NASA INFORMATION SYSTEMS
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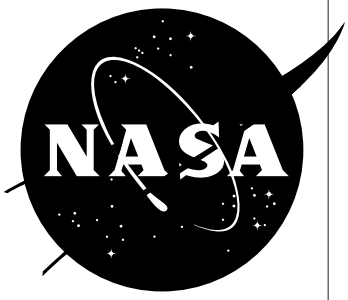
Inside This Issue



The purpose of the Science Information Systems Newsletter *is to inform the space science and applications research community about information systems development and to promote coordination and collabo-ration by providing a forum for communication. This publication focuses on programs sponsored by the Research Management Information Systems in support of NASA's Office of Space Science. Articles of interest for other programs and agencies are presented as well.*

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Features

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From the Editor

The first bimonthly issue of the Science Information Systems newsletter is now on-line at <http://www-sisn.jpl.nasa.gov>.

This is, as promised in the last issue, a new Web site. In addition, the issues are now smaller (about half the size), but—being bimonthly—more frequent. There are other changes as well that, hopefully, you will think are positive. For example, at the homepage you may now subscribe to automatically receive notification (if you don't already) of updates and new issues. The homepage was spiffed up last August, but now the issue links display in a new frames format, unless your browser is unable to handle frames, in which case a text-only version is available.

Beginning with Issue 41, the on-line newsletter has a new "look" as well as a new format; both the frames and text-only versions sport our new masthead and a new easy-on-the-eyes screen display. The frames version provides scrollable table-of-contents and article-display frames.

We are trying to build in features that will make the newsletter as user friendly as possible, as quickly as possible. For instance, you may now download either the entire issue or a specific article in portable document format (PDF) format. If you need Adobe

Acrobat Reader, there is a link to Adobe, where you may download that free application. This feature provides an alternative to reading the newsletter on your monitor and an easy way to save all or a portion of each issue. Another feature now available is the incorporation of email and homepage links. Also, wherever possible, preview images—that expand to full size for better viewing—versus image links will be the standard.

In the near future you will be able to link to author biographies. This feature will include information about frequent contributors: where they work, field of endeavor, etc., hopefully a photo, perhaps a video clip (at a later date), an email link, and a list of his/her authored or co-authored articles that can be found at this Web site, with links (also later) to each of those articles in the issues on-line.

By Fall we hope to provide a search engine that will allow you to search on keywords or subjects (i.e., astrophysics) which will result in a listing of related articles, again with links back to the appropriate issue. Other "goodies" such as animations, virtual reality, video, sound, etc. will be incorporated as time and budget allows (probably at a much later date) but they are planned, so keep watching and reading.

Please comment and make suggestions as this process takes place. Contact me at:

sandi.beck@jpl.nasa.gov
818-306-6691

Also, authors like to get feedback on their work, so use those email links and visit the Web sites you find in these "pages". The purpose of this newsletter is to promote coordination and collaboration among researchers.

Prepared for the Office of Space Science Information Systems through an agreement with the Jet Propulsion Laboratory. Questions on the newsletter effort may be sent to Sue LaVoie at: 818-354-5677; sue_lavoie@iplmail.jpl.nasa.gov

Readers are invited to contribute articles or information regarding published works, awards, announcements (research, opportunity, or CANs), or calendar events for publication. All submittals, changes of address, or questions or comments on content should be sent to the Editor, Sandi Beck, at Telos Information Systems, 320 N. Halstead, Pasadena, CA, 91101; 818-306-6691; sandi.beck@jpl.nasa.gov

All articles and photographs without bylines were written or taken by the Editor, Sandi Beck. Editorial assistance is provided by Pat Kaspar, Ames Research Center, and Judy Laue, Goddard Space Flight Center. Print layout and Web page administration by Sandi Beck.

Calendar

APRIL

1-5 Association of American Geographers Annual Meeting, Fort Worth, Texas; AAG; 202-234-1450; gaia@aag.org

2-4 Virtual Reality WorldWide '97, Santa Clara, CA; CyberEdge Journal; VRWW@cyberedge.com

3-6 National Science Teachers National Convention, New Orleans, LA; NSTA; 703-312-9221; conventions@ddnsta.org

7-11 Sixth International World Wide Web Conference, Santa Clara, CA; http:// www6reg@sf.carlson.com

25-27 Workshop on Early Mars: Geologic and Hydrologic Evolution, Physical and Chemical Environment, and the Implications for Life, Houston, Texas; Lunar and Planetary Institute; 713-486-2123; FAX: 713-486-2160; gary@lpi.jsc.nasa.gov

MAY

7-9 Advances in Digital Libraries (ADL '97), Washington, D.C.; IEEE, NASA, and the Library of Congress et al; 301-286-2080; georgia@cesdis.gsfc.nasa.gov

17-21 28th Annual Lunar and Planetary Science Conference, Houston, TX; simmons@lpi.jsc.nasa.gov

19-21 NASA Communicating Science, Information Infrastructure Technology and Applications Conference, Sunnyvale, CA; NASA; 415-604-0766; slee@mail.arc.nasa.gov

Lead Feature

NASA-Inspired Parallel Workstations Exceed Sustained GigaFLOPS

Jarrett Cohen, Hughes STX, NASA Goddard Space Flight Center

Two parallel workstations based on NASA's Beowulf "pile of PCs" concept have each exceeded one gigaFLOPS performance for a price of approximately $50,000. One system was sponsored by the Office of Space Science and built by the Jet Propulsion Laboratory (JPL) and the California Institute of Technology. The other was funded and is operated by the Theoretical Division at Los Alamos National Laboratory.

Supercomputing '96 conference attendees were able to inspect the systems at the Caltech Center for Advanced Computing Research and Los Alamos research exhibits November 18–21 in Pittsburgh. Tied together with 16 additional ethernet channels, the two Beowulfs worked in concert to realize greater than two gigaFLOPS on several demonstrations. For these achievements, Beowulf was recently nominated by the editors for the 1997 Discover Magazine Awards for Technological Innovation in the computer hardware and electronics category.

About Beowulf

The newest versions of the Beowulf cluster, linking 16 Intel Pentium Pro processors with Fast Ethernet networks, attained over one gigaFLOPS sustained on a cosmological N-body simulation. The architecture was conceived by the Universities Space Research Association (USRA) Center of Excellence in Space Data and Information Sciences (CESDIS) at Goddard Space Flight Center (GSFC). The NASA High Performance Computing and Communications (HPCC) Earth and Space Sciences (ESS) Project funds continuing development.

The JPL/Caltech Beowulf, which ran the N-body calculation at 1.26 gigaFLOPS, was built in collaboration with CESDIS researchers. It consists of 16 Pentium Pro (200 MHz) processors connected through a 100 megabits-per-second Fast Ethernet switch. The system has 2 gigabytes of distributed memory, a theoretical peak speed of 3.2 gigaFLOPS, and 80 gigabytes of disk storage. Michael Warren of the Theoretical Division at Los Alamos constructed a similar machine that also relies on 16 Pentium Pro processors but contains five Fast Ethernet interfaces per processor. This system achieved 1.17 gigaFLOPS on the N-body code, which was written by Warren and Caltech's John Salmon.

The benefits

Using commodity personal computer subsystems allows supercomputer performance at a significantly reduced cost," said Thomas Sterling, a senior scientist at Caltech and JPL who led the original design team. "Any college or university, or laboratory department, can now afford a parallel supercomputer for research and education."

In addition, "Beowulf has a larger memory and much larger disk storage than commercially available workstations in the same price range," Sterling said. "Together with processor speed these qualities provide a robust platform for applications with large datasets, such as in the Earth and space sciences."

The benchmark used by Warren and Salmon to measure the performance is a highly optimized N-body "treecode" simulating the gravitational interactions of 10 million bodies. The fastest overall implementations of the code are on 512 nodes of the Los Alamos Thinking Machines CM-5 (14.06 gigaFLOPS) and the Caltech Intel Paragon (13.70 gigaFLOPS).

Sterling summarized the significance of the Beowulf results when he stated, "We have

entered a new era in which mass market commercial computing products can be harnessed for large-scale scientific computation, greatly reducing the end user cost and allowing more researchers to do more and better computational science."

Beowulf offers a sophisticated software infrastructure through an enhanced Linux operating system. Linux provides UNIX functionality on systems using Intel, Sun, and DEC Alpha processors and is widely available at no cost. CESDIS scientist Donald Becker augmented Linux with channel-bonding software to combine the performance of multiple Ethernet network channels efficiently and transparently. According to Sterling this Parallel Linux, distributed on the World Wide Web, has become the major source of Linux networking software. It also incorporates parallel programming API's such as message passing interface, parallel virtual machine**,** and bulk synchronous parallel.

Building and using Beowulf

NASA has instituted a Beowulf University Consortium to assist colleges and universities in building Beowulfs for teaching parallel programming techniques. Sterling pointed out that electrical and computer engineering students also can benefit from the experience of building a parallel computer. Caltech, the University of Illinois at Urbana-Champaign, and Drexel, George Washington, and Clemson Universities are current participants. Several other universities, as well as magnet high schools, have expressed interest.

Besides its use in scientific computing, Beowulf is being tested as a mass storage device and as a satellite data processing engine. A $500,000 award from the Defense Advanced Research Projects Agency is supporting a 64-node Beowulf terabyte mass storage system with a gigabyte-per-second I/O rate. This array will serve NASA HPCC's 384-node CRAY T3E being installed at Goddard this spring. Nine ESS Project Grand Challenge investigation teams will stress the system with computation runs individually producing up to 500 gigabytes of data.

NASA and the US Air Force are collaborating on placement of Beowulf workstations as inexpensive satellite readout stations. They will allow data product generation and model and forecast processing in near real time, which is a ten-fold improvement over the current standard. Planned installation sites include the NASA Regional Data Centers at Clemson, Louisiana State University, University of Hawaii, and the University of Maryland-Baltimore County.

For further information email the author or access the CESDIS Linux Beowulf homepage, respectively at:

jcohen@pop900.gsfc.nasa.gov

http://cesdis.gsfc.nasa.gov/linux-web/beowulf/beowulf.html

To view the following image in color access it on-line at:

http://sdcd.gsfc.nasa.gov/ESS/beopix.html

Thomas Sterling, senior scientist at Caltech and JPL, discusses the Hyglac parallel workstation with a Supercomputing '96 attendee. Photograph by Judy Conlon, Ames

Feature

Visualizing Volcano Data Gives Scientists New Perspective

When the film "Dante's Peak" opened this February, movie goers got a look at a volcanic eruption—Hollywood style. The film's volcano in the Pacific northwest is fictional, but the Jet Propulsion Laboratory's (JPL) Digital Image Animation Laboratory (DIAL) creates volcano movies—from scientific data—that are anything but fictional.

Data used to create these visualizations come from a variety of remote sensing missions, including the Spaceborne Imaging Radar-C/X-band Synthetic Aperture Radar (SIR-C/X-SAR), the Airborne Synthetic Aperture Radar (AIRSAR), Airborne Visible and Infrared Imaging Spectrometer (AVIRIS), the Airborne Emission Spectrometer (AES), and the Thermal Infrared Multispectral Scanner (TIMS). The DIAL visualizes such scientific data through 3D animations, ranging from simple use of color to combine data sets to more complex simulated flights through the data. The many visualizations of the Earth's volcanoes include Mount Ranier, the Long Valley caldera in the Mammoth Mountains of California, Mauna Loa, Mount Pinatubo and Taal in the Philippines, Mount Etna near Sicily, and the trans-Mexican volcanic belt. The most recent addition to this series is a simulated flight over Mount St. Helens that was created by combining TIMS data with a high-resolution digital elevation model.

"The basic objectives of data visualization are to give scientists new perspectives into complex data sets and to permit them to communicate their findings in a format that is both compelling and accessible."—Vince Realmuto, Digital Image Animation Laboratory supervisor.

Imaging radar

In recent months, AIRSAR, AES, and TIMS were part of a cadre of scientific instruments onboard a NASA DC-8 aircraft that captured images of the Manam volcano within hours of an eruption on an island off the north coast of Papua, New Guinea. Ellen O'Leary, the AIRSAR science coordinator at JPL, stated that airborne instruments allow mapping of topography and changes in topography from a safe distance, as in the case of Manam.

Imaging radar is a particularly useful tool for studying volcanoes because the radar is able to see through the weather and volcanic clouds," said Jeff Plaut, JPL's SIR-C experiment scientist. " It's a good tool for mapping new volcanic deposits because of the radar's sensitivity to texture such as ash and different types of lava flows. Understanding the eruptive process helps us know where lava will flow, and that has a bearing on the hazards that are posed to nearby communities."

James Garvin, chief scientist for the Shuttle Laser Altimeter at Goddard Space Flight Center explained that combining the radar data with information from scanning laser altimeters allows scientists to track changes and then document the impact of erosion, climate, and other factors on the topography and stability of large volcanoes.

Vince Realmuto, JPL's TIMS experiment scientist and supervisor of the Visualization and Earth Science Applications Group, stated that thermal infrared data is used to study volcanoes in three ways: by mapping ground temperatures, which scientists can relate to geothermal phenomena; mapping variations in the composition of lava flows; and mapping the sulfur dioxide in volcanic plumes.

TIMS data are useful for studying volcanoes because thermal infrared remote sensing is the only practical means of obtaining virtually instantaneous maps of dynamic phenomena such as the distribution of temperatures on the ground or sulfur dioxide in a plume," he said. "Such data are of great use in monitoring volcanoes, where changes in ground temperatures or sulfur dioxide emission can signal impending activity."

Scientists use data from these ongoing missions to prepare for future volcanic studies. For example, TIMS is a precursor to the

Advanced Spaceborne Thermal Emission and Reflection Radiometer, which is scheduled to fly on the first Earth Observing System (EOS) satellite in 1998. AES is a precursor to the Tropospheric Emission Spectrometer, scheduled for launch aboard the EOS CHEM-1 platform in 2002.

Data visualization

The DIAL turns scientific data into 3D video animations, and other images, to give scientists new views on how volcanoes are changing. Realmuto, speaking as the DIAL supervisor, said, "The basic objectives of data visualization are to give scientists new perspectives into complex data sets and to permit them to communicate their findings in a format that is both compelling and accessible."

Excerpted from the JPL Universe *article, "Animation lab turns volcano data into 3D movies for researcher" and NASA press release 97-25, written by Mary Hardin, JPL.*

Feature

Multicast Pioneering Work Featured in LAN Times

Christine Falsetti, Internetworking Technologies, Ames Research Center

Ames Research Center was featured on the front page of the February 3 issue of *LAN Times* for sharing its pioneering networking work at the January Internet Protocol Multicast Initiative (IPMI) educational forum in San Jose, California this past January. The use of emerging multicast technologies to transmit data more efficiently across the increasingly crowded Internet was discussed by over 300 vendors and users at the forum. NASA is a charter member of the IPMI and was the first government agency to join the initiative. NASA is one of the leaders in multicast development and is well positioned to help educate potential users about the choices available.

Multicasting offers a potential solution to bandwidth congestion by conserving bandwidth. It does so by distributing a single stream of data that can be accessed by those requiring the data rather than by sending an individual copy of a message to each requester as is done in "unicasting." Multicasting may benefit private intranets as well as the public Internet.

NASA plans on fully utilizing multicast technologies in such future projects as telemedicine (building on earlier successes), distance learning (Internet in the classroom, virtual flight simulator), telescience (Marsokhod rover, Antarctica, biocomputation), virtual aerospace environments (remote wind tunnel operations, remote simulator support) and daily workflow (project collaboration among remote sites, reduced travel costs, improved project efficiency). NASA will work closely with members of the IPMI to help expedite the development and deployment of Internet protocol multicast technologies.

For further information access:

ttp://www.stardust.com/

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Debra Bailey: 415-604-2347
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Feature

Next Generation Internet Promises Increased Speed

John Bluck, External Affairs, Ames Research Center

By 2002 the Next Generation Internet (NGI) could run a million times faster than today's modern home computer modems, according to NASA engineers. NGI is a $300 million federal project, which when complete will enchance Internet operations to1000 times faster than a current standard T1 business computer line. NASA's $30 million portion of the research and development project will be led by Ames Research Center (ARC) in Mountain View**,** California.

President Clinton endorsed the NGI concept in his State of the Union address, saying, "We must build the second generation of the Internet so that our leading universities and national laboratories can communicate at speeds 1000 times faster than today, to develop new medical treatments, new sources of energy, new ways of working together."

ARC's Director, Henry McDonald, announced recently that, beginning in October 1997, ARC will lead NASA in the NGI project, spending about $10 million annually over a three year period and will involve about 30 full time, dedicated workers. "Ultimately, the NGI will have a huge beneficial economic impact after network speed increases are migrated over to the Internet," he said.

NASA Program Manager, Bill Feiereisen, stated that the federal government is going to hook up about 100 universities, research labs, and other institutions at a hundred times the speed of today. Currently NASA has five research sites connected at 155 megabits (155,000,000 bits per second): ARC, Goddard Space Flight Center in Greenbelt, Maryland, Langley Research Center in Hampton, Virginia, Lewis Research Center in Cleveland, Ohio, and the Jet Propulsion Laboratory in Pasadena, California. These sites will soon be converted from a speed of 155 megabits to 622 megabits.

Christine Falsetti, NGI project manager at ARC, stated, "We want to guarantee levels of service that will eliminate slowdowns and network stagnation that users sometimes have to endure now while waiting for Internet images, movies, and other services."

According to Falsetti, NASA, the Department of Energy, the National Science Foundation, and the Defense Advanced Research Projects Agency will conduct research and development that could interconnect "core sites" with high speed lines late this year. "Then we'll connect to GigaPOPs across the country," she said.

She explained that a 'POP' is a 'point of presence,' and 'Giga' stands for a billion (computer bits). A 'GigaPOP' is a regional group of core organizations that will connect their separate computer network systems by high speed communications lines. An example of a GigaPOP in the greater San Francisco Bay Area would be the high speed linking of ARC, Lawrence Livermore Laboratory, the University of California—San Francisco, and Stanford University. "Over time, we will improve GigaPOP interconnects so that they can transmit computer data at faster and faster rates," she added.

Initially, NGI will be a national network, but international partners are being sought to meet the global needs and to build a research network. Technical advances are expected to spin-off from NGI. For example, medical use of NGI is expected to a be high profile application. Local doctors will be able to consult with specialists across the globe, providing increased access to medical expertise worldwide. Industry will put improvements into the 'old' Internet to make it work better and faster.

"Our work should eventually allow users to do things that they can't do today via the Internet," Falsetti said. "For example, consumers might be able to see high quality video programs "on demand" and use high quality teleconferencing via the Internet as a result of this work."

For further information contact the author at:

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Feature

LinkWinds Version 2.2 Now Available

A new version of LinkWinds, a visual data analysis and exploration system and winner of NASA's 1996 Software of the Year award, was recently released. Linkwinds is a powerful viewer for scientific examination of geophysical and climatalogical data retrieved from satellite remote sensing. LinkWinds 2.2 applies a unique data-linking paradigm resulting in a system that functions much like a graphical spreadsheet.

New features

Version 2.2 provides a highly intuitive, easy-to-learn, easy-to-retain user interface on top of the traditional graphical user interface. The linking of data displays and controls for their manipulation provides flexibility in rapidly exploring large masses of complex data to quickly detect trends, correlations, and anomalies. The system is comprised of a large and expanding suite of non-domain specific applications and provides for the ingestion of a variety of database formats. Its many functions and services include:

- 2D and 3D graphical displays of data
- ability to deal with very large data files
- supersetting to construct higher dimen sionality data sets from sets of data files (useful for building time series from daily data accumulations)
- simultaneous display and analysis of multiple data sets which may be totally unrelated
- unique and easy-to-use animation creation and display capability
- interactive color manipulation
- journal and macro capability allowing replay of an entire session or any portion thereof
- hard copy of graphical displays and text
- context-sensitive help
- network support for collaborative data analysis with partners anywhere on the internet, using virtually no bandwidth
- archived data sets
- ability to ingest and display real time data, which may be from spacecraft, laboratory experiments, or computer simulations

New capabilities

The new version, 16 months in the making, has many new capabilities including the ability to run on Sun, Hewlett Packard, and Linux (PC) platforms in addition to the Silicon Graphics, Inc. (SGI) family for which it was originally developed. Several new tools have been implemented including ValueView, (displays numerical values) VolumeView, (displays a volumetric rendering), enhanced hard copy capabilities, and PointInterp, which will draw an image from non-uniform sparse data such as that in the Upper Atmosphere Research Satellite (UARS) Level 3 AT files. In addition to UARS files, LinkWinds can accept data in the following format

- raw binary data in signed and unsigned 1, 2, and 4 byte integers, and 4 and 8 byte floating point
- hierarchical data format (HDF)

- common data format (CDF)
- NetCDF
- Silicon Graphics, Inc. native RedGreenBlue image format
- data with Planetary Data Systemheaders
- astrophysics flexible image transport system
- ASCII text data
- Stratospheric Aerosol and Gas Experiment data format

LinkWinds can act as an application spawned by Netscape or another Web browser. Thus, for example, you can download HDF files from the Earth Observing System DatatActive Archive Centers and have them appear in LinkWinds as data objects. Collaborative sessions or tutorials with anyone on the Internet are easily carried out using a low-bandwidth protocol.

For further information email the LinkWinds team or access the LinkWinds Web site, respectively, at:

Linkwind@twinky.jpl.nasa.gov

http://linkwinds.jpl.nasa.gov/

Article material provided by Lee Elson, LinkWinds project, Jet Propulsion Laboratory.

Publications

NASA's Office of Space Science is proud of the contributions many of its science and applications researchers, scientists, and engineers make to professional organizations and publications. If you have been published in the last six months and wish to be noted in this newsletter, send the citation to:

sandi.beck@jpl.nasa.gov

Portability and Performance Comparison of the Message Passing Toolkit on the Cray J90 and Cray T3E Systems by A. Hudson, J. Miller, and A. Wang of the Science Computing Branch NASA Center for Computational Sciences (NCCS) at Goddard Space Flight Center (GSFC), will be presented at the Cray User Group Conference in May 97 in San Jose.

Frontside Reconnection Dynamics and Topology: Results Using an Unstructured Grid MHD Model With Adaptive Mesh Refinement by S. T. Zalesak, D. S. Spicer, S. A. Curtis, C. M. Mobarry, F. Kazeminezhad, R. Lohner, J.D. Huba, G. R. Joyce, T. Lui, D. Sibeck, and K. Papadopoulos, all of the GSFC NCCS, was presented at the American Geological Union Conference, Fall 1996.

Preliminary Insights on Shared Memory PIC Code Performance on the Convex Exemplar SPP1000, a refereed presentation,by P. MacNeice of Hughes STX, C. M. Mobarry of GSFC, J. Crawford of the Universities Space Research Association, and T. L. Sterling of Caltech, was made at Frontiers '96.

Particle-Mesh Techniques on the MasPar, a refereed presentation by P. MacNeice of Hughes STX, C. Mobarry of GSFC,and K. Olson of George Mason University, was made at Frontiers '96.

*Determining Performance Characteristics of Oxford BSP on a Beowulf,*a refereed presentation by J. Crawford, C. Mobarry, and D. Ridge of the GSFC NCCS, was made at the Bulk Synchronous Parallel Birds-of-Feather group, Supercomputing '96.

Planetary Data System—

Available CD-ROMs

The following data are available on CD-ROM and can be ordered by accessing the Planetary Data System (PDS) Catalog or by contacting the PDS Operator for assistance. Data are available to Office of Space Science scientists free of charge and to all others from the National Space Science Data Center for a nominal fee. The Catalog is available via the World Wide Web at:

http://pds.jpl.nasa.gov/

Select PDS Data Set Catalog listed under PDS Hot Topics!

- Clementine to the Moon Experiment Data Records - 88 volumes
- Earth Geologic Remote Sensing Field Experiment - 9 volumes
- Galileo to Jupiter Near Infrared Mapping Spectrometer EDR - 4 volumes
- Galileo to Jupiter Solid State Imaging REDR From Earth 2 Encounter - 15 volumes
- International Halley Watch Comet Halley Chronological Data - 25 volumes
- International Halley Watch Comets Crommelin and Giacobini-Zinner Data—1 volume
- Pre-Magellan Radar and Gravity Data - 1 volume
- Magellan to Venus Full Resolution Mosaic Image Data - 77 volumes
- Magellan to Venus Compressed-Once Mosaic Image Data - 45 volumes
- Magellan to Venus Compressed-Twice Mosaic Image Data - 20 volumes
- Magellan to Venus Compressed-Thrice Mosaic Image Data - 6 volumes
- Magellan to Venus Altimetry and Radiometry Composite Data - 19 volumes
- Magellan to Venus Global Altimetry and Radiometry Data - 2 volumes
- Magellan to Venus Line Of Sight Acceleration Profile Data Record - 1 volume
- Magellan to Venus Full-Resolution Radar Mosaics - 149 volumes
- Pioneer Venus Orbiter Magnetometer, Electric Field Detector, Ephemeris Data - 67 volumes
- Pioneer Venus Orbiter Supplementary Experiment Data Records - 4 volumes
- Pioneer Venus Orbiter Neutral Mass Spectrometer Data - 1 volume
- Viking Orbiter I to Mars Experimental Data Record Images - 32 volumes
- Viking Orbiter II to Mars Experimental Data Record Images - 14 volumes
- Viking Orbiter to Mars Digital Image Map - 14 volumes
- Voyager Images of Jupiter - 16 volumes
- Voyager Images of Neptune - 4 volumes
- Voyager Images of Saturn - 5 volumes
- Voyager Images of Uranus - 3 volumes
- Voyager Fields and Particles Data of Neptune—1 volume
- Voyager Fields and Particles Data of Uranus— 1 volume
- Welcome to the Planets Educational Resource - 1 volume

For further information contact the PDS Operator at:
pds_operator@jplpds.jpl.nasa.gov
818-306-6130

Spinoff

Vegetation Maps Aid in Predicting Fires

NASA's wealth of technology is being re-used in the fields of medicine, industry, and education and by the military to develop products and processes that benefit many sectors of our society. Spinoff applications from NASA's research and development programs are our dividends on the national investment in aerospace.

Vegetation maps produced from measurements taken by NASA's Airborne Visible and Infra-Red Imaging Spectrometer (AVIRIS) are helping scientists improve predictions of fire hazards and may one day reduce the risk of catastrophic fires. Use of such maps will improve our ability to assess fire risk and predict fire behavior, and perhaps will provide more effective information for planners and agencies concerned with fire prevention, according to Dar Roberts of the University of California-Santa Barbara. Roberts collaborates with Jet Propulsion Laboratory (JPL), where the AVIRIS project is managed.

AVIRIS, an instrument onboard a NASA ER-2 airplane, takes approximately 7000 measurements per second, usually while being carried at speeds of 450 miles per hour at 12 miles above sea level. Scientists such as Roberts have been working on techniques to use the spectral information measured by AVIRIS to map different vegetation communities. For example, the vegetation in the Santa Monica, California, mountains was measured before and after the 1996 Calabasas/Malibu brush fire, which eventually burned more than 12,000 acres.

Fire agencies will use the AVIRIS vegetation maps and measurements to produce computer models to forecast how and where a fire would burn in the area. Moisture content in the foliage can also be predicted, which aids in understanding how different areas will burn. Such information will assist fire fighters to prepare for future fires that reach across both wildland and urban areas.

"An accurate fire model could be very useful in allowing us to strategize by staying one or two steps ahead of an actual fire as it burns, allowing more efficient deployment of resources during an emergency," said Herb Spitzer, assistant fire chief at the Forestry Division of the Los Angeles County Fire Department. "The AVIRIS information can tell us what kinds of fuel are present and that could help us plan safe and effective 'prescribed' burns. If we could burn the vegetation more frequently and in small patches, then it would reduce the risk of catastrophic fires."

Besides predicting wild fires, Earth scientists are using AVIRIS to conduct research on and develop applications for a range of scientific disciplines, including ecology, geology, mineral hazards, snow and ice, and coastal and inland waters. Robert Green, the AVIRIS experiment scientist at JPL stated that the technique of imaging spectroscopy implemented with AVIRIS represents a fundamental new way of studying the Earth.

"We are measuring in detail how light is absorbed or reflected by various materials on the Earth's surface," Green said. "In the case of the Santa Monica Mountains, we are measuring the presence of molecules such as chlorophyll, leaf water, and cellulose. By measuring these molecules we can map different vegetation types, vegetation moisture, and the overall amount of vegetation, all of which play a role in predicting wild fire hazards."

The AVIRIS program is managed by JPL for NASA's Office of Mission to Planet Earth, Washington, D.C. This article was excerpted from NASA press release 96-234, written by Mary Hardin, JPL.

New X-Ray Technology—

NASA Teams With the National Institutes of Health

NASA and the National Institutes of Health signed an agreement in November of 96 (effective through September of 1999) to facilitate the development of new X-Ray technology, which has the potential to improve scientific research and enhance quality of life through better medical imaging instruments. The collaborative research agreement takes new X-Ray technology recently developed by Marshall Space Flight Center (MSFC), X-Ray Optical Systems, Inc. of Albany, New York, and the Center of X-Ray Optics of the State University of New York-Albany and enhances its imaging capabilities for a variety of commercial uses.

The NASA-developed X-Ray technology is capable of generating beams that are more than 100 times the intensity of conventional X-Rays. At the heart of the technology is a new type of optics for X-Rays called Capillary Optics. The X-Rays can be controlled by reflecting them through tens of thousands of tiny curved channels or capillaries, similar to the way light is directed through fiber optics. The high-intensity beams will permit scientific and medical research to be performed in less time with higher accuracy and could permit the use of smaller, lower-cost, and safer X-Ray sources.

Expected applications of this new technology include improved forensic, and improved medical imaging, such as in mammography. Used in research, the new technology could lead to the development of new disease-fighting drugs.

"Once developed, the X-Ray device will enhance a researcher's ability to determine difficult protein structures at a faster pace, which is critical to new drug design," said Dan Carter of Marshall's Laboratory for Structural Biology.

Joel Kearns, program manager of NASA's Microgravity Research Program, stated that this new technology can be applied to research on the Space Shuttle and the International Space Station. NASA's contribution to the agreement is sponsored by Kearn's program conducted at MSFC, and by Applications at NASA Headquarters.

Excerpted from NASA press release 96-241, written by Steve Roy, MSFC.

Corrections

Contact information for the article *Framework for Collaborative Steering of Scientific Applications* in Issue 40 was mistakenly omitted. For further information on this article email Beth Schroeder at:

beths@cc.gatech.edu

Spinoff

Using Remote Sensing In Real Estate

NASA's Commercial Remote Sensing Program (CRSP) at Stennis Space Center (SSC) was enlisted by a local realty company to develop a computerized way of showing property to prospective buyers. Using information provided by the realty company, CRSP created a detailed digital mapping system of the Diamondhead, Mississippi, area, showing numerous characteristics of developed and undeveloped land. The mapping system created allows realtors to present various aspects of a property to buyers without ever leaving the office.

Remote sensing systems employ sensors that are either ground-based or mounted on aircraft and spacecraft to look at the Earth; ground-based sensors look out over the horizon, while air and space based systems look down on the Earth's surface. The pictures or imagery acquired from these systems are then combined with related information to produce maps, track weather events, measure terrain, monitor agriculture and urban infrastructure, and create databases. For the realty project, CRSP collected remotely sensed imagery over Diamondhead—primarily using airborne sensors—and then entered the imagery into a computer mapping system. The imagery was then referenced to the geographic location in Diamondhead and interpreted by CRSP to identify specific geographic information, such as potential flood areas, percent of shade on the lot, setback distance between the street and the house, visibility from a particular house, areas of interest in a neighborhood, and sites of houses, stores, developments, and retail areas.

The connection between satellite remote sensing and real estate is natural," said Richard Campanella, a remote sensing/ geographic information systems (GIS) specialist with Lockheed Martin at Stennis. "People looking for real estate become geographers. So an airborne or satellite image is a natural way to communicate geographic information

According to Cliff Holle, another GIS specialist with Lockheed Martin, the information products this technology offers allows the industry to provide more services to clients. Holle stated that the remote sensing information obtained during this project has many other applications outside of the real estate industry. For example, insurance underwriters, engineering firms, local/ municipal government, investors, and emergency planners can use the information to determine risk, build a road, create a base map, site a shopping mall, and plan emergency evacuation routes.

The CRSP is an element of the Office of Mission to Planet Earth. This article was excerpted from NASA press release 97-16 written by Lanee Cobb, SSC.

Circulation Database

Please help us update our circulation database by sending your email address and new ground mail address (if applicable) to:

sandi.beck@jpl.nasa.gov

Women Of NASA Inspire Young Scientists And Mathematicians

Susan Lee, Sterling Software, Ames Research Center

The Women of NASA project was developed by the Kindergarten Through Grade12 (K-12) Internet Initiative at Ames Research Center to encourage more young women to pursue careers in math, science and technology. Although these fields are still predominately male, the appreciation of cultural and gender diversity in the workplace is growing. The Women of NASA interactive project supports this trend by providing role models; outstanding women—working in diverse fields at NASA—who are thriving in math, science, and technology careers. Project Manager, Tish Krieg, comments, "Our NASA mentors are an impressive group of women. They continue to amaze me with their unlimited amount of energy, compassion for young people, and generous commitment of time. What students see is an outstanding group of women who are dedicated to their work at NASA and who are successful in balancing their professional careers and personal life."

The main component

The biographies of the participants are the main component of this project. These are not merely the formal curriculum vitae of highly accomplished professional women. They offer insights about early childhood aspirations, experiences of success and failure in math and science, pivotal activities and mentors, and some personal insights that identify the Women of NASA as people children can imagine meeting in their everyday world. For example, an astrophysicist may relate that she relaxes by reading mystery stories. Other project components include a Day in the Life of... supplements, teaching tips, and links to additional resources.

Children can interact with the Women of NASA through regularly scheduled WebChats. The WebChats focus on scientific and technical topics particular to their field of work, necessary education, and gender-equity issues. Currently, chats are held on Tuesdays at different times to accommodate classrooms in different time zones. A detailed calendar of times and featured women is listed on :

http://quest.arc.nasa.gov/women/wonchat.html

A webchat

Chat sessions are available by linking from the featured woman's profile in the chat schedule. WebChat participants are encouraged to read the biography of the featured woman prior to the chat in order to be able to ask informed questions. Here is an example of a WebChat with Catherine Collins, chief of Opportunity and Outreach for the Stardust Project at the Jet Propulsion Laboratory:

Q: I have a few questions from my Brownie troop. We're studying careers. How do you take pictures in space?

A: In unpiloted spacecraft, such as Galileo, pictures are taken through a "sequence" of computer commands that tell the camera which filter to use, how long to open the shutter, how much light to let in, where to point, etc. We do all the calculations ahead of time here on Earth.

Q: What is your advice to young students?

A: My advice to young students is to be nice to yourselves. It can be very stressful to learn new things and it's too easy to feel like a dummy. Different things come easily to different people. Some people are good at

OUTREACH

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

math, some at social studies, some at gym, some at art (I stank at art). Concentrate on what you like and/or what you are good at and work at the rest, but don't beat yourself up if you have to work harder to learn some things than others.

Q: You said in your bio that you were most proud of the pictures you took of the meteorite hitting Jupiter (if I remember that right!), What other accomplishments are you most proud of?

A: I took pictures of a comet (Shoemaker-Levy 9) running into Jupiter. It was great! I am also proud of maintaining my sense of self and my integrity in this difficult world. That is of grave importance to me.

"…. I am also proud of maintaining my sense of self and my integrity in this difficult world. That is of grave importance to me."— Catherine Collins, chief of Opportunity and Outreach, Stardust Project, Jet Propulsion Laboratory.

Responses

Responses from educators and parents has been enthusiastic. The media is also interested in this project as both Microsoft, the National Broadcast Company, and Cable News Network are planning features.

One parent wrote in to say, "I think what Fanny said in her bio is right on target. She said she wished she would have known what an engineer actually did, and I think this project is giving some those answers. The clarification on the difference in aeronautics and aerospace was so exciting to the (the children). Thank everyone again for taking time to spend with our young people."

A high school teacher stated, "Several girls in my physics class enjoyed exploring the Web page and I've downloaded several of the biographies to distribute among female students. This may be a simple concept but these kids are starved for validation that it's OK and cool to be into science and math."

The Director of Penn State's Upward Bound Math and Science Center, a program that serves low income and potential first generation college students interested in pursuing careers in math and science, said, "The information you put on the homepage is read by our students. It is a great resource. The interactive portion of the homepage is especially important, in my opinion. It allows our students to communicate with NASA women, and read encouraging words from women who have been in similar situations as our students and who have 'made it' through college and into a successful career. Thank you so much for the Women of NASA project."

"This was our first live chat of this nature and I "experimented" with just three girls. I can't tell you the impact it made on them. One of the most powerful things that you did was to compliment them for having read the biography and sticking to the content.You guessed it...that was part of the lesson for the girls!.....Again....many thanks for your time and patience with the girls. You have really made a difference!"

NASA's K-12 Internet Initiative works to help K-12 schools harness the power of the Internet. Using on-line interactive projects allows students to experience the excitement of real scientific exploration.

For further information on Women of NASA access the Web site or contact Karen Traicoff, respectively at:

http://quest.arc.nassa.gov/women/

traicoff@quest.arc.nasa.gov

For information on additional projects funded by the Information Infrastructure Technology and Applications Program access any of the following K-12 Web sites:

Live from Mars
Active dates: September 1996-December 1997
http://quest.arc.nasa.gov/mars

Online From Jupiter
Active dates: February -March 1997
http://quest.arc.nasa.gov/galileo

Shuttle Team Online
Active dates:March 1997-May 1997
http://quest.arc.nasa.gov/mars

NASA Helps Recreate Amelia Earhart Flight

Ken Christian, Education Coordinator—Tri-State Education Initiative, Stennis Space Center

On March 17, 1937, Amelia Earhart took off from the Oakland, California, airport in an attempt to become the first pilot—male or female—to circumnavigate the globe at its longest point, around the equator. She never finished the trip. Her plane was lost at sea on July 2, 1937. On March 17, 1997, the 60th anniversary of Ms. Earhart's departure, pilot Linda Finch of San Antonio, Texas, will attempt to recreate and complete Earhart's historic expedition.

World Flight 1997

Called World Flight 1997, Finch's journey, spanning five continents and making more than 30 stops in 20 countries, will closely replicate Earhart's route. The flight is expected to take two and a half months.

Although World Flight 1997 is not the first attempt to recreate Earhart's flight, it is the first to do so using the same make and model aircraft—a Lockheed Electra 10E—with only a pilot and navigator at the controls. Of the 15 aircraft originally produced, only two now exist. Finch's is the only one currently airworthy. Using original drawings and photographs, the 1935 aircraft has been meticulously and accurately restored— right down to its rivets—to replicate Earhart's Electra.

World Flight 1997, sponsored by Pratt & Whitney (United Technologies Corporation), is a "learning by doing" activity of the interactive education program, "You Can Soar," which is available to US educators, grades 5-8. This program includes a World Wide Web site <www.worldflight.org/youcansoar/> coordinated with a multi-disciplinary teacher's package, and offers a documentary video called "Heroines of the Sky." Partners for You Can Soar include Stennis Space Center (SSC), Pratt & Whitney, COMSAT Mobile Communications, the US Naval Meteorology and Oceanography Command, and the Ninety-Nines, an organization for the advancement of women pilots. Amelia Earhart was instrumental in the formation of the Ninety-Nines.

In support of World Flight 1997, SSC is producing a geo-map CD-ROM that will allow students in their classrooms to track Finch's flight. The Naval Meteorology and Oceanography Command at SSC, led by Rear Admiral Paul Gaffney II, will help with weather navigation during the flight. Additionally, the National Geographic Society will have a writer and photographer follow and document Finch during parts of her flight. The Society plans to publish "Sky Pioneer," a book for young audiences about Earhart, with a forward by Finch.

Tribute to Earhart

In recreating Earhart's flight, Finch stated that she is not out to set any records. She is doing it instead as a tribute to Earhart's vision and spirit, and the sharing of a message that is as timeless today as it was more than half a century ago. The heart of the project is its outreach to inner city and at-risk youth with Earhart's message about reaching above and beyond limitations.

"Amelia believed that limits were often more perceived than real, and those imposed by society, friends, and fears can be overcome," Finch said. "She thought that if you have faith in yourself, anything is possible and you can accomplish your dreams."

Since the launch of the project last August, Finch has been meeting with school children around the country, inviting them to

The heart of the project is its outreach to inner city and at-risk youth with Earhart's message about reaching above and beyond limitations.

"fly along" with her by viewing the World Flight and You Can Soar Web sites. During her flight, route maps with real-time tracking, combined with messages from Finch and her navigator, will be transmitted daily at these sites, allowing students and people around the world to be a part of the expedition. As she re-creates Earhart's flight, Finch will be stopping at designated airports to meet with students who will be able to see the electra and ask questions.

World Flight 1997 introduces a new generation to the spirit of Amelia Earhart and Linda Finch, along with NASA and the other partners of the You Can Soar education program are making it happen. A complete copy of the You Can Soar World Flight 97 brochure being distributed to schools is available for viewing on NASA's Tri-State Education Initiative Web site at:

http://192.149.120/flight.htm

For Further information and to track Finch's flight, access the World Flight 97 Web site at:

http://worldflight.org

OUTREACH

Tools for Teachers—

Smart Email Provides Internet Access

Stephanie Smith, Information Technology Office, Johnson Space Center

A national effort is underway to provide communications technology and networked information to the Kindergarten Through Grade 12 (K-12) education community. NASA's High Performance Computing and Communications Program sponsors the Learning Technologies Project (LTP) K-12 program that contributes to this national challenge.

About the program

The LTP K-12 program is a collaboration between government agencies and NASA centers to share NASA expertise and encourage local education initiatives at the state level. The LTP program includes videos and handbooks, Internet servers, and K-12 initiatives at eight NASA centers. The NASA center projects cover a broad range of categories such as education technology, teacher enhancement, curriculum improvement, student support, and systemic change.

The K-12 education technology project at NASA's Johnson Space Center (JSC) is the Internet Library Information Assistant (ILIAD), an electronic information assistant that retrieves and processes information from the Internet. It was specifically designed to provide Internet resources for elementary and secondary teachers with limited computing equipment to enhance American education, promote use of the National Information Infrastructure, and disseminate NASA information, particularly math and science materials.

ILIAD sessions

An ILIAD session begins when it receives an email message from an authorized user. The query is launched to multiple Web search engines (AltaVista, Excite, Galaxy, InfoSeek,

Inktomi, Lycos, Opentext, and Webcrawler) where documents are extracted from each engine and returned via the network to the ILIAD server. The returned Internet documents are analyzed for relevance, screened for duplicates, and then emailed to the requestor. ILIAD performs the analysis, duplication screening, and return functions using several interactive software components and a suite of specialized daemons.

Most ILIAD users receive the results of their searches as individual documents in their email. A special option permits you to receive answers to questions as hypertext markup language (HTML) documents that can be viewed in a Web graphical browser. Whether the teacher opts for individual documents or HTML, time is saved because the query is launched and performed automatically and independently of any teacher interaction. Thus teachers can launch queries and return to their computers anytime to review the search results. This differs from most search engines that require sifting through multiple pages of search results online.

Although ILIAD was created to find math and science resources, teachers can search for a broad scope of information. Daily searches on ILIAD range through topics like agriculture, space information (Mars, Apollo, Mir, etc.), ice cream, recycling, tidal pools, and exotic animals, to name a few.

Getting ILIAD

For those interested in testing the ILIAD service, email:

iliad@algol.jsc.nasa.gov

Put "start iliad" (no quotes) in the subject field and leave the body of the message blank. ILIAD will mail you instructions on how to use the software.

In addition to the standard email interface for low-end computers, there is also a Web interface to the ILIAD service at :

http://www.jsc.nasa.gov/stb/iliad.html

For information on transferring this technology to other educational facilities and networks, phone the Information Technology Office at 713-483-8110.

For further information on the High Performance Computing and Communications program or the Information Infrastructure Technology and Applications (IITA) access the following Web sites, respectively at:

http://cesdis.gsfc.nasa.gov/hpccm/hpcc.nasa.html

http://iita.ivv.nasa.gov

Reprinted courtesy of Lynne Keffer, editor Educational Horizons, *a NASA-wide publication.*

Awards

Seven Earth and Space Data Computing Division civil servants at Goddard Space Flight Center received the 1996 Civil Servant Peer Award at a ceremony held in December. Award recipients included Lisa Hamet Bernard, Ellen Salmon, Andrea Hudson, and Toni Evans of the Science Computing Branch; Carol Boquist and Lee Foster of the Scientific Communications Technology Branch; and Pat Coronado of the Applied Information Sciences Branch. For further information access:

http://esdcd.gsfc.nasa.gov/DIV-NEWS/awards.cs.1996.html

Shuttle Team Online Project Launched

Marc Siegel, Learning Technologies, Ames Research Center, and Stephanie Smith, Information Technology Office, Johnson Space Center

The NASA Learning Technologies Project (LTP), a NASA-wide Kindergarten Through Grade 12 initiative, recently launched a new project called "Shuttle Team Online." The project will be publicly available in an interactive mode from March through May of 1997. Shuttle Team Online is designed principally for pre-college classrooms, but everybody is welcome and many adults should find the unique perspective interesting.

About the project

Shuttle Team Online allows you to join the men and women who make the space shuttle fly and learn about their diverse and exciting careers. You'll peek behind the scenes as these folks train astronauts, prepare the shuttle between missions, launch the shuttle, successfully execute the mission from Mission Control, and safely land the shuttle.The focus will be on STS-83, a 16-day microgravity science lab scheduled for launch April 3, 1997.

This project provides lots of opportunities to interact with these enthusiastic people through email exchange and live network events, including WebChats and CU-SeeMe sessions. Curriculum supplements about flying rockets and microgravity experiments are available to help teachers incorporate the lessons of the shuttle into their classrooms. Also, Shuttle Team Online hosts teacher discussion areas to encourage like-minded educators to share good ideas and support one another. Student-to-student interactions are facilitated through space shuttle simulations, as well. Another area on the web is reserved to display student work relating to the shuttle.

Johnson Space Center volunteers

Shuttle team employees at Johnson Space Center (JSC) will be volunteering to write brief biographies and "field journals" describing their day-to-day activities and will answer filtered email question from students. A limited number of volunteers will be involved in the live network events. After the project ends, the question and answer archive will remain available indefinitely.

"Shuttle Team Online is an Internet-based educational outreach program that will share real life experiences of the 'behind-the-scenes' space shuttle team with students and teachers around the world," said Chris Culbert, manager of the Information Technology Office at JSC. "The goal is to demonstrate to students the variety of skills and educational backgrounds required to make the Shuttle program successful."

According to Culbert, although the JSC portion of the project will target students in grades 4-12, it will certainly be of interest to a much broader group. "Shuttle Team Online will ultimately be a general outreach program to the global community interested in NASA's space program," Culbert said. "We're very excited to bring this NASA project to schools in the US and around the world. We also look forward to working with employees, the people who make it happen."

How to join

The Shuttle Team Online project is FREE, open to you, and available now. Even if you are not a teacher, perhaps you'll get some ideas on how you might do similar education outreach in your own scientific pursuits. Shuttle Team Online should prove to be an exciting learning resource and a great ride.

Shuttle Team Online is part of Sharing NASA, a family of online education projects, such as "Live from Antarctica," and "Online from Jupiter."

For further information about Sharing NASA access:

http://quest.arc.nasa.gov/interactive/

If you are interested in Shuttle Team Online, send email to:

listmanager@quest.arc.nasa.gov

State " subscribe updates-sto" (no quotes) in the body of the message. Also, visit the web site at:

http://quest.arc.nasa.gov/shuttle

For further information about the JSC volunteers contact Frances Harris at:

fharris@pt1.jsc.nasa.gov

OUTREACH Activities

Goddard Space Flight Center (GSFC)

Scientific Computing Branch—Nancy Palm NASA Center for Computational Sciences (NCCS)

- Andrea Hudson mentored Eileen Woolley of the University of Virginia (UVA), who participated in the UVA-sponsored EXTERN program, which provides college juniors and seniors with realistic perspectives of career fields and job opportunities.

High Performance Computing and Communications (HPCC) Earth and Space Science (ESS) Project—Jim Fischer

- Lisa Hamet Bernard was selected to serve as NASA representative on the Maryland (MD) Business Roundtable for Education's Technology Oversight Committee, which advises the MD's governor on all MD school technology matters and connects the state's school districts with Federal funding sources.

- Clark Mobarry mentored Jason Crawford's (home high school) work at HPCC in the Visiting Student Enrichment Program.

Science Communications Technology Branch—Jerome Bennett

- Dave Batchelor served on the team that prepared for GSFC's Site Visit by the President's Quality Award examiners in January. Batchelor has been invited to join a team to evaluate and implement Site Visit examiners' recommendations.

- GSFC's Minority University-Space Interdisciplinary Network (MU-SPIN) project assisted the National Indian Telecommunications Institute (NITI) with a hands-on Internet workshop at NITI HQ, Santa Fe, New Mexico. Seven teachers from the Indian Island School in Indian Island, Maine, and 18 Eisenhower National Clearinghouse Members attended.

- The MU-SPIN Project and GSFC were recognized at a press conference ceremony with New York City (NYC) Councilman Guillermo Linares for contributions to the modernization of George Washington High School in NYC.

- "A Multimedia History of Glacier Bay," an educational World Wide Web (WWW) site featuring text, animations, and pictures from NASA's "Glacier Bay, Alaska,from the Ground, Air, and Space" video <http://sdcd.gsfc.nasa.gov/GLACIER.BAY/glacierbay.html> has been posted to the National Science Foundation-funded Event-Based Science program WWW site .

Information provided byJudy Laue, Contributing Editor, GSFC.

Accomplishments

Information Systems Program Highlights

Major accomplishments achieved by NASA's Information Systems are highlighted below. They cover reported work performed from November, 1996, through February, 1997, and reflect the combined efforts of many people.

Ames Research Center (ARC)

NASA Research and Education (NREN)—Christine Falsetti

- Established cost model with NASA Integrated Services Network for bandwidth sharing of asynchronous transport mode (ATM) layer 2 services network using the OC-3c five-site NREN infrastructure.

- Provided DARWIN with ATM DS-3 service costing to Boeing and McDonnell-Douglas locations. Provided Desktop Video group for Kennedy Space Center ATM service (OC-3c and DS-3).

- Developed and participated in interagency Large Scale Networking Workshop on Next Generation Internet (NGI). Examined agency missions, goals, and existing five year plans to determine which planned agency projects have the most relevance to the NGI. Developed an intergrated, interagency action plan framework that indentifies agency directions and opportunities, leverages current agency investments through partnerships, and maximizes agency projects without duplication.

- Attended Internet Protocol Multicast Summit. Presented paper on ARC's successful multicast experience in the Space Bridge to Russia telemedicine project.

- Completed NASA NREN Level II draft plan for FY97 to FY2002. Outlined NASA-wide area networking research and development program incorporating the current NREN work and the future NGI Internet Initiative. Plan sent for peer review wtihin agency.

- Developed High performance networking application selection critieria for testing and demonstrations across the NREN. Established and initiated application solicitation process.

Information provided by Pat Kaspar, Contributing Editor, ARC.

Goddard Space Flight Center (GSFC)

Science Computing Branch—Nancy Palm NASA Center for Computational Sciences (NCCS)

- The IBM 3494 robotic tape subsystem with eight 3590 IBM "Magstar" tape drives was put into production in the NCCS and integrated with the Convex/UniTree mass storage system. This equipment adds over 24 TB of uncompressed capacity to the Convex/UniTree system, bringing the system to 48.8 TB of on-line storage capacity.

- The NCCS added QSC disks to UniTree, increasing UniTree disk cache size from 155 GB to 375 GB and allowing file copies to stay on disk 2.4 times longer.

- The Technical Assistance Group established guaranteed 24 hour response Monday through Friday for NCCS user support for Crays, UniTree, and T3D. Improved the user interface for the NCCS documentation World Wide Web (WWW) page to further enhance user support <http://esdcd.gsfc.nasa.gov/NCCS/Userinfo.html>.

- The Cray systems support staff made extensive preparations to upgrade the

J90 cluster operating system to Unicos 9.0 for the installation of the Cray J90 SE processors, which are expected to yield performance boosts of 50 percent more in the scalar processing area.

- Linked the Science Computing Branch new WWW home page at <http://sdcd.gsfc.nasa.gov/SCB/> from the newly redesigned Earth and Space Data Computing Division WWW site at <http://esdcd.gsfc.nasa.gov/>.

High Performance Computing and Communications (HPCC) Earth and Space Science (ESS) Project—Jim Fischer

- Began work with nine Investigator Institutions and testbed vendor, Cray Research, Inc., under a Cooperative Agreement Notice issued in 1995. In October, Cray Research, Inc. installed a 512-processor T3D system at GSFC for Investigator team use. ESS held the first Science Team meeting of "Round-2" Investigators in conjunction with Supercomputing '96. By the end of January most teams had achieved 10 gigaflops sustained performance on key science codes using the T3D, in many cases enabled by code restructuring and optimization by expert Cray personnel.

- The Beowulf Parallel Linux by the Center of Excellence for Space Data and Information Systems at GSFC has achieved superior price/performance for scientific computing by using low-cost, mass-market components. Beowulf systems from Los Alamos National Lab and Caltech were joined into a 32-processor Beowulf (worth around $100K) at Supercomputing '96, where Mike Warren of Los Alamos National Lab and John Salmon of Caltech rantree code problems achieving twice the performance (around 2.2 Gigaflops) that was achieved on the 16-processor system. The article "Do-It-Yourself Supercomputers," *Science*, December 13, describes Beowulf and its breakthroughs.

- The National HPCC Software Exchange (NHSE) released the Parallel Tools Library repository, High Performance Computing-Netlib (a high performance branch of the Netlib software) repository, and the Chemistry Software and Information Services repository <http://www.nhse.org/>. The beta release of the Repository in a BoxToolkit is also available.

- Sponsored Frontiers'96, the Sixth Symposium on the Frontiers of Massively Parallel Computation, held in Annapolis, Maryland, in October. Noteworthy were presentations by all eight NSF Petaflop/s point design study teams and a ceremony officially handing over NASA's original Massively Parallel Processor to the Smithsonian Institution. Professor Charles Weems (University of Massachusetts-Amherst) and Bill Carlson (Center for Computing Science) will serve as chair and vice chair respectively for the Frontiers '98 Symposium.

- Released the final report (combined) for the Petaflop/s Architecture Workshop '96 and Petaflop/s System Software (PetaSoft '96), edited by Tom Sterling of Jet Propulsion Laboratory/ Caltech. This work in the newly emerging interdisciplinary science of Petaflop/s, involves technical contributions of close to a hundred experts from a broad range of fields. Held the second Petaflops Frontier (TPF-2) workshop at the Frontiers '96 symposium. TPF is the only forum directly related to Petaflop/s computing that is open to the general community.

- The FY96 Annual Report of the HPCC/ESS Project is now available on the WWW <http://sdcd.gsfc.nasa.gov/ESS/annual.reports/ess96contents/ess96.html>.

Science Communications Technology Branch—Jerome Bennett

- Through network upgrades and extensions, GSFC's HPCC/ESS Network Team enabled the National Library of

Medicine (NLM) to use Advanced Communication Technology Satellite at 155 Mbps from its High Data Rate Terminal at GSFC over the ATM-based Advanced Technology Demonstration Network. This experiment is expected to maximize network user access to NLM's 80-Gbyte Visible Human data sets.

- Assisted in developing a new Oracle-based data storage/retrieval system for the Global Legal Information System (GLIN) Project for demonstration to Congressional representatives.Submitted proposal to EU's Minority University Research and Education Program to develop user interfaces, modeling, and effective retrieval for GLIN.

- GSFC's HPCC/ESS Network Team enabled NASA's first 622 Mbps (OC-12c) ATM wide-area network use Nov. 1996, providing OC-12c links among ATDNet, ACTS's High Data Rate Terminal, and GSFC's first OC-12c-attached high performance computer.

- Conducted performance tests of GSFC's first Sun UltraSPARC with an OC-12c/ 622 Mbps ATM Network Interface Card (NIC) . In nttcp memory-to-memory tests with a SUN SPARCstation 20/60 with an OC-3/155 Mbps NIC, approximately 105 Mbps was achieved over GSFC ATM local area network (LAN). By comparison, approx-imately 85 Mbps was achieved between a pair of SUN SPARCstation 20/60's with OC-3/155 Mbps NIC's on the same ATM LAN.

- Achieved new best performance of over 100 Mbps end-to-end in nttcp memory-to-memory tests over the upgraded ATM-based ATDNet between a SUNSPARCstation 20/60 at GSFC and a SGI at NRL. By comparison, our previous best between GSFC and th e Naval Research Laboratory was approxi-mately 85 Mbps end-to-end.

Applied Information Services Branch—William Campbell

- GSFC Director, Rothenberg, and Francis. Lawrence, president of Rutgers University, signed a Memo Of Under-standing establishing Rutgers University (New Jersey campuses), Columbia University, and Hackensack Meadow-land Development Commission as a Regional Validation Center (RVC). RVC's at University of Maryland-Baltimore County and the University of Southern Lousianna are operational. RVC's enable university and institu-tional access to regional data from satellites, as part of an effort to transfer NASA technology to the outside community.

- Steve Maher (visualization personnel) received $70K Director's Discretionary Funding (DDF) for a "Three Dimen-sional Display for Earth Science Data" that will utilize next-generation technol-ogy to display real-time GSFC Earth science data in a truly 3D space. Scientific Visualization Studio Manager, Horace Mitchell, received $40K DDF funding for "Hologlobe Near-Real Time Data Display," a project to link the Smithsonian's Hologlobe exhibit to Mission To Planet Earth data archives.

- Pat Coronado successfully ran a one month SeaWiFS Ground System operational test in December. All systems operated in autonomous mode acquiring all National Oceanic Atmo-spheric Administration 14 and 12 data from each pass. In total, 347 passes were tracked (approx 90 Mbytes per pass) and data were acquired from 341 passes-a 100 percent tracking and 98 percent acquisition for December.

- The Scientific Visualization Studio's established a new on-line video catalog at <http://esdcd.gsfc.nasa.gov/SVS/svscat/catalog.html>.

Information provided by Judy Laue, Contributing Editor, GSFC.