National Space Science Data Center

NSSDCNEWS

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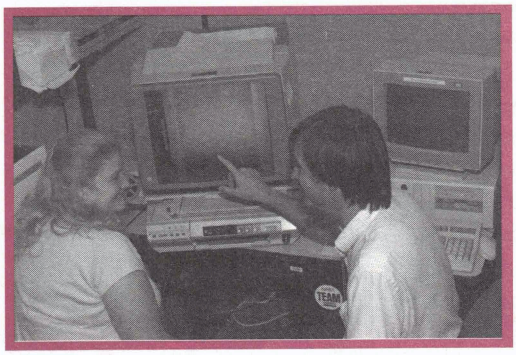
Viking Lander Biology Data Restored by NSSDC and PDS

By Joseph King

NASA placed two Viking Landers (VL) on the surface of Mars in 1976 to study the physical environment there and to look for evidence of life. Three distinct biology experiments were carried on each Viking Lander. According to Viking Project Scientist Dr. Gerald Soffen the post-mission consensus was that life on Mars was not found. However, Dr. Gilbert Levin, principal investigator of the Labelled Release (LR) experiment (one of the three biology experiments), has maintained over the years that the results of his experiment were consistent with and suggestive of the presence of microbial life on Mars.



Allison Lopez (left) and Dr. David Williams (right) discuss the process of the Viking Lander 2 data restoration project.

In April 2000 NASA Headquarters (HQ) received a query on the availability of data from the LR experiment and a request to mount an effort to recover the data and to make them computer-usable if needed. HQ turned to NSSDC and to the Geosciences node of the Planetary Data System (PDS) at Washington University (PDS/WU) for help in finding, and upgrading as needed, these LR data. The recovery and upgrade effort make an interesting story, related herein, but first a brief introduction to the Labelled Release experiment is useful.

In the LR experiment Martian soil samples were brought into a test cell to which was also added a radioactive nutrient containing seven C14-labelled substrates. Any soil-resident living organisms were expected to ingest these nutrients and via some "heterotrophic metabolism" process (e.g., respiration) to excrete radioactive material into the gas of the test cell. Measuring radioactive decay rates in the gas could then give evidence of the buildup of the C14 atoms in the gas with implications for the occurrence of metabolic processes. Further details of the experiment and its results are given in a paper by Dr. Levin and a colleague, Dr. Patricia Straat, published in the *Journal of Geophysical Research* in 1977 (p. 4663).

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Archive Reference Model Gains Wide Acceptance

By John Garrett and Donald Sawyer

A number of men and women have willingly committed themselves to a series of meetings lasting several years; they have committed themselves to writing, reading, rewriting, and rereading several versions of the same large document. They have made this commitment to create for their organizations and for others an important text to aid in understanding and performing digital data preservation functions.

Donald Sawyer (NSSDC) and Louis Reich (CSC) have been the primary authors and editors for the *Reference Model for an Open Archival Information System (OAIS)* (at URL http://www.ccsds.org/documents/pdf/CCSDS-650.0-R-1.pdf). They have been supported by a dozen or so core members and many occasional authors, editors, and reviewers that have brought the OAIS Reference Model to its current state. The model has become an increasingly recognized and used reference for those interested in preserving and sharing information in the digital age. It has generated considerable interest among various international and national library and scientific groups. The NASA Science Office of Standards and Technology (NOST) continues to become aware of organizations that have used the concepts developed in the OAIS Reference Model. Although these organizations are seeking additional updates, they have found the current or earlier drafts of this document to be very useful.

For example, the International Council for Scientific and Technical Information (ICSTI) (see URL http://www.icsti.org/) is an international affiliate of the International Council for Science (ICSU) whose mission it is to promote and enhance the communication of scientific information worldwide. In its "Review of the ISO Draft Standard for an Open Archival Information System Reference Model," ICSTI has said, "The reference model was well received and well understood by the major stakeholders represented by ICSTI. The ICSTI members were most surprised at the broad applicability of the model and believe that this will go a long way to ensure that digital archives will not only be certifiable

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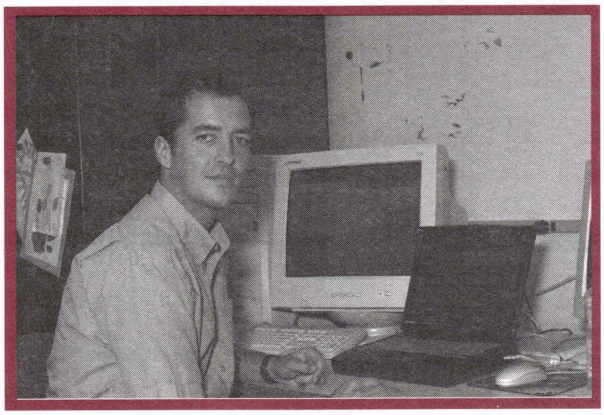
INSIDE

The French SPASE Connection: NSSDC Welcomes CNES Collaborator Thierry Levoir

By James Thieman



CNES's Thierry Levoir will be working with NSSDC staff to create a space physics archive search engine.

The National Space Science Data Center is working closely with the French Space Agency (Centre Nationale d'Etudes Spatiale [CNES]) as well as several other organizations to develop a Space Physics Archive Search Engine (SPASE). SPASE is intended to provide space physics researchers with a rapid data searching and acquisition capability across multiple, diverse archives of space physics data scattered worldwide. To make it easier to work together on SPASE, CNES has sent one of its computer scientists, Thierry Levoir, to work directly with the NSSDC Information Systems group in defining and implementing an initial system for simultaneously searching for data at NSSDC and at the Centre de Données de la Physique des Plasmas (CDPP [Space Physics Data Center]) in Toulouse, France. CDPP is a joint service of CNES and the Centre National de la Recherche Scientifique (CNRS). Mr. Lavoir is spending the months of August and September 2000 working at NSSDC and will return for another two-month stay in early 2001. SPASE will provide a value-added data search capability for the space physics community that will be more than a list of URLs. Results of searches are to be presented to the user in a homogeneous fashion allowing rapid identification of the location of potentially useful data sets. The objectives are to enhance SPASE functionality with time by increasing the categories of search criteria, allowing the resulting data sets to be intercompared by parameters such as overlapping time intervals, and enabling rapid acquisition of the data through the network. An increasingly broad group of space physics data holders and data seekers will be involved in the evolution of SPASE to ensure that SPASE will satisfy real needs in the most cost-effective ways. NSSDC is grateful to CNES for enabling Mr. Levoir to work directly with NSSDC staff, thereby speeding the progress of the creation of SPASE. ◆

Latest NSSDC Archive Plan Now on Web

By Joseph King

NSSDC's three-year archive plans summarize expected data inflows to NSSDC from various NASA missions and discipline-specific "active archives." The latest plan, covering 2000-2002, is now available at http://nssdc.gsfc.nasa.gov/nssdc/arch_plan/2000.html.

This plan shows a total inflow ranging from about 2 terabytes (TB) in 2000 to 4 TB in 2002. Many of the data are in "backup mode" for active archives or are low-processing level data from principal-investigator-mode missions. Neither of these data types is readily independently usable if received directly from NSSDC.

On the order of 0.5 TB per year is the amount of independently usable data to be received by NSSDC that will not be network-accessible from other NASA space science active archives. NSSDC will make these data network-accessible in part via basic FTP and in part by higher functionality systems such as CDAWeb. ◆

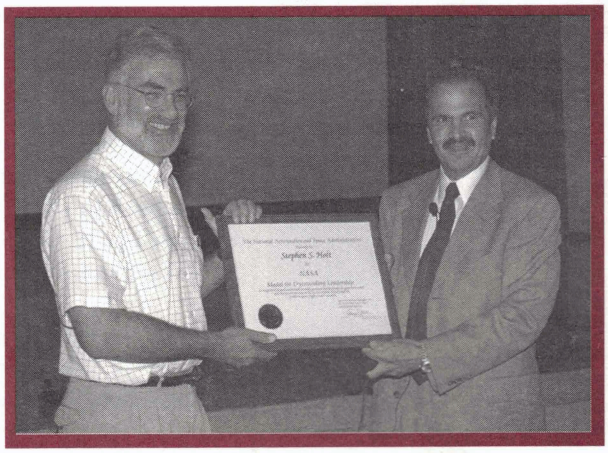
GSFC Space Science Directorate Head Retires

By Joseph King

Dr. Stephen S. Holt, director of Space Sciences at Goddard since 1990, has retired after 34 years of service to NASA. An X-ray astrophysicist who was the project scientist and/or a principal investigator on eight X-ray spacecraft missions, he remained scientifically active throughout his career. His immersion in science continued despite his playing key management roles as chief of Goddard's Laboratory for High Energy Astrophysics and then director of Space Sciences for the past half of his Goddard career.

Goddard is presently pursuing a nationwide search for the best candidate to replace Steve. Steve, meanwhile, will be enjoying the academic life in suburban Boston, Massachusetts.

NSSDC is located within Goddard's Space Science Directorate, with the NSSDC head, the Space Science Data Operations Office chief (Dr. James Green), and the Space Sciences director in a vertical management line to one another. ◆



Dr. Stephen Holt during the week of his retirement receives a leadership award from Goddard Director Dr. Al Diaz.

Educators Join the Sun-Earth Connection Education Forum

By James Thieman, Troy Cline, and Elaine Lewis

The Sun-Earth Connection Education Forum (SECEF) (http://sunearth.gsfc.nasa.gov/) is a NASA-sponsored organization established to use the latest results from NASA's Sun-Earth Connection Science theme to improve science education and awareness in classrooms and in the general population. SECEF has two new staff members with strong, interesting education backgrounds: Elaine Lewis and Troy Cline. Both Elaine and Troy are of great value to the SECEF effort.

Elaine began her education career in 1980 as a sixth grade elementary school teacher. She continued her education and by 1985 had a Master's degree in curriculum development from Loyola College in Baltimore, Maryland. She wrote for a textbook company during the summer and also enjoyed working with students as a naturalist at Irvine Natural Science Center in Baltimore. She continued studying science and began teaching eighth grade science in Prince George's County, Maryland, in 1986. Between 1986 and 1990 she received a second Master's degree in administration and supervision. Elaine worked as the science chairperson within her school, led many national and local workshops for educators, and won a number of grant proposals. In 1990 she received the county award for Outstanding Secondary Science Teacher of the Year and the following year the Presidential Award nomination for Maryland for Excellence in Teaching Science.

Elaine Lewis (right) and Troy Cline (left) bring their educational expertise to SECEF as the newest members of its staff.

In 1996 she was offered an opportunity to work in the Education Office at Goddard Space Flight Center. Between 1996 and 2000 she worked on many existing programs and created new initiatives. Elaine also developed processes and practices by which the work of the NASA Office of Space Sciences education organization can be linked with the mainstream of the NASA Center Education Offices and the Headquarters education function. SECEF was fortunate to be able to hire her to work within the forum after she had served as the liaison between SECEF and the education programs office.

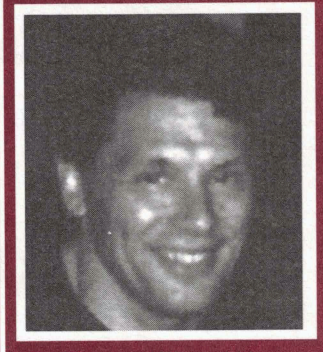
SECEF also welcomes Troy Cline, a science and educational technology specialist. Before coming to Goddard Troy was a high school mathematics teacher and educational technology coordinator at an alternative high school in Virginia, working with at-risk students. During that time he also completed a Master's degree in educational technology and leadership at The George Washington University in Washington, D.C. His undergraduate degree was in education with a strong focus on science and mathematics.

Prior to working in Virginia, his teaching career took him to some exceptional places, beginning with his first teaching experience on the Navajo Indian Reservation in Kinlichee, Arizona. While there he taught in a Bureau of Indian Affairs boarding school for three years. He later joined the United States Peace Corps and served in Chad, Africa, as an algebra and geometry teacher. That experience teaching in Africa involved living in a mud hut and teaching over three hundred Chadian students in a classroom made of elephant grass. At that time the Chadian government was attempting to create a stabilized educational system so that as the country became more developed, an effective structure would already be in place.

SECEF is a partnership between Goddard Space Flight Center (GSFC) and the University of California, Berkeley. The GSFC effort is managed within NSSDC and the Space Science Data Operations Office. ◆

ADF's Rich Pisarski Moves to NASA Ames for a Year

By Joseph King



Dr. Ryszard Pisarski is spending a year at NASA's center of excellence in computer science, Ames Research Center.

Dr. Ryszard Pisarski, head of the Astrophysics Data Facility (ADF) within Goddard's Space Science Data Operations Office (SSDOO), has begun a year's participation in NASA's Professional Development Program. Rich has taken up residence at NASA Ames Research Center in Mountain View, California, which is located south of San Francisco. He will be working hands-on with the Human-Centered Computing group at Ames, learning and applying computer science techniques there that could later be applied to Goddard's space science work.

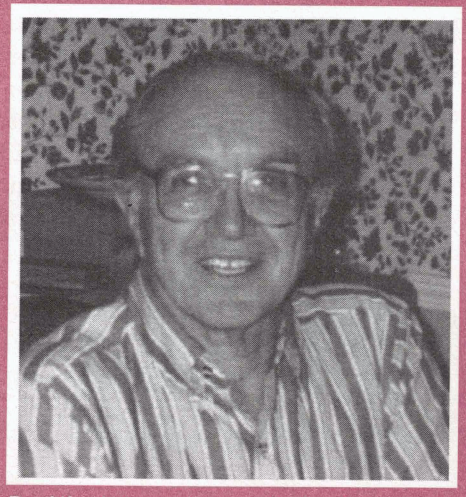
While excellent development and application of computer science is pursued at all NASA field centers, Ames Research Center is designated as NASA's center of excellence in computer science. Rich says, "This program will allow me to work in an intense computer science environment and re-develop my technical skills. This will benefit NASA and Goddard by establishing a better and deeper relation between the Ames's computer science group and Goddard's computer science activities in the SSDOO and Information Systems Center (Code 580)."

Rich has been at Goddard since 1984, joining the government staff in 1987. He has done a mix of astrophysics research and astrophysics data processing and management. He assumed his role as ADF head in 1992; while guiding the broad range of ADF activities, he has been the project manager of the U.S. Roentgen Satellite (ROSAT) Science Data Center and has been especially connected to the pipeline processing of data from ROSAT, the Advanced Satellite for Cosmology and Astrophysics (ASCA), and the Rossi X-Ray Timing Explorer (RXTE) X-ray missions. Dr. Roger Dilling is acting ADF head during Rich's absence. ◆

Vampola Data Sets from DoD Satellites Now at NSSDC

By John F. Cooper

A large collection of magnetospheric radiation belt data sets on 60 CDs and related plot data on microfiche and 35-mm film has been ingested into the NSSDC archive. This collection has come from The Aerospace Corporation experiments on a long series of nine military satellites extending from OV3-3 in 1966-1967 to the Combined Release and Radiation Effects Satellite (CRRES) mission in 1990-1991. Data from the Joint American Soviet Intercalibration Campaign (JASPIC) and CENTAUR suborbital rocket experiments are also included in the collection. Many of the satellite data sets were used in development of the NASA trapped radiation models, most recently AP-8 for protons and AE-8 for electrons, which are available on line from NSSDC. Although some of the data sets from the 1960s and 1970s had already been archived for the NASA model development effort, many of these have been available only on magnetic tape in digital formats users may now find difficult to interpret. With funding support for space physics data restoration from the NASA Office of Space Science, The Aerospace Corporation data sets were compiled and reformatted into easily readable formats on CDs by Dr. Alfred L. Vampola, former senior scientist with The Aerospace Corporation and now a space consultant with his own company (Space Environment Effects, Vista, California).



Dr. Alfred Vampola compiled, reformatted, and provided for NSSDC 60 CDs holding magnetospheric radiation belt data sets.

Dr. Vampola obtained his undergraduate degrees in 1956 in mathematics and physics from Creighton University in Nebraska and later earned his doctorate at St. Louis University. He joined the Space Science Laboratory of The Aerospace Corporation in 1962 and was promoted to his final position as senior scientist in 1978. He personally led development and served as principal investigator for many of the magnetic spectrometer experiments contributing to this data collection. Many of his research publications deal with the morphology and dynamics of the radiation belts as measured by his experiments and with effects of wave particle interactions. In the mid-1980s and after 1990, he was an associate editor of the *Journal of Spacecraft and Rockets*. Since retirement from The Aerospace Corporation in 1990, he has been applying the CRRES and other energetic particle data for updates of radiation belt models and for modeling effects on Earth-orbiting satellites.

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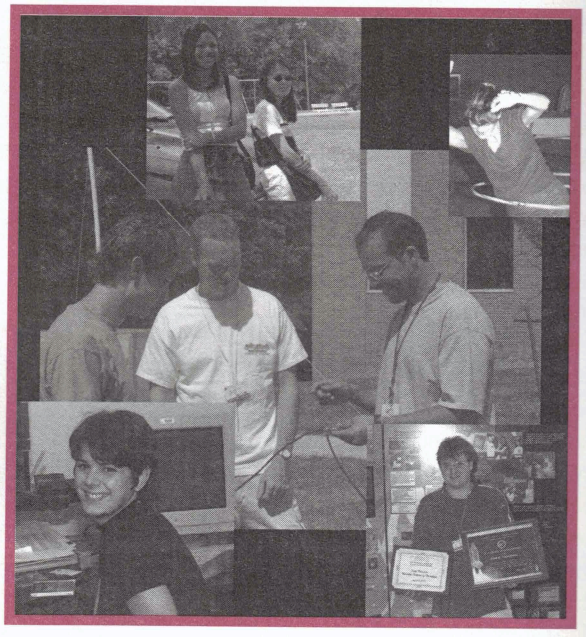
Summer Interns Star at NSSDC/SSDOO

By George Fleming

Again in 2000 SSDOO was the temporary home for a stellar group of interns from a large number of programs. And again as in 1999, one SSDOO intern was given an award for an outstanding presentation! Included below are the students' own characterizations of their projects. Note that their school levels reflect their 2000-2001 school year.



Summer student interns pursue their projects.

LaTarsha L. Brandon, a senior in mathematics and statistics at Virginia State University, worked with Robert Candey on Extreme Value Analysis as related to geomagnetic storms. LaTarsha came as part of the Summer Institute in Engineering and Computer Applications (SIECA) program. She reports, "The theory of Extreme Value Statistics is used to observe extremes of a certain sample from past or present data in order to predict further dangerous phenomena. Extreme values were first used by hydrologists to predict massive floods so that future technology could prevent them. Similarly, and in this case, it can be applied to Space Physics to study geomagnetic storms. Our study consisted mostly of graphical methods that have shown to be very useful tools for exploratory extremal data analysis. Given the data from the geomagnetic indices, the XTREMES software program produced graphs to be analyzed for a specific pattern that indicates the occurrence of a geomagnetic storm."

Tom Narock, a senior in astronomy at the University of Maryland, was part of this year's Radio JOVE project. Working with Tom this year was Albie Davison; their mentor was James Thieman. Albie was in the Radio JOVE project last year and currently works part-time for Raytheon at SSDOO. Tom relates, "The Radio JOVE project is an education and outreach project focused on radio emissions from Jupiter and the Sun. The project allows participants to build their own radio antennas and receivers and to observe and analyze data at a frequency of 20.1 MHz. This summer I had the pleasure to be a part of this project. The summer was spent between education and

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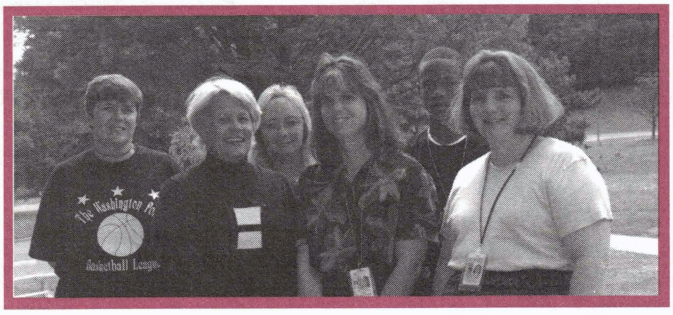
SSDOO Depends on Capable Administrative Staff

By Joseph King

The Space Science Data Operations Office (SSDOO), including NSSDC and other elements, consists of 22 permanent civil servants, five civil servants matrixed from other Goddard organizations, and many tens of on-site support contractors. Fortunately, SSDOO has a team of excellent administrative support people keeping secretarial needs, travel arrangements, budget matters, contract administration, equipment tracking, etc., well in hand. This article is intended to introduce this team.

Secretarial support is provided by Margie Pasini, who first came to Goddard in 1983 as a cooperative office experience (COE) student from Largo High School. After a short secretarial stint at the University of Maryland, she returned to Goddard in 1987 to join the SSDOO team a few years prior to SSDOO's creation. Joining Margie half-time for the new school year is Derrick Jones, also a COE student from nearby Eleanor Roosevelt High School. Derrick's participation in Goddard's COE program provides him his first work experience.



SSDOO's administrative staff: (left to right) Vicky Lopez, Barbara Patala, Linda Resh, Mary Stevens, Derrick Jones, and Margie Pasini.

Lisa Kelly has been SSDOO's financial analyst for the past year, ensuring that all of SSDOO's budget inflows and outflows are managed and tracked in adherence to all government and NASA rules. Lisa ensures that SSDOO and NSSDC staff, in their commitment to bring maximum benefit to NASA and to the space science community, do not overspend! Lisa started at Goddard as a high school senior in 1984. In September Lisa moved to the Hubble Space Telescope Project Office. Her SSDOO duties are being taken over by Barbara Patala until a permanent replacement is named. Barbara has been at Goddard since 1991 and has already had one tour as the SSDOO financial analyst.

Barbara is assisted in aspects (credit card tracking, purchase request tracking, etc.) of SSDOO's budget management by Vickie Lopez. Vickie started working at NSSDC as a keypuncher in 1969, advanced through various data technician roles, and left in 1981 to be a full-time mother. She came back to Goddard in 1988 as an RMS employee in administrative roles and came into SSDOO in 1995 when the pre-existing Orbiting Spacecraft Project Office that she was supporting moved into SSDOO.

SSDOO's key person for equipment and logistics (office moves, telephones, etc.) is Linda Resh. Linda came to Goddard in 1988 as a property supervisor and joined SSDOO in 1993.

Mary Stevens is the Goddard contracting officer for the major SSDOO on-site support contract with Raytheon Information Technology Systems and Science company. While Mary has other Goddard contracts also, SSDOO considers her part of its team as she has been very helpful in the transition from the traditional "level of effort" contract to a mixed level-of-effort/performance-based contract in 1998, and in SSDOO's living in this environment since. Mary has been at Goddard since 1988, mainly in contract administration roles.

These people all work for NASA except Vickie and Linda, who are Boeing employees. Their effectiveness in their roles has contributed greatly to SSDOO and NSSDC's being able to bring the services to the international research community and to the general public that they are able to do. ◆

NSSDC Web Site Selected to Showcase NASA's Commitment to Accessibility

By Nathan James

The next time you visit your favorite Web site, try taking a "walk" through it without using your mouse and without turning on the graphics. Is the site still effective and informative? Web sites that cannot be navigated without a mouse or are useless without graphics or do not have enough information in text format are not "accessible" to all people.

Some physically handicapped people are not able to use a mouse. Many who are visually impaired depend on a text screen reader and a keyboard or voice input to navigate a Web site. However, many Web sites today are not designed with these users in mind. Consequently, numbers of people who are handicapped are locked out of these sites. So what does this have to do with NSSDC?

Since June 2000 NSSDC has been a part of an ongoing effort to make NASA's most heavily used sites Web-accessible. This effort is a result of a memo sent by the Justice Department to all federal government chief information officers. The memo states that federal government Web sites with limited exceptions must be compatible with the assistive technology used by millions of disabled people according to the Section 508 amendments to the Rehabilitation Act of 1973 (Workforce Investment Act of 1998).

Section 508 of the Workforce Investment Act of 1998 states that federal agencies' electronic and information technology is to be as accessible to people with disabilities as to people without disabilities whether they are employees or members of the public.

Ranking number nine in accesses among NASA Web sites (see http://www.hq.nasa.gov/webmaster/accessibility/NASAtop20websites.html) and averaging just over ten million hits per month this year, the NSSDC Web site (http://nssdc.gsfc.nasa.gov/) is one of three Goddard sites and one of 20 NASA sites selected to showcase NASA's commitment to Web accessibility and section 508 compliance. At the time of the selection, the NSSDC Web site was found to be the most compliant Goddard site with the proposed Section 508 guidelines. ◆

Summer Interns

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outreach and data analysis. The first part of the job was to familiarize myself with the radio emission processes of Jupiter and the Sun. Once I had a comfortable understanding of the emission processes, we began putting together education materials for students. The main goal was to provide activities that helped students understand their equipment and how to analyze their data. One of the main advantages of this project was that we had the opportunity to build our own radio antenna and observe regularly. We observed three to four times a week and recorded multiple solar bursts. The data analysis aspect involved analyzing Voyager and Galileo data to better understand the physics of the emission process from Jupiter and to better predict future storms."

Van Hong Nguyen, a graduate student in statistics at the University of New Mexico, came to SSDOO as part of the SIECA program; Van's mentor was Cynthia Cheung. As Van's abstract states, "The Astronomical Data Center (ADC) at the NASA Goddard Space Flight Center distributes collections of data that have been published by professional astronomers. All of these data sets are multivariate data that consist of a number of measurements (variables) recorded for each of the astronomical objects in the study. Multivariate analysis is a large suite of methods and algorithms for understanding the structure of such databases. Histograms, for example, could be used to look at the distribution of values on each variable, and simple scatterplots used to obtain a number of two-dimensional views of the data. A more complex multivariate method is clustering analysis, which looks for distinct groupings in multidimensional parameter space. Some statistical functionality from the Data Viewer has been analyzed by using Catseye, a tool for plotting column data from ASCII tables."

Nichole O'Connell, a senior at the University of Rhode Island majoring in physics, arrived at SSDOO as part of ACCESS: Achieving Competency in Computing, Engineering, and Space Science. Nichole's mentor was Ramona Kessel. Nichole's presentation states that "[t]he examination of data from various satellites has revealed a correlation between ultra low frequency (ULF) waves inside and outside the Earth's magnetosphere. The bow shock is a standing shock wave formed upstream of the Earth's magnetosphere, due to interactions with the supersonic solar wind. The region between the bowshock and the Earth's magnetic field is called the magnetosheath and is characterized as an extremely turbulent area. Because so much is going on in this region, the ULF signal cannot be tracked through it. Therefore, we use data from the Geotail satellite to detect these waves upstream from the bow shock and the geosynchronous satellite GOES, to detect them within Earth's magnetosphere. My contribution to this study has been centered on analysis of Geotail data. I retrieved 3-sec magnetic field data from a WWW database in Japan. Using the Interactive Data Language (IDL), I converted this data to Common Data Format (CDF). Also using IDL, I calculated the cone angle. This data was loaded on to the Coordinated Data Analysis Web (CDAWeb) for easier access. Finally, using Fast Fourier Transformations, I determined the power spectrum of Geotail 3-second data. Comparisons of Geotail and GOES power spectra confirm the similarity of ULF waves at times of high-speed streams and small cone angles."

Thomas Smith (left) and William Pine (right), teacher interns, developed middle school and high school physics curriculum materials for the IMAGE, Radio JOVE, and INSPIRE projects.

James Thieman, Brian Schmidt's mentor, writes, "Brian is now a second year graduate student at James Madison University in Virginia. During his summer 2000 tenure at GSFC as a Student Internship Program (SIP) student, Brian developed an archive interface for the Radio JOVE project. Radio JOVE is an education and outreach project in which schools build radio astronomy receivers and antennas which enable them to receive and record radio emissions from Jupiter and the Sun. As a part of the project, the schools are asked to submit copies of their data log files to the archive when they successfully receive data. They are also asked to send sound files and/or images of the chart recordings of their data. Brian developed a format for submitting information about these files and a search mechanism for schools to use on the database of file information in order to retrieve entries for a particular date, time, target, etc. The schools could then obtain these files in order to compare them to their own data. Brian had not completely finished the project at the end of the summer, but hopes to finish it at the beginning of this school year."

Paul Thompson, a graduate student in computer science at James Madison University, arrived here courtesy of the EEO Summer Internship Program. Shing Fung was Paul's mentor. Paul's abstract states, "The CRRES satellite was launched in July 1990 into a highly elliptical orbit around Earth. Along with other instruments, it carried a magnetic focusing electron spectrometer, identified by 'Medium Electrons A' (MEA). The MEA collected electrons into bins of various energies. Also recorded was a host of other parameters, including the angle of the magnetometer with respect to the local magnetic field. The volume of data collected is huge, with a record every .512 second continuing for over a year, covering 11 CDs. It has been suggested elsewhere that the distribution of electron fluxes trapped in the Earth's radiation belts fits the equation $F = \sin^N a$ where a is the angle between the particle velocity and the magnetic field. The goal of this project was to write a program to go through the CRRES data and determine the parameter N by fitting a one-minute set of data to the given equation. This goal was accomplished."

SSDOO was delighted with all of the final reports, but special mention must be made of Paul's. Paul received a special presentation award, the Rashaan Jackson Presentation Award, for his efforts this year! Congratulations for a job well done! ◆

Viking Lander Biology Data

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Nine distinct soil samples were analyzed over the course of the two Viking Lander missions. Each analysis involved the collection of data over many days or weeks. The data were radioactivity count rates mostly taken at 16-min intervals, accompanied by similarly resolved temperature values obtained in the test cell and at the radioactivity detector to help with the interpretation of the count rates. Thus, the basic data are time-tagged sets of three numbers mostly every 16 minutes for each of nine multiday periods.

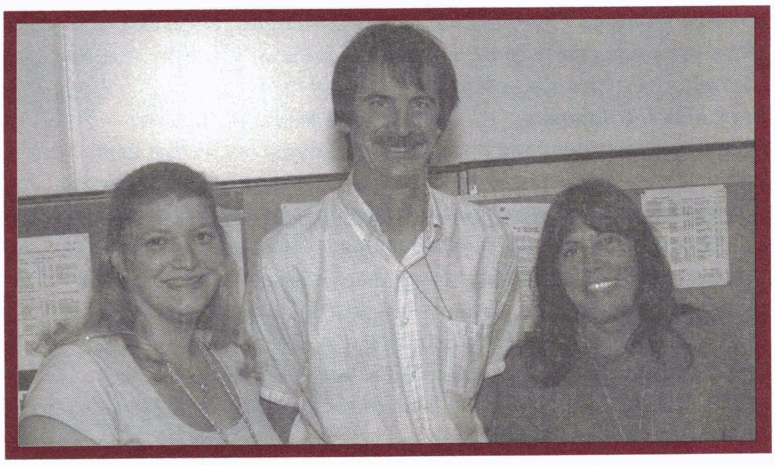
LR data were available at NSSDC in two forms. First, NSSDC held 24 reels of microfilm whose frames contained images of pages of computer printout generated by the Viking Project for archiving. While each reel was specific to either Viking Lander 1 or 2, the data from the three biology experiments were highly intermixed. Further, while the focus of the 24 reels was the VL biology data, the reels contained engineering and other data vastly more than needed for the use of the LR count rate and temperature data. Attempting to scan these reels of microfilm would have been expensive and owing to the poor quality of many frames would likely have produced very unreliable ASCII files. Even if done reliably, the further effort to develop software to recognize, extract, and organize the desired LR data would also have been expensive.

NSSDC as well had some CDs of Viking Lander data generated by the Jet Propulsion Laboratory as part of its institutional data restoration effort. A sample of these with the limited available documentation was sent by NSSDC to PDS/WU where Dr. Ed Guinness and his colleagues determined that the VL data could not be used to identify and retrieve the desired LR data. Further, PDS/WU identified, requested, and through JPL's Michael Martin received copies of another set of VL CDs; again, insufficient documentation prevented their use in retrieving the desired data.

Thus, at this point the best option for recovering the desired LR data was a very tedious and labor-intensive reading of many microfilm reels to find all the desired LR reading of data and to key these data as encountered into a computer. Fortunately, an attractive alternative materialized.

Labelled Release Principal Investigator Dr. Levin operates a company, Biospherics, Inc., located in Beltsville, Maryland, less than ten miles from Goddard. NSSDC contacted Dr. Levin, who was very enthusiastic about the possibility of the recovery and new analyses of his data. NSSDC Planetary Acquisition Scientist Dr. David Williams and this author met twice at Biospherics with Dr. Levin and his colleague, Dr. Pat Straat, who is now working in an unrelated field in nearby Bethesda, Maryland. Dr. Straat was able to produce from her personal archives computer listings generated during the Viking missions that were LR-specific and were greatly more convenient to use than the NSSDC microfilm frames.

She initially provided a copy of the listings for cycle 3 of the Viking Lander 2 mission. A "cycle" was everything connected with a specific soil sample. This cycle, of about 12 weeks' duration, was the cycle of most interest to the researcher whose request stimulated this recovery effort. A copy of the copy was created at NSSDC and sent to PDS/WU, where it was keyed by Phil Valko, a WU student, under Ed Guinness's watchful eye.



Allison Lopez (left), Dr. David Williams (center), and Lois Hughes (right) were all active in restoring the Viking Lander 2 data.

This material contained much but not all the count rate and temperature data for this cycle. The additional data were on the NSSDC microfilm and were keyed by NSSDC staff, mainly Allison Lopez and Lois Hughes, then quality-checked and sent as a file to PDS/WU for the preparation of the complete VL 2, Cycle 3 data set.

PDS/WU has prepared an LR Experimenter's Notebook, an LR Web page (whose URL will be given in the Web-version of this article once the page is publicly available), and the new data set, which integrates the PDS/WU and NSSDC data recovery efforts. They have also made arrangements for PDS peer review of the VL 2, Cycle 3 data as per standard PDS practice. The data will be publicly accessible via network from PDS/WU shortly after the peer review slated for September 2000.

As of early September 2000 NSSDC was acquiring from Dr. Straat copies of her voluminous printouts for the other LR cycles. These printouts will be student-keyed at PDS/WU. In the coming months well-organized LR data for all cycles will be network-accessible from PDS/WU and will also reside on PDS/WU-created CDs at the NSSDC archive.

PDS hopes to mount an equivalent effort for the other two Viking Lander biology experiments. Whether data as conveniently organized as the LR data provided by Dr. Straat are needed and available outside NSSDC/PDS remains to be seen.

Fortunately for posterity, data prepared for archiving by current and recent NASA space science missions are done digitally and in adherence to standards that did not exist in the 1970s. ◆

Archive Reference Model Gains Wide Acceptance

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but transferable and persistent. ICSTI recommends that as much as possible within the International Standards Organization (ISO) framework, the draft standard should be reviewed for adoption by not only the spatial data community but by the broader information community. This community would include the technical committees and bodies at the national levels that deal with libraries, information processing, computing, and data bases.

ICSTI commends the CCSDS for taking a broad view of the problem and for keenly identifying that without a basic reference model, with definitions, there would be little hope of standards for digital archiving, whether of data or any other information type." Another example of its adoption is the Koninklijke Bibliotheek (KB – National Library of the Netherlands), which in its "An Experiment in Using Emulation to Preserve Digital Publications" by Jeff Rothenberg states, "The OAIS is a proposed 'reference model' for archival preservation of digital information. It has been of great value in providing a comprehensive and consistent frame of reference that encompasses many of the issues surrounding the creation of digital repositories."

The Web-resident full version of this article has testamonials from the National Library of the Netherlands, the Networked European Deposit Library, and the National Library of Australia. It also summarizes the 1995-2000 history of the development of the model to date.

NOST has now reached the point where it needs help to continue to increase the quality of the document and to continue to make it applicable to wider audiences. It needs comments on the draft. The ISO review period for the OAIS Reference Model draft ends November 15, 2000, but everyone is strongly encouraged to submit comments by September 30, 2000. Comments may be submitted by following the instructions at http://www.ccsds.org/RP9905/.

For further information about the OAIS Reference Model or other archiving issues, readers may contact one of the authors of this article: John.Garrett@gsfc.nasa.gov or Donald.Sawyer@gsfc.nasa.gov.

Vampola Data Sets

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Tables detailing the content of Dr. Vampola's data sets are in the Web version of this article. However, none of the data sets are currently available on line; the schedule and sequence for making them electronically accessible will be affected by community requests for these data. Further questions on data contents and availability may be addressed to the author of this article at jcooper@nssdca.gsfc.nasa.gov. Readers may order specific data sets (please specify NSSDC ID if known) on CD or other off-line media from NSSDC's Coordinated Request and User Support Office (CRUSO) via E-mail to request@nssdca.gsfc.nasa.gov or by telephone at (301) 286-6695 or FAX at (301) 286-1635.

David Han Finishes NSSDC Tour

By Joseph King

David Han has spent two years at NSSDC supervising the CDF software effort.

David Han, a member of the Science Data Systems Branch of Goddard's Information Systems Center, has completed his detail to NSSDC and has moved on to manage software development for the Solar-Terrestrial Relations Observatory (STEREO) project within Goddard's Solar-Terrestrial Probes Program. David's responsibility at NSSDC was the management of the evolution of the Common Data Format (CDF) software and support of CDF users. During his two-year NSSDC tenure CDF 2.7 was issued, Java versions of all CDF software were created, and CDF documentation was converted to Portable Document Format (PDF). The main advance of CDF 2.7 over earlier versions was its JAVA-based tools and Java Application Program Interfaces (APIs) and the removal of several bugs from the core CDF library.

David was also a member of the Formats Evolution Process Committee to which he brought his rich understanding of the CDF environment. As of this writing NSSDC is looking for a replacement for David in his CDF role. ◆

NSSDCNEWS

NSSDC News is published quarterly by NASA's National Space Science Data Center. Please send your address changes and requests to the appropriate address listed in the box below. Your comments are welcome.

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