's a LOT of stuff floating around the net, some of which you may find offensive. While we can control the material that's stored on NASA systems, we have no control over the rest of the net. You may disapprove of some of the image files that are available, some of the stories or articles that are posted, or some of the opinions that people express over e-mail. The best way to deal with non-NASA stuff that offends you is to stay away from it. If you come across material on a NASA system that you suspect is in violation of our policy please let us know so we can take appropriate action. If you feel at any time that you are being harassed over the network you should contact fuzzy@quest.arc.nasa.gov so we can take action. All users have the right to be let alone.

Real-life laws apply on the net. Libel and slander are still illegal. Stealing other people's property (like software) is illegal. Obscenity is illegal. Causing harm is illegal. Threatening or harassing people is illegal. If you engage in any of these activities you run a real risk of being caught and prosecuted. Don't do it, and report those who do.

It's easy (maybe too easy) to cut, paste, and post on the net. Don't use other people's words without giving them credit, and don't post private mail to public forums like newsgroups or mailing lists without the author's permission. While this is not (usually) illegal, it is considered bad manners to do so.

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Your Responsibilities to the K-12 Initiative

The purpose of providing you with an account is to encourage the development of internetworking skills among the broad population of K-12 educators. To facilitate this goal we require that you engage in four activities:

- 1) Find ways to use the Internet as part of your classroom activities or classroom prep time. Get yourself and your students involved on-line. If your account goes for three months without being used we will contact you about terminating it.
- 2) Share your experiences with other educators and with your students. Become a mentor and a model for networking skills.
- 3) Pursue local connectivity for yourself and your school. We do not have the resources to be a significant provider of K-12 connectivity, nor would that be appropriate. Every week new and more affordable connectivity options appear around the country, and you and your school should pursue these.

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Using the network for financial or commercial gain.

Gaining or attempting to gain unauthorized access to network resources.

Disrupting network operations.

Deliberately wasting network resources, including bandwidth, storage, and CPU cycles.

- 4) Three times each year submit a summary of your activities in the above three areas to fuzzy@quest.arc.nasa.gov. These are due in June, September, and January and are required to maintain the active status of your account.

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Password and Network Security Issues

This is a short list of Do's and Don'ts (mostly Don'ts) to help you keep your account safe. Safe-keeping is your responsibility and in your interest; if we find that you've failed to maintain NASA security we will remove your account.

You've been assigned a default password that will allow you on the system, but you must change it as soon as you log on for the first time. NASA's terminal server system will automatically prompt you to enter a new password. On the quest.arc.nasa.gov computer, you will have to initiate the change by typing the "passwd" command (without the quotes).

To maintain network security, it is important that you choose a good password, using the following guidelines:

- Passwords should not be too short. The system will not accept passwords less than 8 characters.
- Passwords should never be easily guessable. Using your name, your phone number, your name backwards, the name of your school or your license plate is a bad idea. Common dictionary words are not advised, nor are the names of TV, movie, or comic-book characters.
- Combining two words is one good way to start. Adding a punctuation mark and numbers to your password is another good idea. Using both upper and lower case letters helps to further secure your password.
- Some examples of good passwords include:
Mavis:mydog 1969-year zippy(\$\$) Dr.Pain##

Do not divulge your password to *anyone*. If other teachers or students must use your account, NASA requires that you personally logon to the system without revealing your password. If you plan to allow others to use your account on a regular basis, let us know first. You are responsible for all activity that occurs from your account.

If you do inadvertently share your password, or suspect that it might have been otherwise compromised, change it immediately. You can do this on most NASA machines by typing "passwd" (no quotes) at the command prompt.

Choose a password that you can remember without writing down. If you must write down your password, do not leave it near your computer or in your wallet. Don't write it on the same page as your user name or the dial-in phone number. Do not write "This is my NASA password" on the paper. Use common sense, and guard it as carefully as you would your cash machine code.

Don't enter your password while someone is watching you type. Common courtesy dictates that a person should turn away when another person is typing a password. If you are about to enter your password but your companion does not turn away, ask the person to avert his or her eyes.

Do not keep a record of your password on-line. Also never include your password in a mail message. There have been cases in which hackers have illegally browsed mail messages/files and passwords had been located. Avoid this threat by not saving passwords online or communicating them via E-Mail. Of course, you shouldn't be communicating your password by any means

Be aware that you may maintain only one connection to the NASA terminal server at a time. Your account and password will not support multiple simultaneous logins and any attempt at this will disable your account and trigger a network operations alarm.

Finally, never answer questions about your account or password to strangers on the telephone or on Email. Crackers have been known to pose as computer security personnel. Typically they will say something like, "This is John from NASA Security and we are doing a security audit; please tell me your account name and password." A legitimate NASA security person does not need to ask that question. So if that happens to you, please do not reveal any details and report this incident to the NASA K-12 Internet Support Center immediately. You can reach the Support Center by phone at 415.604.0766, Monday-Friday from 1-5:00pm Pacific time, or by email to fuzzy@quest.arc.nasa.gov.

NSI ACCEPTABLE USAGE POLICY

What is Acceptable Use of the NASA Science Internet?

The following "Acceptable Use Statement," along with official NASA policy on Automated Information Security and relevant U.S. federal laws, forms the basic tenets of the NSI Security Program:

Summary:

NSI supports all NASA science flight missions, discipline research programs, and collaborating scientists at NASA Centers and elsewhere.

NSI is not to be used for private gain or profit.

Specific:

1. Use of NSI must be in support of official NASA programs; all user requests for NSI connectivity must be validated and supported by cognizant NASA Science Discipline Chiefs.
 2. Use of NSI to support coordination and administrative execution of NASA research grants is permissible.
 3. Use of NSI to support NASA research, related training, and associated technical activities at non-profit institutions of research and education is acceptable.
 4. Use of NSI for commercial or intellectual gain by for-profit organizations is not acceptable, unless those organizations are using NSI to satisfy specific NASA contract or grant requirements.
 5. Use of NSI for research or education at for-profit institutions will be reviewed on a case-by-case basis to ensure consistency with NASA programs; lack of program approval will result in disconnection.
 6. Use of NSI to gain unauthorized use of resources attached to NSI may result in disconnection and legal prosecution. NSI will make every attempt to implement precautions to safeguard against unauthorized use of NASA computers, databases, and other attached federal resources.
 7. Use of NSI for the introduction of worms, viruses, trojans, or other software which maliciously interferes with normal NSI operations is unlawful.
-



NSI SECURITY POLICY

What is the Security Policy of the NASA Science Internet?

NSI is fully interconnected with the Internet and other networks. In general, valid users enjoy unrestricted network access. However, access from Internet or other sites to or through NASA/NSI resources is only authorized when that access is in conjunction with valid work or project-related requirements.

The use of NSI is inappropriate when that use:

- Compromises the privacy of users and their personal data.
- Damages the integrity of a computer system, or the data or programs stored on a computer system.
- Disrupts the intended use of system or network resources.
- Wastes resources (people, network bandwidth, or CPU cycles).
- Uses or copies proprietary software when not authorized to do so.
- Uses a computer system as a conduit for unauthorized access attempts on other computer systems.
- Uses a government, corporation, or university-owned system for private purposes or for purposes not in the direct interest of the government, corporation, or university.
- Consists of unauthorized and excessive snooping, probing, or otherwise connecting to a node or nodes in a manner which is deemed not to be of an authorized nature.
- Results in the uploading, downloading, modification, or removal of files on any node in the network for which such action is not authorized.

Incidents of misuse and abuse of NSI by hackers or overly curious network users have necessitated certain limitations to be imposed in order to ensure the continued security and integrity of the network.

As long as a person's activity is related to and necessary for the completion of their work then that activity is generally considered an authorized use of the network and is allowed. In cases where a person's work might generate multiple or random network connections, it is advised that such activity coordinated with the Network Operations Center or the remote system managers so as not to inadvertently cause a security incident.

Use of NSI to gain unauthorized use of resources attached to NSI may result in disconnection and legal prosecution.



[Back to the NSI Home Page](#)

IITA K-12 Workshop Attendees Roster

**IITA K-12 WORKSHOP ATTENDEES ROSTER
APRIL, 1995**

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