NSSDC NEWS

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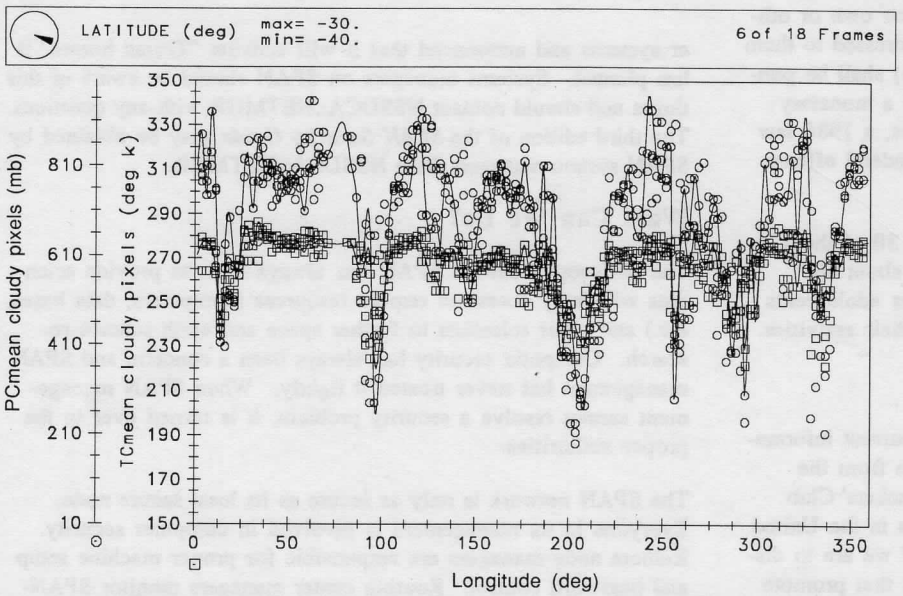
Common Data Format Becoming Standard Tool

NSSDC's Common Data Format (CDF) is a self-describing data abstraction for the storage and manipulation of multidimensional data. CDF is designed to support any scientific application in a discipline-independent fashion, so it is a powerful tool for the development of systems that can archive, manage, manipulate, display, or analyze data. This abstraction, which consists of a software package and a self-describing data structure, is a result of NSSDC's applied computer science work.

These research and development efforts are not just "pie in the sky" nor do they merely generate documents—they have a strong emphasis toward practical applications. For example, CDF has been used to develop a number of generic data management, display, and analysis capabilities for a wide variety of disciplines at NSSDC. It is designed to be portable so that copies can be made available on computer systems outside of NSSDC to exchange both software and data.

More than 50 organizations outside NSSDC—representing various NASA laboratories, research groups, and current and future flight projects, as well as other government agencies, universities, corporations, and foreign institutions—are now becoming beta-test sites for the CDF software package. As a result, the CDF has become a standard method for storing space and earth science data for a variety of applications.

see CDF, *page 3*



This figure illustrates data from the International Satellite Cloud Climatology Project (ISCCP) that has been stored in a CDF. The NSSDC Graphics System (NGS), which can visualize data stored in a CDF, generated it. ISSCP world grids at 00:00 GMT on July 4, 1983, were selected and sliced into 10° latitude bands as an animation sequence of 18 frames. Cloud top data from the sixth frame of this sequence (40° to 30° S. latitude) were plotted as a function of longitude. Specifically, the individual pressure and temperature cell values from that latitude band were extracted from world grids of these parameters and are shown in this scatter diagram as circles and squares, respectively. In addition, the two collections of points were fitted with separate cubic splines. This analysis shows the correlation of pressure and temperature values at the cloud tops at a microscopic level.

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Message from the Director

European Authorities Seize Evidence of Unauthorized Computer Access by German "Hacker" Club

Recently, the German Federal Criminal Agency (BKA), the French police, and the Department for Computer Crime in Hamburg, Germany, raided the Chaos Computer Club, whose members claim to have "tapped top secret arms and space research material stored in a U.S. National Aeronautics and Space Administration (NASA) computer system" by using the Space Physics Analysis Network (SPAN) to get to the computers.

In addition to seizing materials in the club, authorities searched the homes of three members and confiscated all computer material. No arrests have been made as yet, but the club is being accused of unauthorized computer access, and erasing and changing data.

One newspaper in Germany said that the seizures were based on reports of "hackings" from the European Nuclear Research Center (CERN) in Geneva, Switzerland, as well as Phillips Electronics in France. The appropriate authorities in the United States are still collecting information about the unauthorized access on SPAN.

New Laws Enacted

Since about August 1986, a new German law has made computer "hacking" a felony. The law addresses three distinct areas: spying on data, unauthorized changing of data, and computer espionage. The law states that whoever "takes data for their own or others usage without authorization (data that are not addressed to them or were specially secured against unauthorized usage) shall be punished with up to three years of jail sentence or with a monetary fine" (approximate translation). In the United States, a 1986 law makes unauthorized access to a computer system a federal offense and carries a similar punishment.

The Chaos Computer Club has about 180 members, 30 of them active, and produces a newsletter with a mailing of about 600 persons. My understanding is that the club contains adolescents as young as 13 years old, with adults supervising their activities.

Press Active in Europe

The press in Europe has been very active with the current information on the European hackers. A typical article title from the London newspaper *Guardian* recently was "NASA Hackers' Club Files Seized." I am very disappointed that the press in the United States has ignored this important followup story. If we are to discourage our youth from getting involved with clubs that promote and teach unauthorized access, the repercussions from such activities should be as sensational a news item as the original stories.

What was the hackers' response? A spokesman for the Chaos Computer Club sees the raid as a "dangerous step that subjects a critical technical group to criminal charges," and that it really wasn't them in the first place but "other persons in the vicinity of the club that had penetrated computers of the American space agency (NASA)." I guess we should have expected that answer. The Chaos Computer Club recently declared war on NASA computer systems and announced that it will activate "Trojan horses" it has planted. Systems managers on SPAN should be aware of this threat and should contact NSSDCA::NETMGR with any questions. The third edition of the *SPAN Security Guide* may be obtained by SPAN system managers from NSSDCA::NETMGR.

Associated Press

Wau Holland, chairman of the Chaos Computer Club, displays a computer at a Hamburg news conference that he says was used to break into NASA's worldwide computer network.

What Can We Do?

The philosophy behind SPAN has always been to provide scientists with easy access to remote resources (computers, data bases, etc.) and other scientists to further space and earth science research. Computer security has always been a concern, and SPAN management has never treated it lightly. When SPAN management cannot resolve a security problem, it is turned over to the proper authorities.

The SPAN network is only as secure as its least secure node. Everyone in its management is involved in computer security. Remote node managers are responsible for proper machine setup and password control. Routing center managers monitor SPAN-wide traffic and manage gateways. There is a policy whereby systems that do not follow the SPAN security procedures are disconnected. The Data Systems Users Working Group has a security subgroup that reviews the security policies issued on SPAN and makes the appropriate changes.

The users of SPAN have a major say in how the network is operated. The procedures have worked well over the last eight years and will definitely continue in the future to provide SPAN users with an acceptable level of security.

James Green

CDF, *from page 1*

CDF also has been critical to the success of NSSDC's current Coordinated Data Analysis Workshop (CDAW) 8 activity. The CDAW 8 participants can now produce scientific results via data interpretation and analysis at an unprecedented rate. CDF has been used to manage a diverse scientific data base (more than 50 different data sets) that was a driver for various generic (i.e., CDF-based) data analysis and displays tools.

Although FORTRAN language bindings for CDF are now operational on DEC VAX/VMS computer systems, NSSDC's efforts in generic data storage structures have not stopped. C language bindings have just been developed and are being tested for VAX/VMS, IBM MVS and VM, and UNIX (e.g., Sun, AT&T) environments, coupled with conversion utilities to transparently move the physical files composing a CDF from one computer system to another.

These developments will be enhanced for distributed access over local area networks. This distributed or network CDF is being developed as part of a joint effort with the Unidata Project sponsored by the National Science Foundation through the University Corporation for Atmospheric Research (UCAR). The Unidata Project has adopted CDF as its data storage standard for all applications. Since the implementation of the CDF data abstraction really implies an extension to a conventional programming language for the support of multidimensional data objects, a recasting of CDF into an object-oriented programming language will also be pursued.

In summary, this work involves the integration of various physical science disciplines and the computational sciences with an emphasis on developing capabilities for a researcher to concentrate on doing science, not hacking on a computer. What is important is not the details of the technology, but what that technology can easily and inexpensively provide to promote science. Such efforts will further the use of heterogeneous computer systems to support management, analysis, and display of any scientific data of interest separately from a centralized computer system.

Lloyd A. Treinish

Standard Formatted Data Unit and Common Data Format Uses Clarified

Many people have asked for clarification of the relationships between the Consultative Committee for Space Data Systems (CCSDS) Standard Formatted Data Unit (SFDU) and the NSSDC Common Data Format (CDF), especially in view of the fact that NSSDC has been supporting the development of both technologies. The following discussion should help resolve potential confusion about SFDU and CDF.

Although SFDU and CDF both have the word "format" in their titles, neither is a standard format in the commonly understood sense (e.g., FORTRAN formats, magnetic tape files), and the primary focus for their functionality is different. This different focus justifies a different implementation and yields a technology optimized for a particular class of problems. However, like many related technologies, each has the ability to do part of the job (in principle) for which the other has been optimized. These technologies are far more complementary than competitive.

The CDF approach has been to drive generic data system applications (such as graphics, management, or analysis) and to provide a self-describing data abstraction for the storage and manipulation of multidimensional data implemented in software. Much space science data can be usefully viewed through this data abstraction, while the same cannot be said, for example, for relational or network data models. The software provides a more friendly environment and better performance for scientific application developers than do commercial data base management systems, which are oriented toward business applications.

To support CDF among heterogeneous hardware and software environments, CDF software is under development in multiple environments. Developments include utilities for transparent transformation of the underlying CDF data structure among these environments. However, not all data are effectively viewed as CDF data objects (e.g., raw telemetry). Thus, there are needs for other data models.

The SFDU approach has been to focus on information transfer in an open, multimedia, heterogeneous environment. This approach requires the capability to transfer any data type or set of data types, and complex data abstractions, with the documentation needed for their understanding and their parsing. The result is a technique that is also highly applicable to long-term archiving. SFDU transfers should occur as automatically as possible, which implies that the underlying data structures are combinations of self-describing and standard structures.

SFDU functionality will increase in an evolutionary manner. One abstract view of the SFDU, supported by current evolutionary directions, is as a hierarchy of information objects. An information object may be as simple as a documented flat file or as complex as a multispectral image with associated attributes, or a full CDF. In the latter case, assuming that the CDF data structure details are unknown to SFDU services software, but that the CDF has been registered as an external authority, further processing of a CDF object would be handled by local CDF software. In this way, the SFDU can serve as the glue that provides a common view of many data abstractions, while allowing specialized software such as CDF to provide detailed access to specific data elements.

Another way to see a relationship between SFDU and CDF is to envision a local data management system using CDF as a key data access mechanism, with the need to import a variety of user-defined data structures and abstractions. By encapsulating the user data structures in SFDU forms and documentation, they become readily parsable, and appropriate transformations to the CDF data abstraction can be more easily determined and accomplished.

Currently, an operational set of CDF software exists, while only a limited set of SFDU services software has been tested. However, recommendations on SFDU structure have been virtually approved; these recommendations are sufficient for testing to begin, allowing some of the promised SFDU functionality to be realized. A full description of the SFDU program and concept will appear in a future newsletter.

Don Sawyer and Lloyd Treinish

NSSDC Informs Space Scientists About Significant Spacecraft Events

An ongoing responsibility of NSSDC, as the World Data Center for Rockets and Satellites (WDC-A-R&S), is to alert the space science community to significant events concerning spacecraft status, as recommended by the international Committee on Space Research (COSPAR). More specifically, NSSDC/WDC-A collects information on imminent and actual launches and decays of spacecraft in orbit, along with other essential data.

The Data Center disseminates this information worldwide, in a timely fashion. The benefit of this role arises from the Data Center's ability to obtain and assess the numerous inputs it receives from the governmental and independent sources around the globe.

In a typical week, NSSDC/WDC-A receives about 80 telexes, many of them from the North American Air Defense Command (NORAD) and from the network of Foreign Broadcast Information Service (FBIS) stations around the world. The latter source is particularly helpful in providing background and prelaunch information gathered from press releases and radio announcements from the Soviet Union, China, Japan, India, and other nations. The FBIS network also supplies information on malfunctions, imminent re-entries, and actual re-entries.

The NORAD telexes provide the actual launch verification soon after a spacecraft has been launched and its orbit has been determined. NORAD, knowing the established ID convention, suggests an international ID number for the spacecraft, which is then officially assigned by NSSDC/WDC-A on behalf of COSPAR. By COSPAR agreement, the launching agency is supposed to notify WDC-A of its launches, but in practice this often doesn't happen.

After extracting information from NORAD, FBIS, and several other sources, NSSDC/WDC-A staff send telexes to 12 COSPAR-recommended institutions around the world. They, in turn, forward the information to numerous space science institutions in their jurisdiction. The telexes, sent within about 48 hours after launch, give the name of the spacecraft, international ID, and date and country of launch.

NSSDC/WDC-A also publishes a detailed monthly periodical, the *SPACEWARN Bulletin*. The bulletin includes pre- and post-launch announcements on spacecraft. One section of the bulletin contains expected re-entry dates of any spacecraft, rocket body, or debris, and actual re-entry dates.

Launch announcements are compiled by WDC-A if they are not provided by the launching agency. These announcements contain brief mission descriptions and orbital parameters. Updates of orbital/radio beacon data are also included for certain spacecraft, i.e., those with frequencies in the VHF range of interest for ionospheric/atmospheric study. The operational status of a beacon, especially on a spacecraft not routinely tracked by Goddard Space Flight Center, is usually not readily available, although communication with users has often been helpful in ascertaining the status.

C. M. Wong and R. Parthasarathy

Pilot Project Initiated To Improve Access to SIMBAD Astronomical Data Bank

NSSDC has initiated a pilot project for improving access to the SIMBAD data bank in France, one of the largest astronomical data bases in the world. SIMBAD stands for "Set of Identifications, Measurements, and Bibliography for Astronomical Data."

A request for proposals was recently published in the American Astronomical Society newsletter. Winners were announced as this newsletter went to press.

The purpose of this pilot effort is to examine cost effective ways of providing the American astronomical community with better access to SIMBAD and to support astronomical research to the best extent possible. NSSDC will support the project for approximately six months. If successful, the developed capabilities will be extended to the wider astronomy community as funds allow.

The STARCAT system developed at the European Southern Observatory/Space Telescope-European Coordinating Facility (ESO/ST-ECF) has been installed at NSSDC with help from ESO and ST-ECF staff. The system provides online retrieval of data from approximately 40 astronomical catalogs and will be used to access SIMBAD.

NSSDC supports major communication access in the United States by the Space Physics Analysis Network (SPAN), the NASA Science Network, and GTE/Telenet. In addition, NSSDC has an international Telenet gateway to France and will pay all telecommunication charges to access NSSDC resources and SIMBAD.

NSSDC congratulates the winners and hopes this new capability enables them to successfully complete their research.

James L. Green and Wayne H. Warren Jr.

NSSDC is proud to announce that it will be able to support the following researchers in the SIMBAD project:

Dr. R. Kent Honeycutt	Indiana University
Dr. Richard A. Wade	University of Arizona
Dr. Harry M. Heckathorn	Naval Research Laboratory
Dr. Robert E. Stencel	University of Colorado
Drs. Saul J. Adelman and Robert J. Dukes Jr.	The Citadel
Dr. Harry L. Shipman	University of Delaware
Drs. Francois Schweizer and Vera C. Rubin	DTM
Dr. Lucy-Ann McFadden	University of California, San Diego
Dr. Bruce J. Hrivnak	Valparaiso University
Drs. Priscilla C. Frisch and Donald G. York	University of Chicago
Dr. Carol A. Grady	CSC/NASA/GSFC

Security and Funding Issues Receive Attention During Recent Meeting of Data Systems Users Working Group

The Data Systems Users Working Group (DSUWG) meeting was held at the Ramada Inn, Lanham, Maryland, on November 18-20. It attracted over 100 Space Physics Analysis Network (SPAN) attendees, including users, system managers, networking specialists, discipline scientists, and program managers. The first day was devoted to network-specific issues, and the following two days included general sessions, working group meetings, joint meetings, and the wrap up.

Security a Hot Topic

Security was a hot issue during the entire DSUWG meeting. Jim Green (NSSDC) discussed SPAN's experience with the German hackers, who broke into SPAN through a "security hole" in the DEC operating system. A translated video of the German television program "Panarama" was shown, so attendees could hear interviews that included hackers who discussed what had happened and how it was possible. The hackers on TV gave the impression that not all hackers support illegal computer activities. Green identified U.S. laws that prohibit unauthorized access into computer systems. As a followup to the break-in, German police raided the Chaos Computer Club office and confiscated its equipment. German authorities and the FBI are working on this case. Meanwhile, NASA and SPAN management's immediate goal is effective electronic security.

During the security splinter group meeting, Frederick Tompkins (NASA Headquarters) gave a presentation on the NASA Computer Security Workshop and the security implications for NASA and NASA-funded systems. Also, Robert Rosenthal (National Bureau of Standards) discussed the implementation of security in the OSI model. In the subgroup meetings that followed, attendees expressed concern about the potential creation of security policies that would defeat the purpose of an open scientific network by making security implementation so expensive that a disproportionately large part of the scientists' research dollars would go for security rather than for research.

DEC personnel presented their plans for DECnet's migration to the Open System Interconnect (OSI) protocol. OSI is a design standard that will be adopted by major electronic equipment vendors over the next few years. Its significance is that it will eliminate protocol compatibility problems for networks. The situation now is that a DECnet-based network requires the use of only DEC products or DECnet interfaces for non-DEC computers. When OSI is implemented, however, designers' products will conform to the OSI standard of compatibility. DEC expects to have OSI file transfer and electronic mail products available within a year. Complete implementation of OSI is a few year away.

Other activities on the first day included a discussion by AT&T participants about their Information Systems Network (ISN) communications capabilities, along with their ISN pilot project at Marshall Space Flight Center and a planned pilot at Goddard Space Flight Center. There were splinter group meetings on new node management, SPAN_NIC, and X.25 access.

SPAN_NIC's current capabilities, which include some recent improvements, were discussed and demonstrated. Responsibility for SPAN_NIC has been passed from Thuy Ha (NSSDC/SAR) to Pat Sisson (NSSDC/SAR), who talked about the plans for further improvements.

The X.25 presentation by Thuy Ha and Anne Beckman explained how attendees could access their computers at their home facilities without making a long distance phone call. Three terminals with modems were available for attendees to use to access their systems and SPAN_NIC. Barry Jacobs (NSSDC) gave a presentation on DAVID, a system that allows transparent distributive access to remote heterogeneous data bases.

Funding Another Major Issue

In addition to security, another major topic of concern was funding, which was discussed in various sessions over the next two days. These meetings were particularly important because of the new NASA Headquarters funding arrangements that will be implemented in fiscal year 1989 (beginning October 1988) and the requirement that SPAN management justify the need for retaining each of the SPAN nodes in light of the funding changes.

To address the funding issue, formal presentations were given by a NASA Headquarters representative and a SPAN user. Tony Villasenor presented NASA Headquarters' approach to the funding changes. A presentation was given by Theodore Clarke (JPL) on Gallileo's use of SPAN and justification for retaining access to it. The SPAN project manager had previously requested justifications from SPAN nodes, and quite a few users have sent in summaries of the types of activities supported by, facilities being accessed over, and general uses being made of SPAN.

Funding discussions continued during the joint SPAN/NSN/NSI management meetings. The Policy Subgroup made a recommendation on how the NASA Headquarters discipline offices should be charged, starting in FY89, for SPAN lines supporting their disciplines. Based on the recommendation, NASA science offices would pay for a basic level of connectivity (9.6 kb/s) for SPAN from a general fund. For SPAN links requiring greater than 9.6 kb/s, the associated discipline offices would be charged individually for any cost over that of a 9.6-kb/s link.

In general, the SPAN/NSN/NSI meetings were especially valuable because they allowed management from the two major NASA networks to discuss and resolve issues of mutual concern. Barry Leiner (Research Institute for Advanced Computing Systems), a very active participant in the SPAN/NSN/NSI meetings, talked about networking philosophy as the guest speaker at the DSUWG banquet. Meetings of SPAN/NSN/NSI management will continue, and joint committees have been set up to work on some specific actions that came out of the sessions.

DSUWG attendees were brought up to date on the SPAN support for the supernova. Bruce McLendon (NSSDC/SAR) discussed the arrangements that were made to provide electronic access between SPAN and the Southern Hemisphere observatories and the supernova balloon and rocket cam-

see DSUWG, *page 12*

Astronomical Data Center Puts Star Catalogs onto Computer Screens

NSSDC's Astronomical Data Center (ADC) specializes in acquiring, processing, documenting, archiving, and distributing astronomical catalogs and specialized data sets for astronomical disciplines in machine-readable format. The ADC evolved as an outgrowth of work begun in NASA's Laboratory for Optical Astronomy and continued in the Laboratory for Astronomy and Solar Physics under the direction of Dr. Jaylee M. Mead. The collaboration continues between NSSDC and Goddard Space Flight Center's Space Data and Computing Division, where Mead is associate chief.

The ADC's primary functions are to acquire machine-readable astronomical data; to edit, modify, and improve the data sets, usually in collaboration with the astronomers who provide the data; to document each data set; and to prepare these data for distribution to astronomers and for exchange with other astronomical data centers, such as those in Japan, Moscow, East Germany, and Strasbourg, France. Requests for astronomical data currently constitute 20 to 25 percent of NSSDC's total request volume, or about 500 requests per year—not including the thousands of questions about data availability, catalog content, and uses of the data. "The goals of the ADC are to increase the quality and quantity of machine-readable astronomical data available to the scientific community and to document those data to assure their continued usefulness," says Dr. Wayne Warren, ADC group leader.

The data being collected at ADC are primarily star catalogs that provide tables of information about all types of astronomical objects. There are more than 500 of these catalogs, but only 40 are currently available on line. ADC continues to work with other catalogs in an effort to bring even more star catalogs to online users.

The star catalogs are used to support basic research, to point and track telescopes and spacecraft, to reduce online data and make them easier to access, and to analyze new observations in light of previous research. Because the catalogs contain different types of information—for example, the often-used Durchmusterung catalog contains stellar identification information, whereas the HD catalog contains spectral information—the catalogs must be cross-referenced to get all the available information about a particular star. This cross-referencing task is extremely time-consuming; the *Catalog of Stellar Identifications* (CSI) is a cross-index catalog that took more than 10 years to build.

Once catalogs are cross-indexed, a data base can be built. A bibliographic data base called the *Bibliographical Star Index* (BSI) contains information about papers

Rudiger Pauley

ADC staff members, from left: Nancy Roman, Gail Schneider, Wayne Warren, and (standing) Young Woon Kang.

that cited particular objects. It is particularly useful to astronomers who need to know what research has been done on a particular object. By combining the CSI and BSI, the Centre de Données Astronomiques de Strasbourg (CDS) developed an online data base system called SIMBAD (Set of Identifications, Measurements, and Bibliography for Astronomical Data) that provides detailed information about an object's position, spectral type where applicable, papers written about that object (including measurements cited in the paper), and a variety of other useful information. The ADC is the U.S. contact for SIMBAD and has a cooperative data exchange agreement with the CDS.

The ADC has been part of NSSDC for the last 10 years. It is currently staffed by four employees of Science Applications Research (SAR) as part of the NSSDC support contract, plus ST Systems Corporation (STX) employees Lee E. Brotzman, Anne C. Raugh, and Robert S. Hill under contract to the Space Data and Computing Division. The SAR/NSSDC employees are Dr. Wayne Warren, Dr. Nancy Roman, Dr. Young Woon Kang, and Gail Schneider.

Dr. Wayne Warren, the group leader, is a 10-year NSSDC veteran—all of these years spent at the ADC. Warren has a Ph.D. in astronomy from Indiana University in Bloomington and is an expert in star catalogs. Directly after graduate school, he had a National Science Foundation fellowship at NASA with Jaylee Mead. On completing the fellowship, he joined NSSDC and began his career with the ADC.

In his current position, Warren is responsible for the overall operation of the ADC. He is the primary interface between the ADC and the scientific community, and he also edits and documents data. "Essentially, I whip data into shape and write documentation," he says. "This is a never-ending—and sometimes exasperating—business, since often by the time data are fully ready for dissemination they have been superseded by newer data." Warren is also the acquisition scientist for International Ultraviolet Explorer (IUE) and Infrared Astronomical Satellite (IRAS) data.

Dr. Young Woon Kang writes documentation and brief descriptions for catalogs, and helps modify them to meet the general needs of the astronomy community. So far, he has finished about 80 descriptions out of the 500 catalogs that are available. Kang also works on making these data catalogs available to users on line, and he recently developed an online ADC system (see the September 1987 *NSSDC News* for more information). Now that the ADC system is operating, he will also have to maintain the code. Kang also translates data between the VAX and IBM computers at Goddard. Most data are stored on an IBM 3081, but VAXes are used at NSSDC and by a number of scientific researchers.

ADC staff members do their own astronomical research in addition to their other duties; Kang's research is on eclipsing binary stars. He earned his Ph.D. in astronomy from the University of Florida, while his B.S. and M.S. degrees are from Yonsei University in Seoul, Korea. Upon completing his doctorate, he came to NSSDC and has been with the ADC ever since.

Gail Schneider fills requests for data catalogs via networks, magnetic tape, and microform. Requests come in through electronic mail, by letter, or through the NSSDC request service. Most data are supplied on requester-provided magnetic tapes that are submitted with a request form that details how the data are to be formatted to assure that they can be read at the requester's facility. When a request comes in, Schneider prepares magnetic tapes to the user's specification and sends them, with appropriate documentation, to the user.

Schneider has worked at NSSDC since August 1981; for five years she was in the computer services section, where she filled requests for satellite data sets. For the past year, she has been working with the ADC and enjoys her more varied responsibilities. She frequently communicates with requesters through wide area networks such as the Space Physics Analysis Network (SPAN) and BITnet. According to Warren, "Gail is great at communicating with the user community and has a genuine interest in data quality and customer satisfaction, and that's what the business is all about."

Dr. Nancy Roman works on projects that require specialization in astronomical data. She edits and reformats machine-readable data catalogs and is now working with a set of 24 catalogs, trying to resolve inconsistencies and form a single, uniform catalog. "There are a lot of problems, as these catalogs are not in a uniform format because they were done many years ago, and it takes a great deal of time just figuring out how to translate them," Roman explains. "They need to be put into a homogeneous format for simplified machine processing." Roman is trying to resolve internal inconsistencies, find errors, and make the data more usable to the astronomical community.

Previously, she worked on published atlases of constellations, rearranging the data to make it easy to determine in what constellation an object appears. "I try to put major astronomical catalogs into a machine-readable form that's most useful to the scientific community," Roman says, "and I try to resolve problems in the data at the same time." To improve the data catalogs, she checks for errors in the data and combines data from different catalogs. Sometimes her work involves putting data into significantly different formats or a format that's more easily used by the astronomers. For example, she will add information from other catalogs to make the data more useful (essentially adding new fields to the data file). Each catalog is documented as she works on it so that astronomers will know what information is in the catalog and how it may have been changed.

Roman has a Ph.D. in astronomy from the University of Chicago, and she worked on stellar astronomy there for six years after completing her degree. She then went to the Naval Research Laboratory, where for more than three years she worked on radio astronomy. After leaving NRL she went to NASA Headquarters, where she ran the astronomy program for 21 years. Upon retiring from NASA Headquarters, she made a deal with Wayne Warren—if he would teach her more about computers, she would offer her expertise in astronomy to the operation of the ADC. He accepted the offer, and she has been a valuable contributor to ADC functions ever since. She reflects, "I am familiar with the astronomical catalogs from the user's point of view and I appreciate the needs of the users. I've done research using these catalogs, and online systems weren't available then."

Mark Stevens

Satellite Situation Center To Support Inter-Agency Consultative Group

The seventh meeting of the Inter-Agency Consultative Group (IACG) for Space Science was held in Kyoto, Japan, in October. IACG has chosen solar terrestrial physics as its next major thrust, and NSSDC has been charged with upgrading its Satellite Situation Center to support this new effort.

IACG was formed in 1981 by four agencies —the National Aeronautics and Space Administration (NASA), the Institute of Space and Aeronautical Science (ISAS), the European Space Agency (ESA), and Intercosmos. Its purpose is to provide mutual support to enhance the overall scientific return from the missions and related activities of the four member agencies. The first major thrust of the IACG was to coordinate the agencies' efforts for the Comet Halley encounters in early 1986, resulting in much improved spacecraft trajectory information, data exchange mechanisms, and coordinated science meetings.

Building on the tremendously successful Halley encounter experience, the IACG plans to coordinate observations from over 20 existing and approved spacecraft missions involved in solar terrestrial physics from 1989 to 1997. This activity has grown beyond the scope of the International Solar Terrestrial Physics (ISTP) Program (see *NSSDC News*, Vol. 1, No. 3) because of increased international cooperation that now includes the Soviet Union.

The delegations of the member agencies were headed by Dr. L. Fisk (NASA, U.S.), Prof. M. Oda (ISAS, Japan), Dr. R. Bonnet (ESA, Europe), and Academician R. Sagdeev (Intercosmos, Soviet Union). Two working groups were created to study the science and data exchange activities needed during the proposed coordinated solar terrestrial study period. The Science Working Group defined the multimission science objectives, identified necessary coordinated data acquisition opportunities, and discussed the intercalibration of science instruments and the sponsorship of workshops and symposia. The Data Working Group considered the scope of data exchange policies, data system requirements, standards in formats and networks, and implementation schedules.

The Science Working Group, chaired by Dr. Stanley Shawhan (NASA) and cochaired by Dr. Alex Galeev (Intercosmos), defined three intense periods of coordinated observations termed the early, middle, and late periods. The early period, from 1989-91, will involve several existing spacecraft such as IMP 8, AMPTE/CCE, DE, ICE, and Sakigaki. The new spacecraft that will be of importance are EXOS-D, Interball, Galileo, Phobos, Ulysses, CRRES, and Solar-A. In the middle period, from 1992-94, the participating spacecraft in the IACG program will be RELICT-2, Geotail, Galileo, Sakigaki, Polar, and Wind. Finally, in the late period, from 1995-97, SOHO, Wind, IKI-1, IKI-2, and Cluster will be of primary importance.

In addition to the spacecraft and science definition, the Science Working Group recommended a number of other important activities to facilitate the correlative space measurements that will be undertaken. The need to specify standard magnetospheric reference models was identified. It was also recognized that the use of a satellite situation center will be essential to plan for acquisition of multispacecraft coordinated observations and identify post-acquisition coordinated science opportunities. Another recommendation accepted by the agencies was to institute a mechanism during the operations phase that will help in the coordination of the science, spacecraft operations, and data exchange. It was expected that the IACG will sponsor two or three major symposia plus science workshops.

The Data Working Group was chaired by Dr. Nishida (ISAS) and cochaired by Klaus Blank (ESA). The major thrust of this working group was to define the data exchange policies and procedures. The exchange of data will be done with "quid pro quo" participation from each of the agencies. These policies will protect the rights of the principal investigator by defining the phases of data accessibility.

The first level in the exchange will require the creation of a directory and catalog of

see IACG, *page 12*

"NSSDC Account" Improved for Better Access to Data and Services

In a past issue of this newsletter, the "NSSDC account" was described. This account, recently moved from NSSDC's VAX 11/780 to NSSDC's VAX 8650 to improve performance, is the vehicle through which selected NSSDC data and services are made easily available to the scientific community.

Data now accessible through this account include hourly averaged solar wind field and plasma data, IUE extracted spectra data, and Nimbus 7 Gridded TOMS ozone data. Personnel and data set directory information are available, as is the AIAA newsletter, Canopus. NSSDC customers may also request offline data through this account instead of by letter or telephone.

The use of this account has been climbing steadily. Between 70 and 100 different external users have accessed various options during each of the past few months. Canopus readers number about 50, with two sessions per reader per month. Interplanetary, Nimbus, and IUE data are accessed by about 15, 7, and 12 persons per month, respectively. A dozen data requests are received monthly.

This account is reached from a SPAN node by entering SET HOST NSSDCA at the $ prompt. At the Username: prompt type NSSDC. The intent is for additional, appropriate data and services to be made available through this account. All comments and suggestions are welcome.

Joe King

NSSDC Cooperates With European Agencies To Provide IUE Data

The International Ultraviolet Explorer (IUE) project is a cooperative venture among NASA, the British Science and Engineering Research Council (SERC), and the European Space Agency (ESA). NSSDC plays a major role in archiving and distributing the IUE data.

The IUE mission was designed to provide spectra of astronomical objects in the ultraviolet (UV), from which scientists have been able to identify the composition and physical properties of many types of stars, galaxies, interstellar matter, and objects in our solar system. Recently, IUE has made many observations of the supernova in the Large Magellenic Cloud, which has received worldwide attention for being the closest supernova since the invention of the telescope.

The IUE satellite was launched on January 26, 1978, into an elliptical geosynchronous orbit over the Atlantic Ocean and continues to provide highly useful data. Guest Observer mode operations are conducted from NASA's Goddard Space Flight Center 16 hours per day and from ESA at the Villafranca Satellite Tracking Station (near Madrid, Spain), or VILSPA, for 8 hours per day.

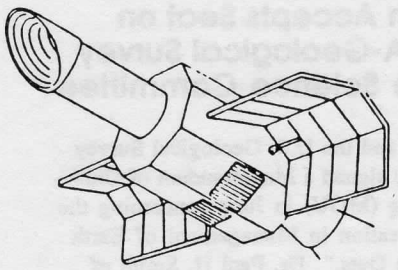
The satellite carries a 45-cm-diameter telescope and two spectrographs, optimized for the near (190-320 nm) and far (115-200 nm) UV, respectively. Each spectrograph has two entrance apertures and can be operated in either a high (.01 nm) or low (.6 nm) spectral resolution mode. The nominal small aperture is a circle 3 arc seconds in diameter; the nominal large aperture is a 10 x 20 arc second slot. Each spectrograph has one primary and one redundant camera that integrate the spectrograph image in an array of SEC vidicon detectors. The 768 x 768 pixel array is digitized (8 bits per pixel) for transmission to the ground.

The full suite of IUE digital data for one observation consists of raw image data, geometrically and photometrically corrected image data, and reduced data called "extracted spectrum files." The reduced data are produced at the NASA and ESA observatories using similar software. The principal data products consist of digital spectral images in special Guest Observer format and photographic hard copy produced on an Optronics Photowrite film writing device. The digital data consist of images of flux versus wavelength in a varying number of files depending on the spectral resolution at which the data were taken. Photowrites are photographic representations of the digital spectral images represented as 256 (8-bit) discrete gray levels on 8 x 10-inch sheet films.

IUE data are supplied in monthly shipments to NSSDC, where they are processed and archived. Copies of the data are sent to data centers at VILSPA and in the United Kingdom (Rutherford Appleton Laboratory). The current volume of primary IUE data at NSSDC consists of 917 high density (6250 bpi) tapes, of which 670 are from NASA and 247 are from VILSPA, and 48,307 photowrites, of which 47,284 are from NASA and 753 are from VILSPA (VILSPA photowrites are not generated for archiving on a regular basis). The primary reference documentation for these data is the *IUE Image Processing Information Manual*, available from NSSDC.

Additional data products have been created for the convenience of scientific users. In the "extracted spectrum files," low and high dispersion data are segregated on different tapes. The extracted spectra are also transferred to the mass storage system on the NASA Space and Earth Sciences Computing Center's IBM 3081 computer, where they are more readily available to IUE project personnel, visiting scientists, and, through the software described in the September *NSSDC News*, to the general scientific community.

Another data product of the IUE observatory is a merged log of NASA and VILSPA observations. It is a compilation of basic information that identifies all objects observed and describes the fundamental observational parameters needed for evaluation of the observations by scientists. The IUE merged log is produced for dissemination on an annual basis, although it is updated more frequently. The merged log is also generated on microfiche and is included annually in issues of the *IUE NASA Newsletter* and *IUE ESA Newsletter*, where it is described in more detail.



Three IUE spectral atlases have been produced in digital form and are available for distribution. The *IUE Ultraviolet Spectral Atlas* is a compilation of 468 spectra of 173 "standard stars." The *IUE Low-Dispersion Spectra Flux Catalogue. Part 1. Normal Stars* is a similar compilation issued by the European IUE scientists. Finally, the *IUE Atlas of O-type Stars* contains high dispersion spectra of 98 O-type stars in the wavelength range 120-190 nm.

All the data products described above are available from NSSDC, while the digital products are available to European scientists through the VILSPA IUE data center and World Data Center C1 at the Rutherford Appleton Laboratory. The spectral atlases are also available from the Centre de Données de Strasbourg.

An excellent book describing the IUE project, instruments, data processing, products, and much IUE science has recently been published. It is entitled *Exploring the Universe with the IUE Satellite* and is edited by Yoji Kondo, Reidel Publishing Company, 1987.

P. K. Bhartia, Wayne Warren, and Joseph King

-NEWSBRIEFS--NEWSB

Smith Accepts Seat on NASA-Geological Survey Earth Science Committee

NASA and the U.S. Geological Survey (USGS) signed a Memorandum of Understanding (MOU) in June concerning the "Cooperation in Management of Earth Science Data." Dr. Paul H. Smith of NSSDC has accepted a seat on the joint coordination committee as a representative of NASA's Pilot Land Data System. PLDS is the only data system with representation on the committee, which plans to meet several times a year.

The memorandum was signed by James Blesecher of USGS and by Drs. Shelby Tilford and Caldwell McCoy of NASA. It specifies that a joint NASA-USGS coordination committee perform the following functions:

- Coordinate joint program responsibilities
- Identify potential areas of cooperation
- Provide oversight to the development of joint activities
- Advise on the resolution of policy differences between the two agencies
- Provide a forum for information exchange
- Develop specific agreements for data exchange and cooperative projects

Paul H. Smith

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Online Information System Implemented for ROSAT

In September, Phase 1 of the ROSAT Mission and Information Planning System (MIPS) was implemented in the form of an online information system with an accompanying user's guide. The system concepts and some of its existing capabilities were demonstrated to members of the U.S. ROSAT Science Committee by Jeanne Behnke and Henry Linder of NSSDC.

MIPS is designed to assist guest investigators in selecting targets for their proposals for observing time on the Roentgen Satellite (ROSAT), a cooperative program between West Germany, the United Kingdom, and the United States for the study of stellar x-ray sources. MIPS is an online information system that provides users access to data concerning approved ROSAT proposals and to the observation catalogs of ROSAT and closely related missions (i.e., Einstein and EXOSAT). A mail facility and bulletin board containing the latest information on the ROSAT mission will also be available to users. Calculation programs, such as programs to calculate target observing time and viewing windows, will be available to assist users in target selection.

To encourage active participation in the development of the ROSAT MIPS, Phase 1 was submitted to members of the U.S. ROSAT Science Committee for review and testing. It was then reviewed and discussed at the November 1987 meeting of the U.S. ROSAT committee. The committee was pleased with the concept of the system and its performance. Recommended changes are being prepared for distribution in the MIPS Phase 1a, to be released in the beginning of 1988.

Jeanne Behnke and Henry Linder

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Optical Disk Systems Mass Buy Completed

A major milestone for NSSDC was achieved with the delivery of 20 optical disk systems in October. An option for purchasing 20 more is now being exercised.

This activity has major significance for NSSDC and the space science community because it provides an opportunity to investigate a completely different way of data distribution and management. Most of the units that were procured will go to universities and space industry organizations that will be sending platters of their scientific data to NSSDC for archiving. Normally, these "data producers" would be sending 1600 and 6250 bit per inch tapes. Each optical disk platter holds the equivalent of 40 tapes of 1600 bpi density, so the volume of data storage media will be condensed greatly.

More importantly, the manner in which the data are written to these disks is a major leap forward. The data are written in random access files with a management file that describes the contents of the disk. Instead of the months previously required to register the massive amounts of incoming data, it will take only a few hours with the optical disk. In addition, by keeping some platters spinning, NSSDC will be able to offer scientists access to data via networks (such as the Space Physics Analysis Network) on line at any time of the day or night, and not just during normal NSSDC working hours.

Barbara Lowrey and James Green

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Campbell Delivers Invited Lecture on Intelligent Data Management Project

William J. Campbell of NSSDC's Data Management Systems Facility recently delivered an invited lecture on the Intelligent Data Management Project at the second workshop on Artificial Intelligence Research in Environmental Sciences (AIRIES) held in Boulder, Colorado. The project's objective is to develop advanced information management systems that allow users to interact, maintain, and update very large and complex data base information with minimal understanding of a data base's architecture, stored data, or query language.

Specific results of a recently developed expert system prototype using natural lan-

RIEFS --NEWSBRIEFS-

guage and graphics as an intelligent interface to an operational scientific data base were presented.

The talk was well accepted and resulted in further discussion on possible joint research between NASA/Goddard Space Flight Center and NOAA. Campbell also served on a panel that discussed the future role of AI in environmental science.

The goal of this three-day workshop was to serve as a forum for discussions among researchers currently applying artificial intelligence (AI) technologies to a wide range of environmental science problems. It also enabled individuals to evaluate the applicability of current AI technologies to their own environmental problems. More than 120 persons attended the workshop, including researchers from federal agencies, universities, and private industry.

William J. Campbell

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Interplanetary Medium Compilation Updated

Recent updates to the interplanetary medium compilation, available as a menu choice in the NSSDC account, brought IMF data up to April 1986, solar wind plasma data to March 1987, and solar/geomagnetic activity index data to February 1987.

Howard Leckner

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Science Steering Group Reviews Build 1 of PLDS

The external NASA Headquarters-appointed Science Steering Group (SSG) met on November 4-5 to review the activities of the Pilot Land Data System (PLDS). During the past year the PLDS Project has been working extremely hard to develop and implement the first phase, Build 1, of the evolutionary advanced data and information system. The SSG reviewed the development and status of the current Build 1 system and complimented the PLDS Project on its impressive engineering development.

The SSG also was briefed on the FY88 plans to operate Build 1 for the land science community and to develop and install user-driven enhancements to the current system. The SSG suggested that emphasis be given to bringing additional data sets into PLDS during FY88.

On the second day of the meeting there was considerable discussion on the Build 2 phase of PLDS, scheduled for roughly FY89-91. Discussion centered around the question of which science users the Build 2 phase should be developed to support. More time was needed to reflect on this question, so a meeting of the Headquarters program offices, the SSG members, and the Project Office is planned for March 1988 to again bring together the key participants needed to resolve this issue.

Paul H. Smith

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Perry Describes SPAN Data Availability at IUE 3-Agency Meeting

The International Ultraviolet Explorer (IUE) 3-Agency Meeting was held at Goddard Space Flight Center on November 10-12. Among the wide range of topics covered was the final archive format of all IUE data and its proposed completion timetable. Included in the discussion was the question of changing the current Guest Observer (GO) format to a Flexible Image Transport System (FITS) format, and the impact that change might have on the user community. This subject will be studied further, and other options will be considered. The topic will be brought up for additional discussion and possible action at the next meeting, scheduled for April 1988.

Charleen Perry (NSSDC/SAR) delivered a presentation on "Requesting IUE Data via SPAN" and provided a short paper on the subject. The audience was enthusiastic about the project, and a discussion followed concerning possible enhancements. Many attendees retired to the closest available computer terminal to fully explore the useful new options that had been presented, when a sudden snowstorm prevented them from leaving Goddard at the end of the scheduled meetings.

Charleen Perry

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Vette, Sawyer Play Role in Development of Standard Formatted Data Unit

Dr. James I. Vette and Donald Sawyer of NSSDC recently attended the Consultative Committee for Space Data Systems (CCSDS) panel 2 meeting in Garmish, West Germany. The purpose of this meeting was to further the development of the Standard Formatted Data Unit (SFDU) recommendations. A recommendation on SFDU structures was finalized and is expected to be officially approved by all agencies through a letter ballot by the end of the year.

Vette led the NASA delegation and chaired the technical subpanel, while Sawyer chaired the operations subpanel in the absence of the European Space Agency representative. Sawyer gave a joint presentation (with Lou Reich of Computer Sciences Corporation) on a Reference Model, chaired the Reference Model Structures Working Group, gave a presentation on the use of SFDUs by the Dynamics Explorer project in the submission of data to NSSDC on optical disks, and conducted a review of the Control Authority Procedures Recommendation.

Donald Sawyer

CALENDAR

January 11	Data System Lexicon Working Group Meeting Jet Propulsion Laboratory
January 12-14	Catalog Interoperability Workshop Jet Propulsion Laboratory
March 1-3	PLDS Data Management Working Group Goddard Space Flight Center

DSUWG, *from page 5*

paigns. In addition, a presentation was given by Roger Hauck, of the Smithsonian Astrophysical Observatory (SAO), on how SPAN was used to provide a quick distribution of the supernova information to astronomers and astrophysicists through the International Astronomical Union's "Circular," an online bulletin board for astronomical observations at SAO.

For the first time at a DSUWG meeting, NASA's video teleconference facilities were used for the SPAN routing center managers and the the SPAN/HEPNET joint management meetings. This made it possible to include management at Marshall Space Flight Center, who were unable to attend the meetings because of travel funding problems.

The DSUWG subgroups met and discussed issues related to standards, data management, networking, and policy. A summary of the issues discussed and action items will be part of the meeting's proceedings. To acquire a copy of subgroup meeting summaries, contact the Request Coordination Office (NSSDCA::REQUEST).

Despite the large attendance, there was some disappointment that more discipline scientists did not participate. The policy committee recommended that the scientific community be surveyed to learn why the scientists' attendance is declining. Another recommendation was to change the name of the meeting to the "SPAN Users Meeting," because that would have more meaning to a scientist than the "DSUWG Meeting." Part of the problem may have been inadequate dissemination of information about the meeting, so publicity for meetings will be improved.

Valerie Thomas

IACG, *from Page 8*

the available data, to be held in a coordination/data handling facility (CDHF) by each of the agencies. Each of the CDHFs will be connected to appropriate solar terrestrial networks (such as SPAN in the United States and European SPAN in Europe) and linked together, as necessary, to facilitate electronic access to information about the participating missions of the IACG.

Key parameter data will be extracted from the raw observations and will also be made available to IACG participants at the CDHFs. The structures of the key parameter data, directories, and catalogs will be standardized as much as possible. NSSDC has been given the task of being the NASA CDHF by Dr. Fisk. A subcommittee of the Data Working Group has been meeting with experts in each of the agencies to work on the standards issues and network connections that will be necessary.

The upcoming era of coordinated solar terrestrial measurements being planned through these IACG activities looks promising. For those wishing to participate or know more about the standardization efforts, contact Jim Green at NSSDC, Klaus Blank at ESA, Hiro Nishida at ISAS, or Alex Galeev at IKI. The next full meeting of the IACG will be in the United States in the early fall of 1988.

Stanley Shawhan and James Green

Data Inquiries

For information on submitting data to the Data Center or inquiries regarding availability, cost, and ordering procedures, researchers within the United States should contact:

Submissions:

Dr. H. K. Hills
National Space Science Data Center
Code 633.8
Goddard Space Flight Center
Greenbelt, Maryland 20771
Telephone: (301) 286-4106
SPAN: NSSDCA::HILLS

Requests:

National Space Science Data Center
Code 633.4
Goddard Space Flight Center
Greenbelt, Maryland 20771
Telephone: (301) 286-6695
Telex: 89675 NASCOM GBLT
TWX: 7108289716
SPAN: NSSDC::REQUEST

Individuals residing outside the United States should contact Dr. James I. Vette for information on submissions. Inquiries to Dr. Vette and requests from outside the United States must be directed to:

World Data Center A for Rockets and Satellites
Code 630.2
Goddard Space Flight Center
Greenbelt, Maryland 20771 U.S.A.
Telephone: (301) 286-6695
Telex: 89675 NASCOM GBLT
TWX: 7108289716
SPAN: NSSDC::REQUEST

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