NSSDC

NSSDC/WDC-A-R&S 91-14

1990
ANNUAL STATISTICS AND HIGHLIGHTS REPORT

National Space Science Data Center

March 1991

NASA

Goddard Space Flight Center
Greenbelt, Maryland 20771

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James L. Green
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Preface

It is my view that the science user community needs rapid access to archival data and information about data, and the National Space Science Data Center (NSSDC) has been set on the course to provide just that. Five years ago the NSSDC came "on line," becoming easily reachable for thousands of scientists around the world through the electronic networks it managed and other international electronic networks to which it connected. Since that time, the data center has developed and implemented over 15 interactive systems, operational nearly 24 hours per day, and is reachable through DECnet, TCP/IP, X.25, and BITnet communication protocols.

The NSSDC has torn down its walls by becoming a clearinghouse for the science user to find the data needed through the Master Directory system whether it is at the NSSDC or deposited in over 50 other archives and data management facilities around the world.

The response from the international science community to the new "on-line thrust" of the data center has been tremendous, with over 13,000 user accesses to the NSSDC electronic systems, last year alone. Thousands of requests for data have been satisfied, resulting in the NSSDC's sending out a volume of data last year that nearly exceeded a quarter of its holdings.

I am delighted to provide this document, which reports on some of the highlights and distribution statistics for most of the basic NSSDC operational services for fiscal year 1990. It is my intention to provide this report to the science user community on an annual basis. Call it the "NSSDC report card," if you will. This report will tell how well we are doing in supporting the space and Earth science user communities. At this point I wish to express my thanks to Winnie Humberson (McDonnell Douglas Space Systems Company) for compiling and preparing the document and Len Blasso, Miranda Knowles, and Lynda Williams (ST Systems Corporation) of the NSSDC publications group, for their help in expediting the production of this publication.

It has taken the NSSDC nearly 25 years to accumulate over 6 terabytes of space and Earth science data. The NSSDC is entering a new era as NASA aggressively whittles away at its space flight backlog. Current archiving plans with future NASA missions indicate that the NSSDC's holdings will nearly double every two years. We expect a massive amount of data will be delivered to the science community for further analysis from the archive. Our intention is to continue to provide rapid access to larger volumes of data held at the NSSDC by improving our on-line services and to point to other important data holdings elsewhere.

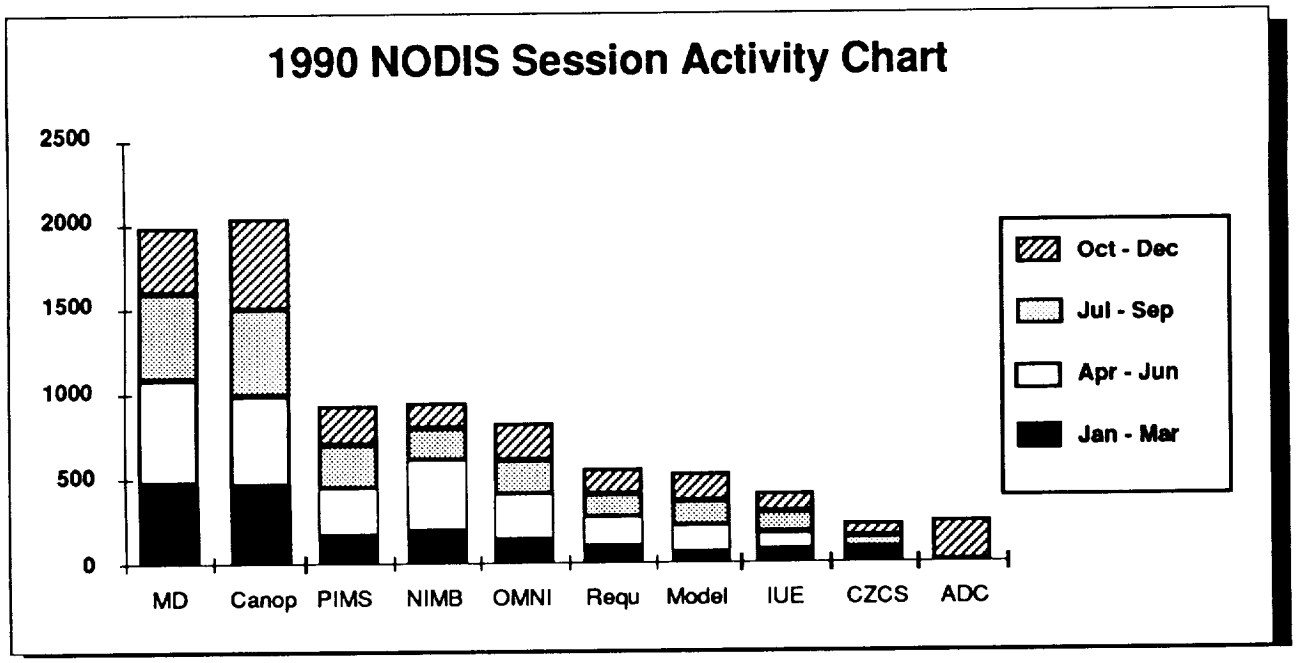
Dr. James Lauer Green, Director
National Space Science Data Center
March 1991

Contents

General Services

1. NSSDC On-Line Data and Information Services (NODIS)

The NSSDC On-Line Data and Information Services (NODIS) is a menu-driven utility accessible nearly 24 hours a day, seven days a week to anyone able to reach the NSSDC computers via dial-up or network. This service allows access to on-line information held at NSSDC as well as limited amounts of on-line data. Data available via NODIS include International Ultraviolet Explorer (IUE) extracted spectra data, Nimbus 7 (NIMB) Gridded Total Ozone Mapping Spectrometer data, Coastal Zone Color Scanner (CZCS) data, and the OMNI data set of hourly solar wind parameters. The information services include the NASA Master Directory (MD); the Personnel Information Management System (PIMS), which is an interface to a personnel data base containing over 30,000 users of NSSDC services; the American Institute for Aeronautics and Astronautics (AIAA) *Canopus* newsletter; and the Astronomical Data Center (ADC) On-Line Information System for Astronomical Catalogs. Access to ionospheric, atmospheric, magnetospheric magnetic field, and magnetospheric energetic trapped particle models are available for downloading or executing. There is also a menu option that facilitates requests for off-line data services. The chart below shows the annual session totals for each of the NODIS services.



2. The Master Directory and Catalog Interoperability

For more than five years a project called "Catalog Interoperability" or CI has been seeking to enable rapid and efficient identification, location, and access to data of interest to the science community. The project started as a NASA effort but now includes representatives from other U.S. federal agencies, international agencies, and academic institutions. The goal of the CI group is to create a worldwide data information network composed of interconnected directory, catalog, and inventory systems.

The first steps to establishing this network were to create directories to aid in finding data. The directories contain brief summary information about the data sets, sufficient for the researchers to determine whether further investigation is warranted. They also provide automated links to other information systems that give more detail on data of interest, or they indicate whom to contact for additional information. The NASA Master Directory was created to serve this purpose for NASA. The directory served its purpose very well, and other agencies and international organizations have been given copies of the NASA directory software to perform the same function within their groups. These directories have been interconnected via computer network to enable information sharing to the benefit of all. In addition, the NASA directory at GSFC has been requested to serve as the Global Change Master Directory (GCMD) for describing the global change data holdings of all U.S. federal agencies.

A common format for describing data sets has been developed by the Catalog Interoperability group, called the Directory Interchange Format (DIF), which is used as the basis of information to be shared among the directories. These DIF files can be passed among the directories to keep their information up-to-date.

THE INTERCONNECTED DIRECTORY SYSTEM

With the development of the DIF, the sharing of information among directories was made significantly easier. An interconnected system of directories sharing information via DIF file exchange was formed. Figure 1 shows the present and near-future configuration of the directory system. These are just the directory nodes. Connections to other data information systems (guides/catalogs, inventories) are not shown. Existing directories are shown in boldface type. These include the NOAA Earth System Data Directory (NESDD) and the USGS Earth Science Data Directory (ESDD). During 1990 the directory nodes in Tokyo, Japan (Committee on Earth Observations Satellites Prototype International Directory—CEOS_PID), and Munich, Germany (Deutsches Forschungs Anstalt fuer Luft und Raumfahrt—DLR), were established. The USGS EDC (EROS Data Center) node in Sioux Falls, South Dakota, UNEP/GRID (United Nations Environmental Programme/ Global Resources Information Database) node in Geneva, Switzerland, and CEOS PID CCRS (Canadian Centre for Remote Sensing) node in Ottawa, Canada, will all be operational in the first half of 1991. (See Figure 1.)

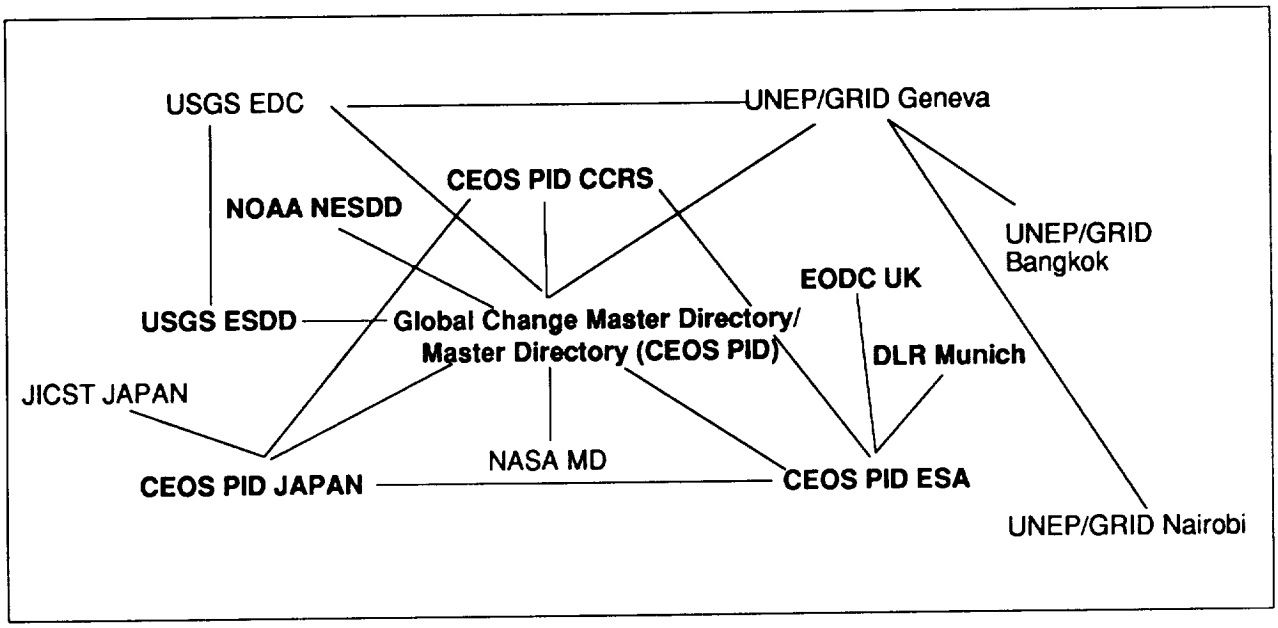


Figure 1: Interconnected Directory System

MASTER DIRECTORY STATUS

The directories represent the most widely used part of the interoperable data information system. This is evident from their ever-increasing usage. The Master Directory at GSFC has been operational for more than two years, and over 3000 user sessions were logged during 1990 at this node alone. Since the directory is intended to provide quick information to users and lead them on to actual data sources, wherever those sources may be, users do not need numerous sessions to obtain results. Thus, over 1000 users were accommodated by the Goddard node during last year.

The information content of the directory has made similar progress. As shown in Figure 2 below, over 900 entries are contained in the directory, describing the most useful and usable data sets in the five major discipline categories. Since more than one data set can be described in a single entry (and sometimes tens to hundreds may be aggregated in this way), there are many more than 900 data sets described in the directory. Several hundred of these were added in the past year, and also several hundred of the existing entries were reviewed and revised, sometimes resulting in a net decrease in the number of entries. This reflects the emphasis on keeping information current as well as maintaining quality and utility of the entries rather than increasing quantity. The number of entries will increase more rapidly as the other directory nodes begin to describe their data holdings and the data in their surrounding communities.

Not just data sets are described in the directory. There is also supplementary information about other data information systems and data archives, organized data collecting campaigns and projects, data sources such as spacecraft or Earth-based observing platforms, and data sensors that were used to acquire the data. The latter two of these information categories were added to the directory in 1990. Also in the last year, the number of data information systems described in the directory has nearly doubled to approximately 60. More than a third of these may be directly accessed from the directory through an automated network link. This access is performed automatically upon request by the user.

DIRECTORY ACCESS

The best way to reach an understanding of the nature and utility of the directories is to try them. Figure 3 below shows the procedures for accessing the directory at NASA/GSFC through several networks or via dial-in line.

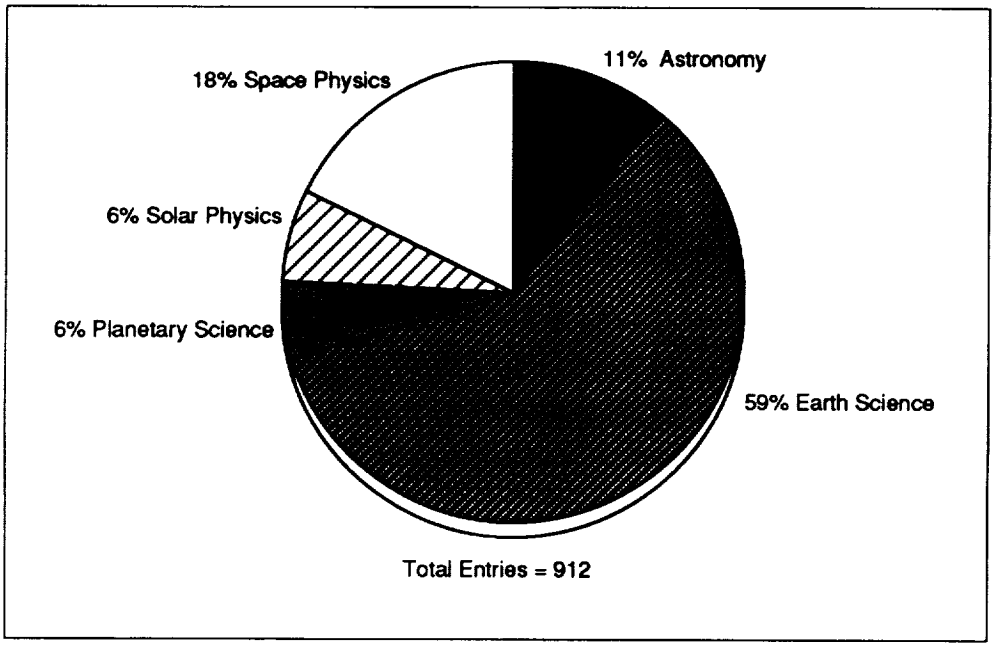


Figure 2: Percentage of Directory Entries by Discipline-FY90

Several methods of potential use to increase interoperability are currently being applied in limited situations. Context passing was demonstrated in 1990 using the Master Directory and several remote systems. A limited form of automated multi-system searching, which does not assume Standard Query Language (SQL) data bases in remote systems, is being developed for version 0 of the Earth Observing System (EOS) Project Data and Information System (EOSDIS). The Astrophysics Data System (ADS) is currently testing multi-system searching through a uniformizing data base overlay called the Distributed Access View-Integrated Database (DAVID). The lessons learned from these various approaches will be applied more generally in the future to improve the overall search process and access to data.

CATALOG INTEROPERABILITY

As mentioned previously, the directories are only the first step in achieving the goals of catalog interoperability. Once users have determined from the directory where data of interest might reside, they usually need to obtain more information about the data and/or determine whether data exist for a particular criterion, such as time or location. The CI project seeks to make this process ever more efficient.

SPAN	DIAL-IN LINES
$ SET HOST NSSDCA	**Dial 301-286-9000**
USERNAME: **NSSDC**	*CONNECT 1200 (or 2400 or 300)*
	Enter several carriage returns
INTERNET	*ENTER NUMBER*
TELNET 128.183.10.4	**MD**
USERNAME: **NSSDC**	*CALLING 55201 (or 55202)*
	CALL COMPLETE
OMNET	**Enter several carriage returns**
GOTO NSSDC	*USERNAME:* **NSSDC**

ITALICS INDICATE RESPONSE FROM THE COMPUTER.

Figure 3: Directory Access

3. Distribution of NSSDC Data Via Non-Interactive Modes

The National Space Science Data Center archives and distributes a large variety of scientific data and information related to spacecraft and ground-based observations. In 1990, the Coordinated Request and User Support Office (CRUSO) handled close to 5000 requests received by various modes (described later) and involving the transmission of data by mail or networks. Of these, 25% were for astrophysical data, 42% for spacecraft and model data spanning the range of scientific disciplines, 20% for related documents, and 13% were referred to other agencies or the Goddard Space Flight Center Public Affairs Office for processing. (See Figure 1).

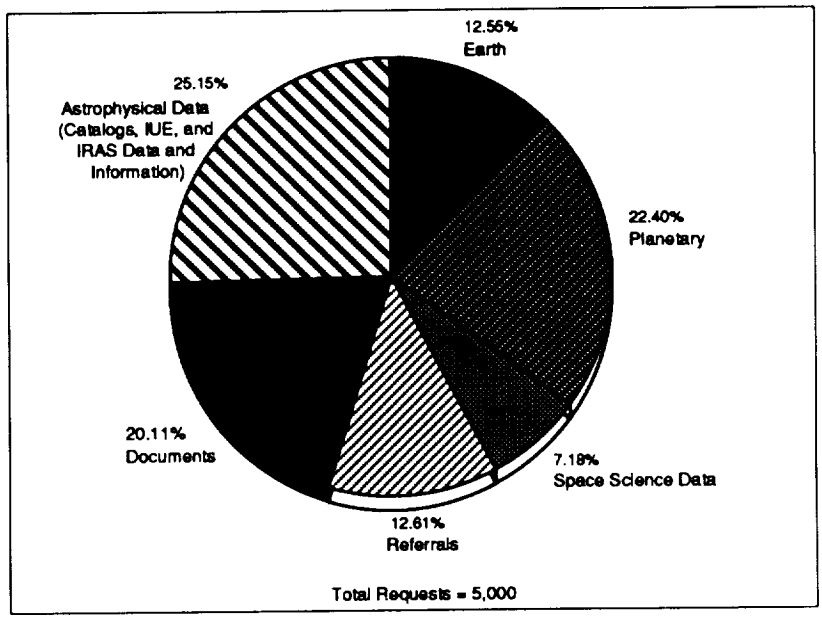


Figure 1. Mainline NSSDC Requests by Categories

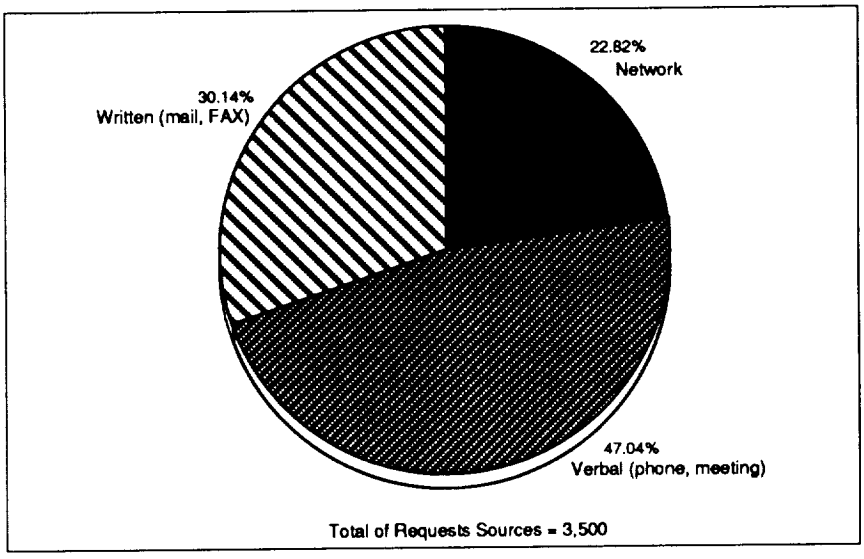


Figure 2. Requests Sources Categories

These various requests were received in three main categories: 1) through oral communication (47.04%) such as telephone calls, on-site visits, and from conferences; 2) as electronic messages (22.82%) via SPAN or other networks; and 3) by written correspondence (30.14%), including regular mail and telefax. (See Figure 2.)

Virtually, all requesters used NSSDC data and information for scientific research. Only a small percentage was commercially oriented. The user community covered a wide spectrum of institutions. (See Figure 3.) In accordance with NSSDC charge and service policy, users were charged for data only on an incremental cost recovery basis. Modest amounts of data, however, were typically provided free to affiliated scientific researchers.

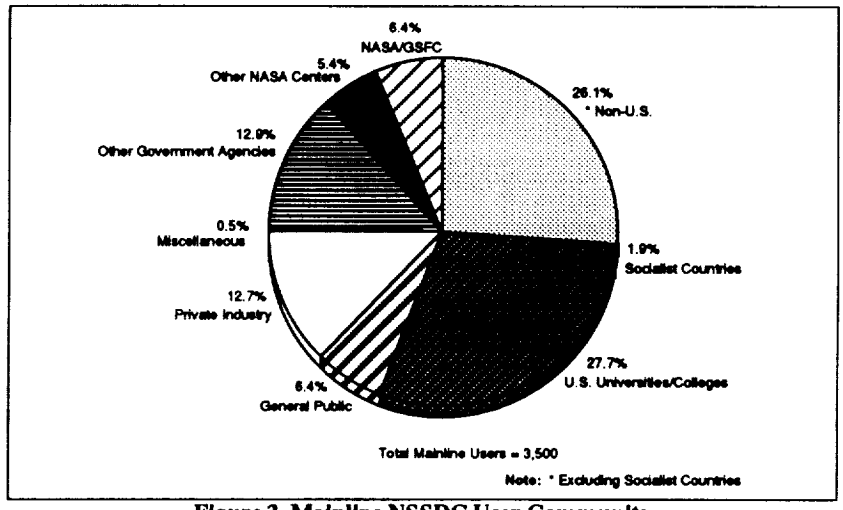


Figure 3. Mainline NSSDC User Community

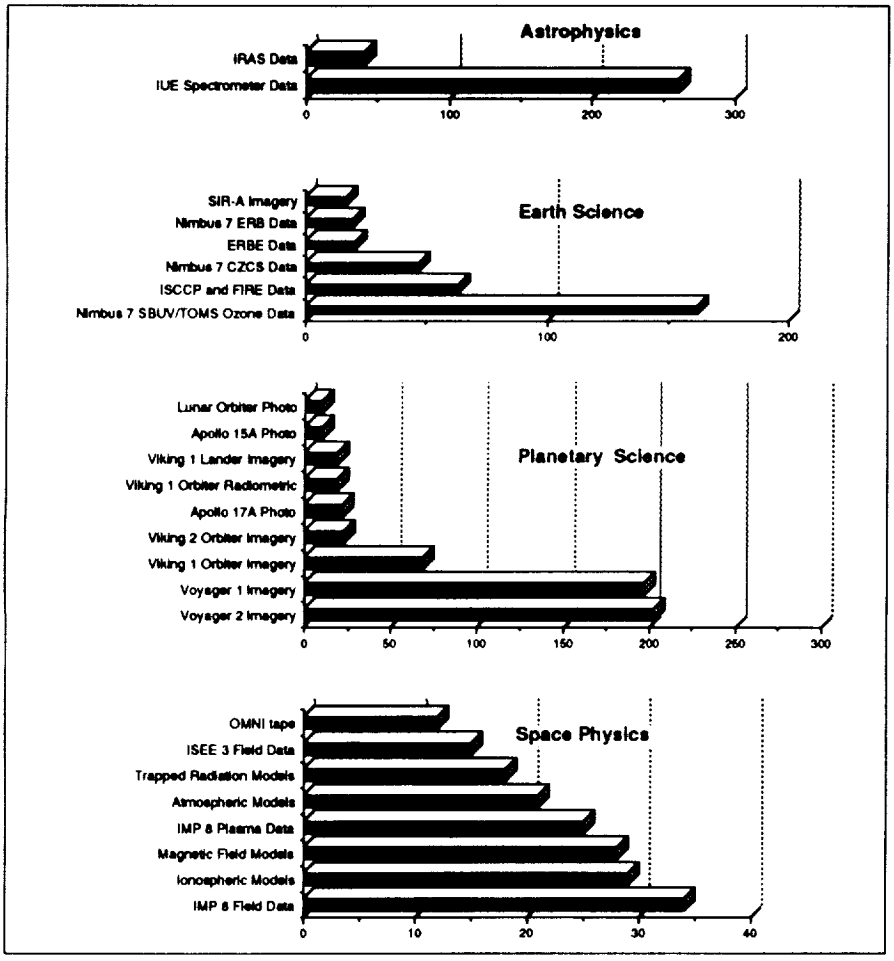


Figure 4. Numbers of 1990 Requests for Most Requested Data

Among the most frequently requested data sets were International Ultraviolet Explorer (IUE), Infrared Astronomical Satellite (IRAS), Voyager imagery of outer planets, Nimbus 7 ozone data, and magnetic field and plasma data from Inter-Planetary Monitoring Platform 8 (IMP 8). See Figure 4 for details. These and other requests were filled on a variety of media including CD-ROM, tapes, and film. An increasing number of requests were also filled electronically by sending across SPAN or by staging the data in the anonymous File Transfer Protocol (FTP) account. The statistics are summarized in the following Table 1.

Table 1. NSSDC Request Off-Line Data Output by Medium (FY90)

Medium	Requests Completed	Quantity	Average Quantity per Request	Output Unit
I. Digital				
CD-ROM	331	1,076	3,251	Each Disc
Computer Tapes	770	5,138	6,673	2400-Foot Tape
Floppy Disks	90	150	1,667	Each Disk
Sent Via Network	578	3,240	5,606	Each File
II. Analog				
Books/Bound Vol.	1,349	1,985	1,471	Each Binder
Hard Copy	669	17,259	25,798	Each Page
Microfiche	96	5,873	61,177	Each Plate
Microfilm	12	100	8,333	100-Foot Reel
Microfilm Copies	2	1	0,500	100-Foot Reel
Movie/Kinescope Film	1	3	3,000	Each Roll
Negatives (Feet)	1	481	481,000	Each Strip
Negatives	44	1,220	27,727	Each Sheet
Photographic Prints	142	4,296	30,254	Each Sheet
Slides	23	234	10,174	Each Slide
Transparencies (Feet)	2	6	3,000	Each Strip
Transparencies	12	111	9,250	Each Sheet
Other	97	693	7,144	Various

4. NSSDC Data Archive and Distribution Service (NDADS)

One of NSSDC's highlights of 1990 was the incorporation of a new archive initiative. After several years of support to the Space Telescope Data Archive and Distribution Services (ST-DADS) project, NSSDC became the recipient of the ST-DADS prototype hardware. With this system, the NSSDC will evaluate the hardware and software structures for the ST-DADS. In order to emulate the ST-DADS computing system structure, NSSDC had to augment the prototype equipment with some additional equipment. The bulk of the additional computing hardware arrived in April 1990. The prototype equipment was moved from the ST-DADS site to GSFC Building 28 in July 1990. The entire system was reassembled and put on line in August of 1990. In November 1990 NSSDC accepted the final delivery of NDADS equipment. This formidable collection of computing equipment is now known as the NSSDC Data Archive and Distribution Service or NDADS. The NSSDC is developing the NDADS facility to be a near-line archive of astrophysics and space physics data. The NDADS facility is a DEC VAX based cluster that supports the development of optical disk jukebox archives. NDADS can support a Level of Archive Services 4 (LAS 4), as defined in the archive cost model. For approved projects and users NDADS will provide easy access to large archives, data management services, and data manipulation tools.

The NDADS facility consists of three CPUs that perform the following roles: Host, Archive, and Catalog. The Host CPU will provide access to users to the facility. The Archive CPU is used to access the peripheral archive equipment, such as the optical disk jukeboxes. The Catalog CPU is used primarily by the data base management system to control the information on the inventory and data sets. The cluster of CPUs on the NDADS facility presently consists of a VAX 6410 and two VAX 8250s. Peripheral equipment on NDADS includes clustered magnetic disks, two 9-track magnetic tape drives, a high speed line printer, a laser printer and various console equipment. The archive hardware consists of two CYGNET 1802 optical jukeboxes and one Cygnet 1803 optical jukebox. This provided the NDADS facility 230 slots for 12-inch optical disk platters and access to six second generation SONY optical disk drives. In total, the NDADS facility provides 1.2 terabytes of optical disk storage space. Access to the optical disk farm is provided through an APTEC I/O processor and its 2 GByte staging disk. (See Figure 1.)

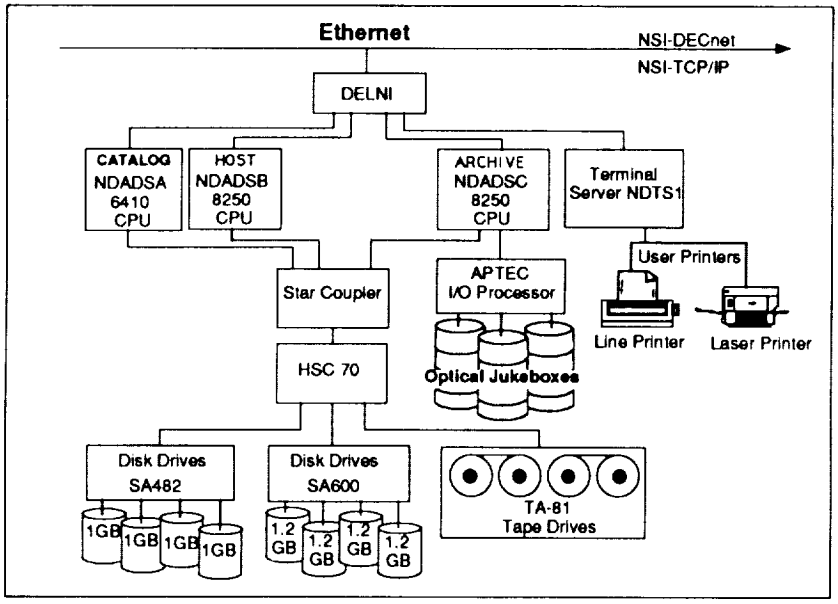


Figure 1. NDADS Facility Configuration

5. Visual Reproduction Facility

The NSSDC's Visual Reproduction Facility (VRF) continued to upgrade its capabilities in 1990 to provide quality support of photographic and audio-visual needs to the scientific research community. The current hardware inventory has been enhanced with the addition of several new items of equipment. The purchase of a JOBO color processor has resulted in increased in-house color slide work and allows the duplication and shipment of material within hours. The 710 Com-unit (which transfers magnetic tape data to a silver-based film medium) was reconfigured to record satellite data on film that is a wet process, thus eliminating the costly dry film development process. The procurement of a JVC Camera has enabled the recording of on-site Coordinated Data Analysis Workshops (CDAW), NASA Climate Data System (NCDS), and Pilot Land Data System (PLDS) seminars and conferences. These VHS and U-Matic tapes can be sent to users unable to attend these functions. Just one of these many tapes of interest is the TOMS-OZONE tape, which has been sent worldwide to selected requesters.

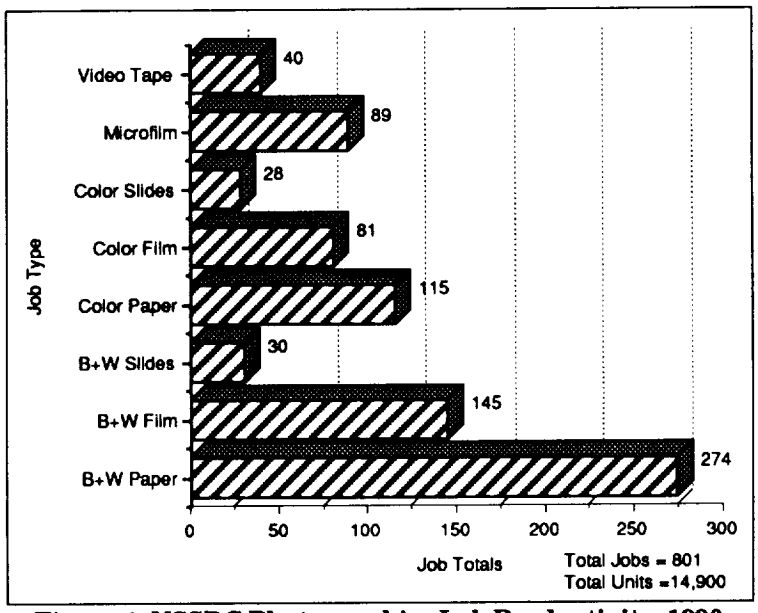


Figure 1. NSSDC Photographics Lab Productivity, 1990

In maintaining conformance with its mission, the facility has continued to provide a variety of visual formats to the science community. The Apollo, Viking Orbiter and Lander, Voyager I and II, and Magellan data continue to be the most requested missions. The VRF has been conscientiously striving to sustain its efforts to improve the accessibility of visual data from NASA missions. (See Figure 1.)

The laboratory has handled some very substantial jobs this past year. Some of these were completed for NASA scientists and consisted of large numbers of special sized prints of a type that is not normally routinely provided. Large projects (also including custom-sized photos) were also completed for Mr. Mitchell W. Colgan of the College of Charleston, and Mr. Paul Lewis of the University of Tennessee. The facility also did some work for Time/Life, Los Alamos National Laboratory, Picture Research, and the Naval Research Laboratory.

Support for the VRF's school intern program has continued. Three high school students have been working in the facility learning routine photographic tasks. These internships have helped students to gain an insight into the internal operations of NASA and the laboratory, while the facility simultaneously has benefitted from the enthusiastic help of students who some day might be data requesters themselves.

Earth Science Data Systems

1. NASA's Climate Data System (NCDS)

WHAT IS NCDS?

The NASA Climate Data System (NCDS) is an interactive scientific data management system composed of an integrated set of software tools for locating, accessing, manipulating, and displaying data from NASA and other correlative research missions (see Figure 2 below for overview). NCDS was initiated in 1980 as a pilot study and became an operational interactive data management system in late 1988. It provides comprehensive information about available data and offers flexible access to a number of valuable climate data sets from both satellite and conventional sources. To use NCDS, one must be able to access the NSSDC Computer Facility (NCF).

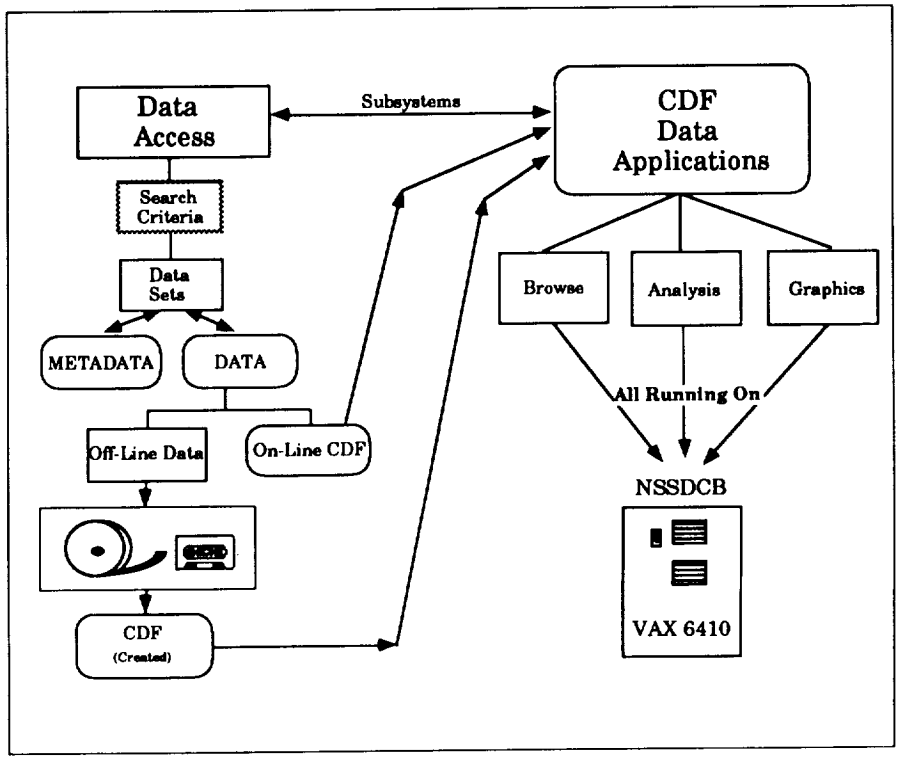


Figure 1. Stucture of NASA's Climate Data System

The NCDS consists of two major subsystems: Data Access and CDF Data Applications (see Figure 1). The Data Access Subsystem provides data descriptive information and access to both off-line and on-line data. On-line data (no operator intervention) are stored in Common Data Format (CDF). Off-line data can be dynamically transformed from their native format into CDF through in-house software written to perform this task. The Common Data Format is data set independent, allowing the application of a single set of analysis tools regardless of the original data format. In CDF, data can be subset, manipulated, or plotted within the CDF Data Applications Subsystem. Improvements in CDF and new CDF-based tools are being developed for enhanced functionality.

NCDS now offers access to more than 50 data sets. It is providing interactive computer access for hundreds of scientists annually who rely on NCDS for obtaining and analyzing oceanographic and climatological data. NCDS serves as the First ISCCP Regional Experiment's (FIRE) Central Archive and directly supports the International Satellite Cloud Climatology Project (ISCCP). NCDS has begun to produce value-added climatologies and plans to increase the production of these from existing data sets of higher temporal and spatial resolution. NCDS is also integrating the use of various media through their data management system, such as write-once, read-many (WORM) optical platters.

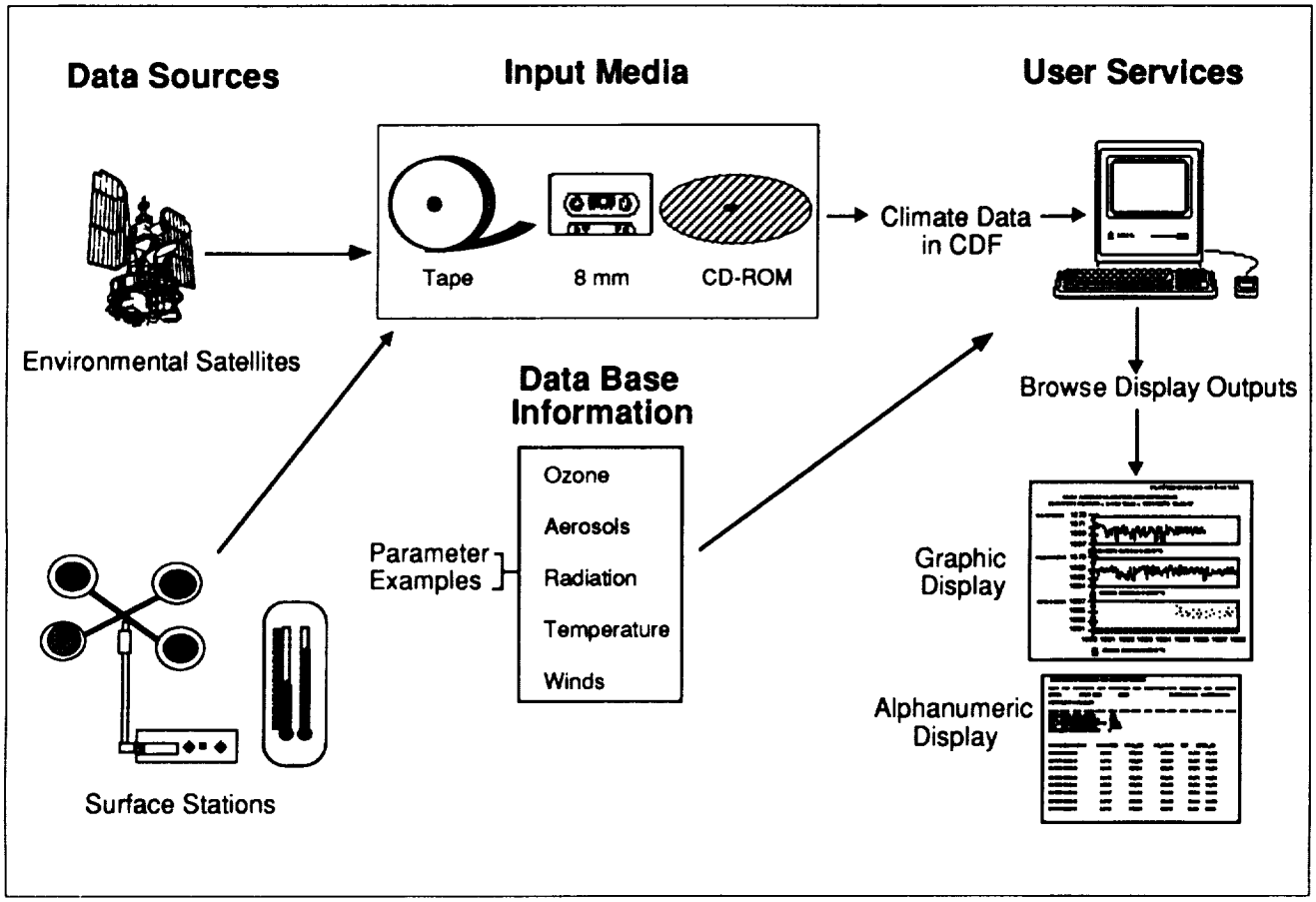


Figure 2. Overview of NASA's Climate Data System

In response to a growing user community, NCDS migrated its user operations from the Virtual Address Extension (VAX) 11/780 to the more powerful VAX 6410 in July of 1990. The NCDS development team continues to work on other machines in the cluster to maximize the CPU available to NCDS users. (See Figure 3.)

NCDS serves many users worldwide. Approximately 25% of these are NASA-funded university scientists; another 25% are scientists from government agencies other than NASA; about 15% are associated with the First ISCCP Regional Experiment (FIRE), a project supported by NCDS; and the remainder are NASA and Goddard scientists. (See Figure 4.)

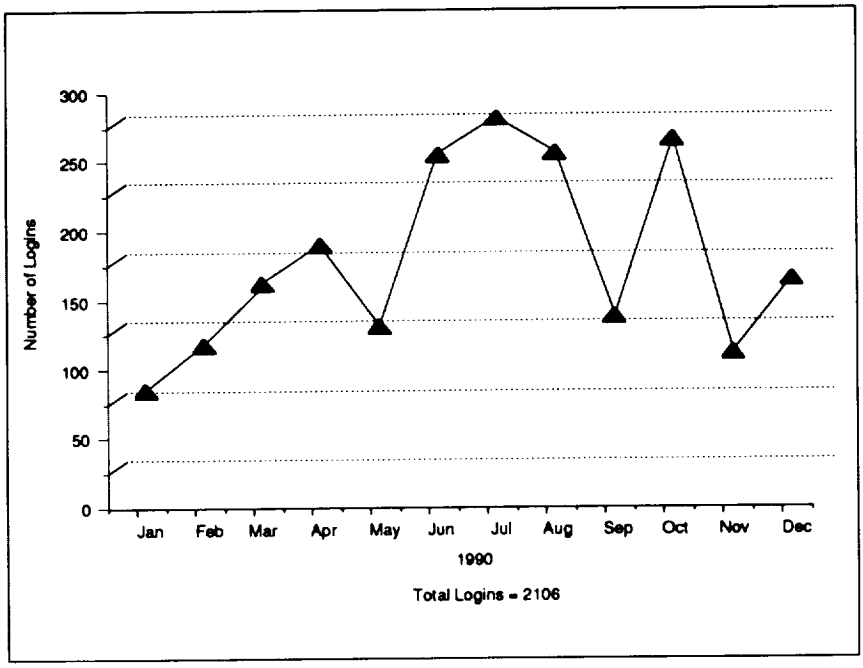


Figure 3. NCDS Computer Logins in 1990

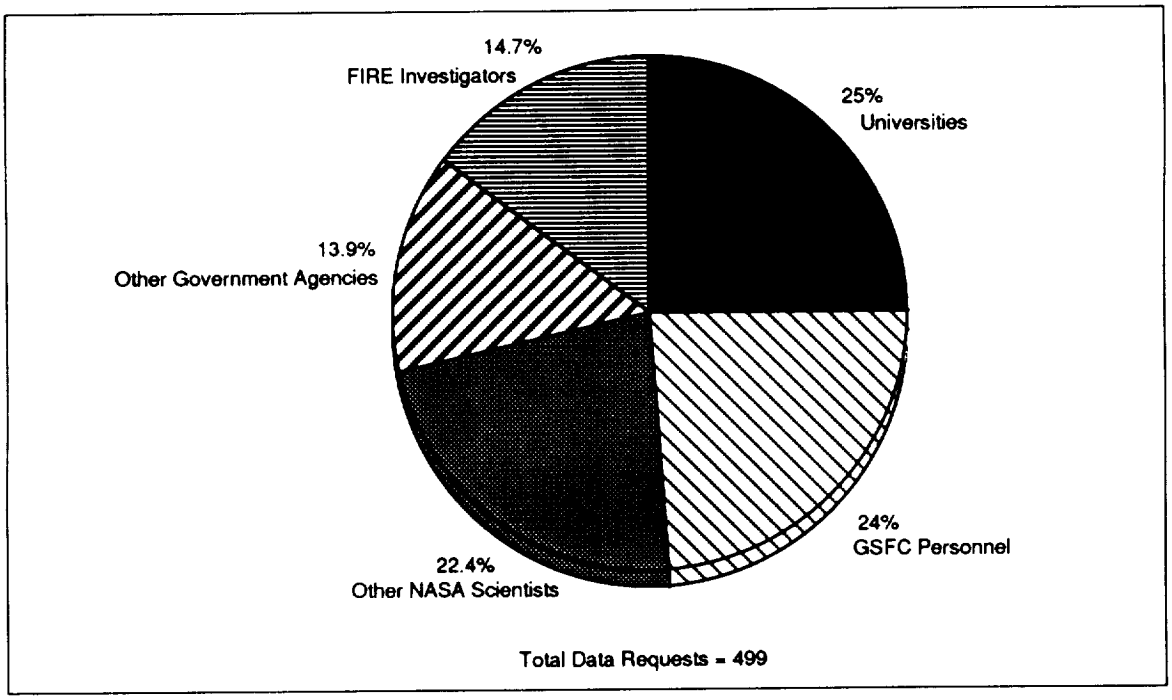


Figure 4. NCDS Data Requests 1990

NCDS is experiencing increasing interest and usage (noted by usage statistics; see Table 1 below) from scientists in many disciplines, as the scope and volume of data increase. In response to user comments, a new user interface has been designed to streamline the pathways to data. Early reactions indicate this much-improved access will further increase interest and use of NCDS.

Table 1. Fiscal Year 1989/1990 NCDS Usage

	1989	1990
Average number of NCDS logins per month	84	176
Average number of NCDS users per month	17	23
Total number of NCDS interactive logins	1035	2106
Number of NCDS requests processed through IRAND	82	291
Approximate number of NCDS data base operations	2500	4500
Average number of data base queries/user/session	2-3	3-4
Total number of NCDS users	150	166
Number of "active" NCDS users per month	20	25

2. Pilot Land Data System (PLDS)

BACKGROUND

NASA's Pilot Land Data System (PLDS) is a distributed information management system designed to support NASA's land science community. It has sites at the Ames Research Center (ARC) and Jet Propulsion Laboratory in California and the Goddard Space Flight Center in Maryland. The PLDS provides a wide range of services including

- Management of information about scientific data.
- Access to a library of scientific data.
- A data ordering capability.
- Communications.
- Connection to data analysis facilities.
- CD-ROM publication.
- An Earth resources browse facility.
- Science project support.
- User assistance.

ON-LINE USAGE

The on-line component of the PLDS is not yet operational. In December 1990 the PLDS began a very limited scale test and evaluation period that will last for several months. During this period, the PLDS Science Working Group and their associates began using the data system and supplying their impressions and comments to the data system staff. The PLDS statistics for 1990 reflect only the usage at the Goddard node of the PLDS and show data before and during the test and evaluation period. The clear increase in usage in December 1990 reflects the start of the evaluation period. (See Figures 1 and 2.)

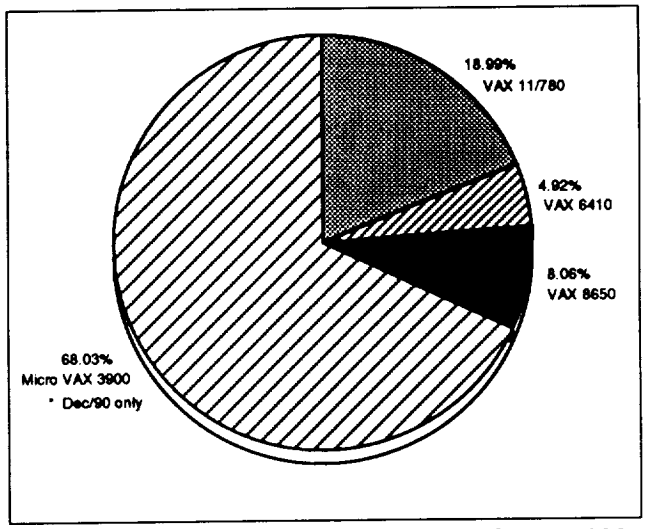


Figure 1. Overall Computer System Usage, 1990

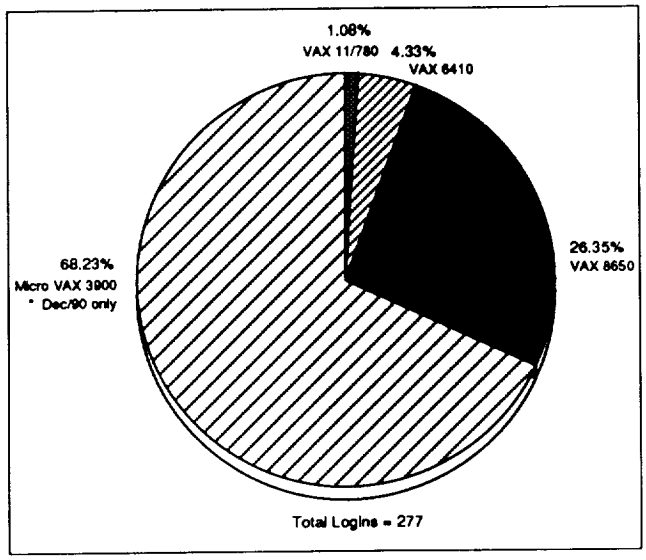


Figure 2. Computer System Logins in 1990

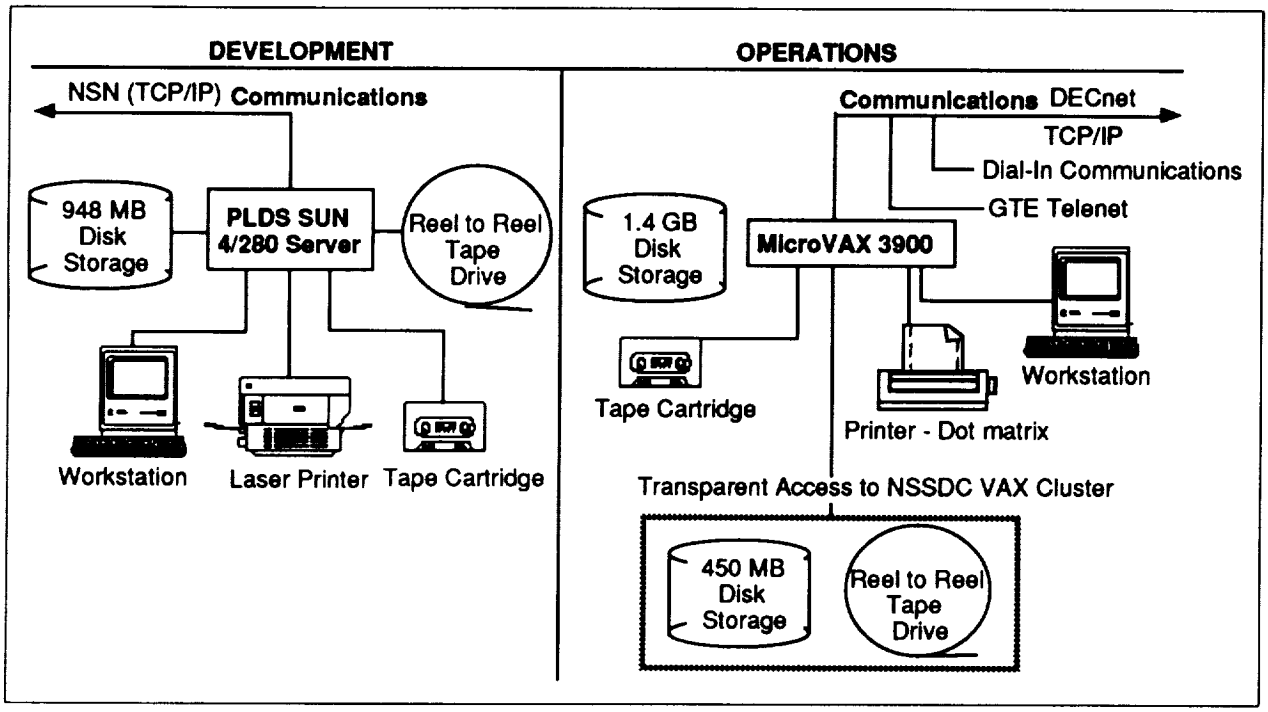


Figure 3. PLDS at GSFC Hardware Configuration

HARDWARE

These on-line services are supported by an operational and a development computer hardware configuration at NSSDC (see Figure 3). The operational configuration provides computational resources for the scientific users of the on-line system while the development configuration provides computer resources for the data system software development team.

OFF-LINE SERVICES

The off-line components of the PLDS (the Earth Resources Browse Facility, the user assistance service, the CD-ROM publication service, and the science project support service) have provided a variety of services in 1990. The Earth Resources Browse Facility is a fully operational component that became an integral component of the PLDS in December 1990. Since 1986 this facility, as an independent entity, has been providing a wide range of operational services. The browse facility provides a walk-in facility where scientists can browse film and map holdings and can request prints or digital data. It also assists scientists with the acquisition of data from other archives and from the EOSAT Corporation.

The user assistance service has been a component of the PLDS since its inception, although not until the initiation of the evaluation period last December did this service begin filling on-line requests for data and providing assistance to users of the on-line system. (See Figures 4 and 5 below for information on PLDS users.) Previously, all requests for assistance or data and information were received by telephone or mail.

The CD-ROM publication service and the science project support services were formally initiated in 1990. In March 1991 the PLDS published the first in a series of several CD-ROMs in conjunction with the First International Satellite Land Surface Cli-

matology Program (ISLSCP) Field Experiment. In 1991 and coming years this service is expected to expand greatly. Plans are already under way for publication of several other data sets on CD-ROM.

The science support services became a formal and integral component of the PLDS in 1990. The ARC node of the PLDS began supporting the Oregon Transect Ecosystems Research project and the GSFC node began providing the on-line data base for the First ISLSCP Field Experiment. Like the CD-ROM publication service, this service is expected to grow and take on more responsibility as it matures.

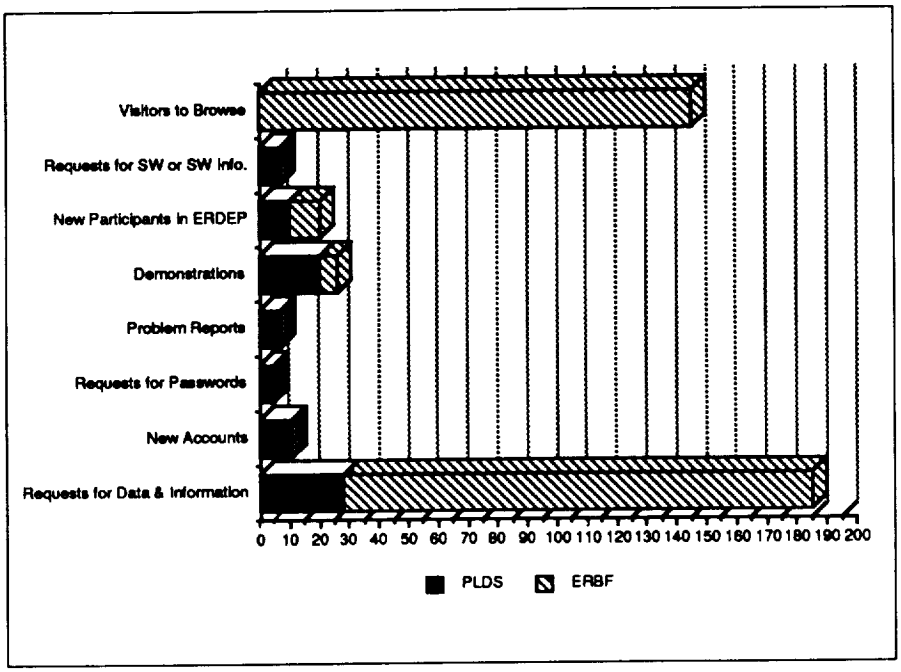


Figure 4. User Interaction, 1990

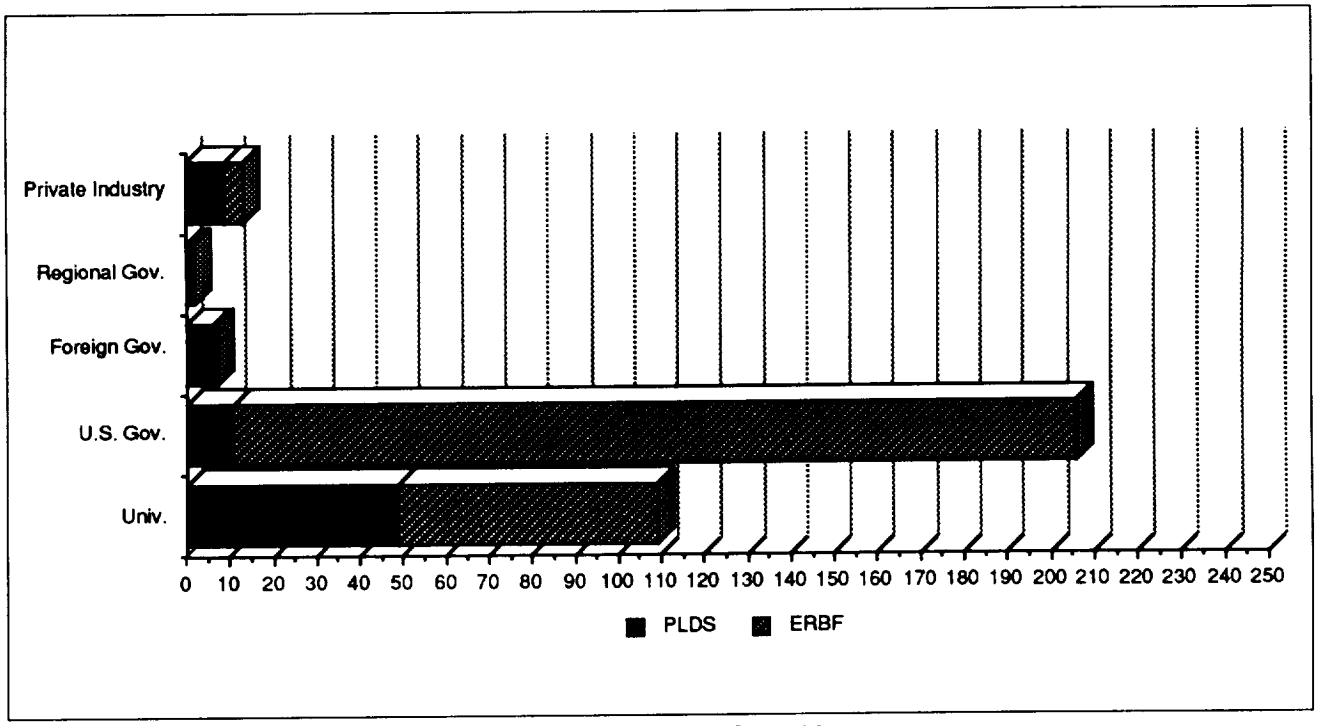


Figure 5. User Profile, 1990

DATA VOLUMES

The volume of data and data sets supported in the PLDS archives at GSFC are diverse (see Table 1 below). The total volume of digital data is currently not large but is estimated to increase significantly over the next few years as the data system begins operations. Activities are now under way to identify and prioritize prospective new data sets. Today, there are about 15 data sets available, ranging from laboratory and ground measurements to satellite measurements. In the next few months, another 70 data sets from the First ISLSCP Field Experiment will be available at the GSFC node.

PUBLICATIONS LIST

- *Pilot Land Data System*
- *Experiment Plan for the First ISLSCP Field Experiment FIFE*, First Version
- *Requirements for Ongoing Development of the Pilot Land Data System (PLDS)*
- *Validation and Verification of PLDS-88*
- *An Information and Data Management System for Land Science, The Pilot Land Data System*
- *PLDS User's Guide*
- *The PLDS GenSQL User's Guide*
- *Requirements & Guidelines for PLDS Nodes*, Working Draft, Revision 1.6
- *The Pilot Land Data System GenSQL Installation Guide*, Draft 0.2
- *Data Set Documentation, Product Description, and User's Guide for the Nimbus 7 SMMR*
- *Polarization Differences Vegetation Index*
- *A Guide to NASA's Pilot Land Data System*
- *Data Set Documentation, Product Description, and User's Guide for the Nimbus 7 SMMR*
- *Derived Global Snow Cover and Snow Depth Data Set*

Table 1. PLDS Data Volumes

Number of granules in data system 5447
Number of granules held in GSFC/PLDS library 4229

Tapes in library →

PLDS	1462
ERBF	1027
Total	2489

Volume of data in GBytes

Off-line 61.41 GByte
On-line .291 Gbyte (70 data sets on-line)

Maps > 500 Topographical maps & National Geographic maps
ONC - Operational Navigational Charts (ONC)
GNC - Global Navigational Charts (GNC)

Film > 1,785,000 frames

3. Crustal Dynamics Data Information System (CDDIS)

BACKGROUND

NASA first established the Crustal Dynamics Project (CDP) to apply space technology to the scientific study of Earth dynamics, tectonophysics, and earthquake mechanisms. The three basic methods of collecting measurements of crustal plate movements are satellite and lunar laser ranging (SLR and LLR), Very Long Baseline Interferometry (VLBI), and the Global Positioning System (GPS). The measurements derived from these techniques are used to accurately pinpoint within several millimeters the position of sites located worldwide. Comparing these measurements over many years allows scientists to monitor the movement of the tectonic plates that make up the Earth's crust. The Crustal Dynamics Data Information System (CDDIS), managed at NSSDC, is the repository for all these measurements as well as the data archive for the Crustal Dynamics Project. The CDDIS has been fully operational since September 1982. The main purpose of the CDDIS is to centrally store and disseminate all

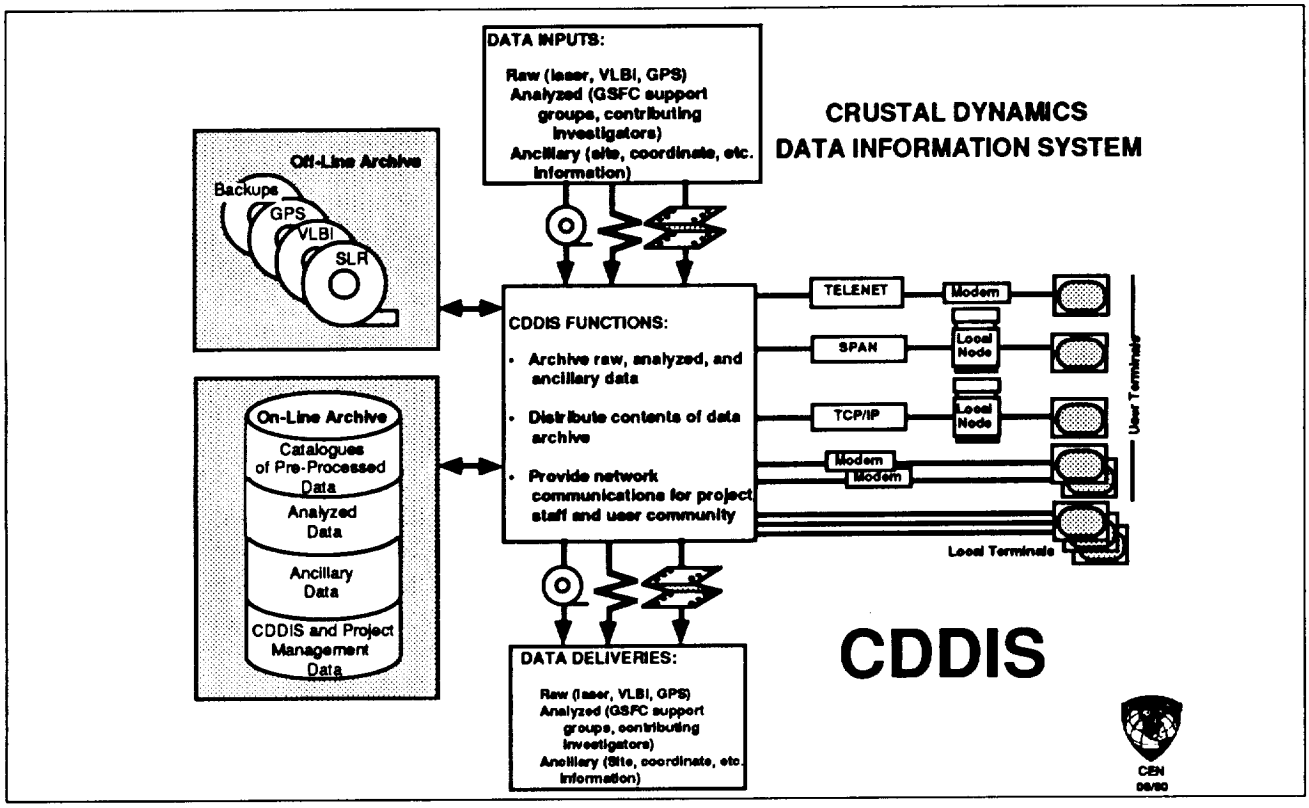


Figure 1. Crustal Dynamics Data Information System

geodetic data products acquired by the project and to maintain information about the archival of all project related data. (See Figure 1 for an overview and Figure 2 for the configuration.) The CDDIS is operational on a dedicated Digital Equipment Corporation (DEC) MicroVAX II computer with nearly three GBytes on-line disk (magnetic and erasable optical) storage. All authorized project investigators, staff, and cooperating institutions have access to the system through the NASA Science Internet (NSI, both DECnet and TCP/IP), BITnet, and the GTE Telenet facilities as well as dial-up telephone lines.

GPS DATA ARCHIVE

The CDDIS began the archive of Global Positioning System (GPS) data for the CDP during FY90. The CDDIS GPS archive includes several different categories of GPS experiments: local, intercomparison surveys between existing SLR and VLBI monuments, regional surveys, and footprint surveys. Currently, the CDDIS is archiving data in raw, receiver format as well as the approved Receiver INdependent EXchange (RINEX) format. A set of tables in the CDDIS ORACLE data base has been created to track GPS experiment, session, site, and satellite information. Software has been developed to summarize RINEX-formatted GPS data and load this information into the data base. CDP investigators can query these tables by time and location to determine data availability. The data are temporarily archived on line to an erasable optical disk for archive processing. At that time, users can access these data and perform remote file copies to their home institutions for further analysis. As more GPS

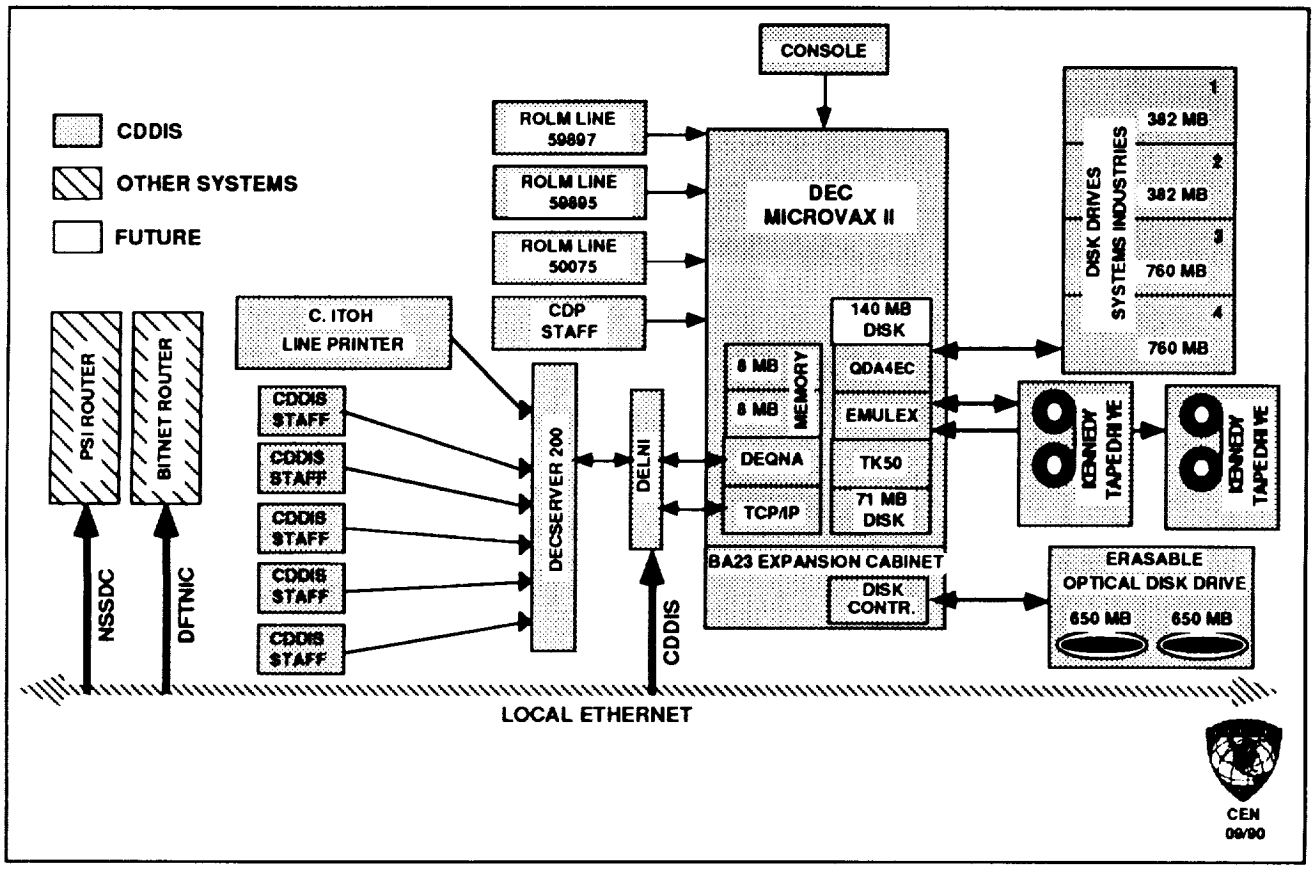


Figure 2. Configuration of CDDIS Computer System

data arrive at CDDIS, older data are archived off line to magnetic tape.

COMPUTER DEVELOPMENTS

An erasable optical disk unit (containing two drives) was installed in the CDDIS computer facility. This device has increased the on-line storage capacity to 2.5 GBytes with an additional 0.6 GBytes of "near" on-line storage. Thus far, these optical disks have been utilized to provide on-line access to the CDDIS GPS data archive.

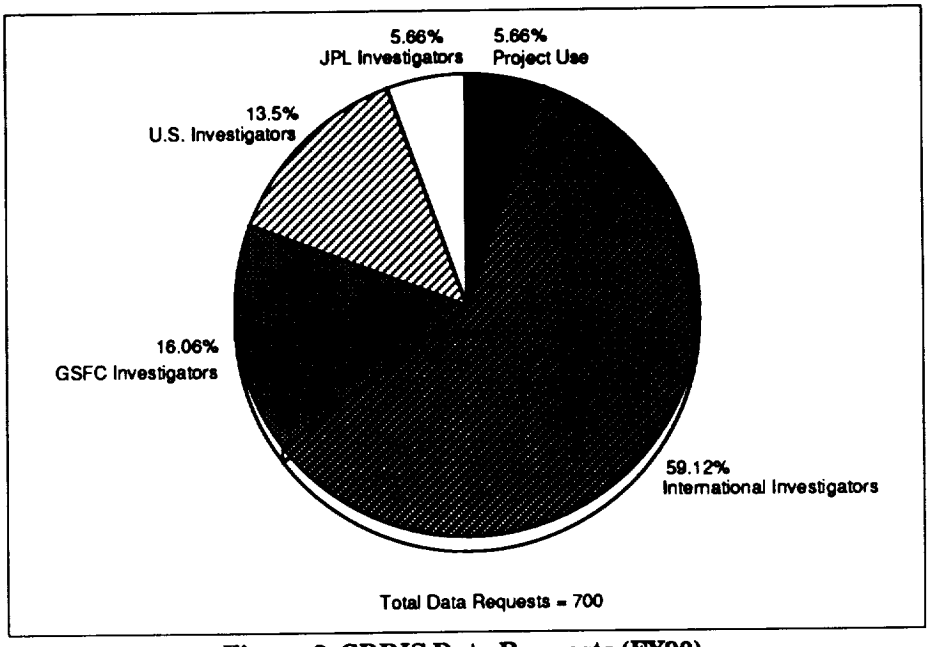


Figure 3. CDDIS Data Requests (FY90)

PUBLICATIONS

The CDDIS continued to publish the *DIS Bulletin* on a bimonthly basis. This newsletter provides up-to-date information about the CDDIS and its archive, including new data arrivals and reported data problems. The CDDIS also published two versions of the *CDP Personnel and Networking Directory*. This document has been widely used by the geodynamics community to promote timely communication among scientists.

USER REQUESTS

During FY90, nearly 700 user requests were received and satisfied via magnetic tape and electronic data transmission. (See Figure 3.)

POD SUPPORT

The ESA Remote Sensing Satellite (ERS 1) precision orbit determination team (located at the German Processing and Analysis Facility, D-PAF, in Oberpfaffenhofen, Germany) will be utilizing quick-look SLR data from the CDSLR network. The CDDIS will archive these data sets on line for daily extraction by D-PAF for a generation of these precision orbits. In return, D-PAF will deposit ERS 1 acquisition data into the CDDIS generated from the orbit calculations for use by the CDSLR tracking stations. Software was developed to archive and catalog these data sets.

OTHER DATA SUBMISSIONS

New analyzed data sets were received from the GSFC SLR and VLBI analysis groups, USNO, and DGFI, Germany. These data included precision baseline and station position determinations, and Earth rotation/polar motion results. The CDDIS began the archive and distribution of the SLR data from the U.S.S.R.'s ETALON-I and -II satellites. In addition, over 400 new tapes were received and archived in the CDDIS tape library. These tapes included SLR full-rate data and VLBI and GPS experiments.

Space Science Data Systems

1. Coordinated Data Analysis Workshop (CDAW) Program

The CDAW program is an effort by NSSDC to further the conduct and development of tools and techniques for the conduct of large-scale collaborative scientific research, using simultaneous data from many investigators to attack significant physical problems of global scale that may not be otherwise addressable. The concept originated in the solar-terrestrial community with a need within the International Magnetospheric Study (IMS) program to analyze simultaneous data from a variety of sources to better understand the structure and dynamics of systems like the Earth's magnetosphere.

The CDAW program is distinguished by its combination of a traditional workshop format with assembly of a digital data base where the data and relevant models have been cast into a common format, with supporting software and graphics devices during the workshops to allow participants direct interactive graphic display and data analysis. NSSDC serves as a focus for the organization and logistics of the workshops. The selection of scientific problems and overall planning are the responsibilities of the interested science community. Access to the data base between workshop meetings is supported over electronic networks such as NSI/DECnet and NSI/TCP-IP. The CDAW program is one model for how some aspects of the collaborative work to be included in the Inter-Agency Consultative Group (IACG) 1990s initiative in solar-terrestrial science and significant parts of the global science objectives of the Global Geospace Science/International Solar-Terrestrial Physics (GGS/ISTP) program might be carried out.

The current CDAW workshop series (CDAW 9) was initiated with a major meeting at NSSDC in May 1989. The focus of the CDAW 9 analysis is five specific events during the March-June 1986 Polar Regions and Outer Magnetosphere International Study (PROMIS) campaign period. During the PROMIS period, an international effort was made to gather simultaneous solar-terrestrial observations toward the goal of an improved understanding of the relation between polar phenomena and physical processes in the magnetosphere as a whole. The campaign included concurrent imaging of northern and southern hemisphere aurora by the Viking and Dynamics Explorer spacecraft, respectively.

The overall CDAW 9 effort involves over 100 participating scientists from around the world and a data base including 14 spacecraft and numerous ground-station observations. Some 80 distinct data sets (for each of the five CDAW 9 events in most cases) plus satellite ephemeris data comprise the basic data base. CDAW 9 meetings have been (or are to be) held at Goddard (May 1989, June 1990, June 1991), Stanford University (December 1989), and the Solar-Terrestrial Environment Laboratory (STELAB) of Nagoya University (August 1990). The workshop in Japan was supported by porting and reinstalling the data base on local facilities; the other workshops have been supported by either direct or network access to the data base and software at NSSDC. Access and use of the data base for the primary CDAW 9 analysis period is governed by a set of "Rules of the Road" that establish the requirements to be considered a CDAW 9 participant and for use of the CDAW 9 data in publications.

During the workshops themselves, literally a thousand or more plots have been produced for either

interactive graphics terminal or hard copy display. On-going access to the data continues between workshops. In a number of cases, data have also been interactively extracted from the data base for local manipulation and display by participants. As a recent example at what is now a relatively mature phase of the CDAW 9 analysis, a total of 44 participant sessions to access and use the data base were logged in the three months from November 1990 through January 1991.

A special session on initial results from CDAW 9 was held at the 1990 Spring American Geophysical Union (AGU) meeting in Baltimore. CDAW 9 results will be more comprehensively summarized in papers now in preparation for the International Association of Geomagnetism and Aeronomy (IAGA) meeting to be held in Vienna, Austria, in August 1991. Some of the still unfolding research deriving from the CDAW 9 effort include

- The relation between ultraviolet auroral images and the ground magnetometer signatures that have been used in the past to imply auroral structure and motions.
- Cross-tail current development, field line mapping, and substorm onset mechanisms.
- Modeling of the instantaneous distribution of electric fields, horizontal currents, field-aligned currents, and magnetospheric heating.
- Substorm development as seen in dual auroral imaging.

Work also continues on the underlying software system to improve both its functionality and its performance to meet future analysis needs.

2. Satellite Situation Center (SSC) and SPACEWARN

During 1990, the SSC and SPACEWARN office supported the following activities:

- Providing routine mission support.
- Coordinating/supporting international multi-spacecraft research.
- Evolving new heliospheric orbital codes to meet Inter-Agency Consultative Group (IACG)/International Heliospheric Study(IHS)/SOLar Connection to Transient Interplanetary Processes (SOLTIP) needs.
- Computing and loading on-line SSC print files and executable codes for remote access.
- Continuing Committee on Space Research (COSPAR)/International URSIGRAM and World Days Service (IUWDS)/SPACEWARN activities.
- Extending help/oversight/validation of the SSC codes being ported from MODCOMP to VMS and UNIX.

PROVIDING ROUTINE MISSION SUPPORT

Support for the DE 1 project office continued. Ephemeris files for DE 1 and AKEBONO spacecraft, using the (Code 500) Gridded Trajectory Determination System (GTDS) program were produced on magnetic tapes. There were 27 such files for each of these spacecraft, each produced for a future period of two weeks, six weeks in advance. The DE 1 files were inputted to an SSC code to supply hard copies of the coordinates of DE 1 every three minutes in several coordinate systems of interest. Both DE 1 and AKEBONO files were then inputted to another SSC code to provide list outputs of the times when both spacecraft would be on any common magnetic field tube. Hard copies of these conjunctions were supplied to the DE 1 project office (again in advance, for two-week periods). These pairs of list outputs were also networked to Palo Alto and Kyoto investigators routinely and occasionally to a few other research scientists on request. Besides those advance predictions of DE 1 coordinates, definitive ephemeris tapes were also produced for the spacecraft; ("definitive" signifies that actual orbital elements were used). Inputted ephemeris files, predicted and definitive, totaled 122 MBytes (equivalent to 244,000 VAX blocks), and outputted files totaled 23 MBytes.

Support for the IMP 8 project consisted of producing definitive ephemeris tapes for the full year of 1992 and inputting the file into an SSC code to provide plots of the spacecraft trajectory in GSE X-Y plane. Each plot covered one full orbit, for a total of 30 plots for the year.

Two-line U.S. Space Command (USSPACECOM–previously known as the North Atlantic Air Defense Command [NORAD]) orbital element sets of several thousand orbiting objects were networked three times a week to Johnson Space Center (JSC), Houston, Texas. JSC is using these data to support a study on space debris. The total number of such tapes (from USSPACECOM) was 156, containing 117 MBytes of data.

Orbital element sets for ten science interest spacecraft were extracted from the USSPACECOM tapes and loaded three times a week into the "anonymous

FTP" network account [ACTIVE]. They occupy 150 KBytes in the account. For some foreign investigators who had expressed difficulty in accessing [ACTIVE], the elements were E-mailed periodically. These data were available to over 30 investigators.

COORDINATING/SUPPORTING INTERNATIONAL MULTI-SPACECRAFT PROGRAMS

IACG/ACTIVE: The Soviet spacecraft ACTIVE (also known as ACTIVNI or ACTIVNYI) was the centerpiece of an IACG effort, coordinating joint investigations involving ACTIVE, DE 1, AKEBONO, and SCATHA spacecraft and numerous ground-based research stations. The SSC was designated as the central prediction/coordination center for this effort. For each month, January through June, SSC produced advanced predictions of

- the location of ACTIVE,
- its magnetic field foot-point in the Northern Hemisphere,
- its magnetic field conjunctions with DE 1, AKEBONO, and SCATHA.

These predicted files were made available to all joint investigators through on-line files in the "anonymous FTP" network account [ACTIVE]. The orbit predict files totaled about 8 MBytes each month, totaling 48 MBytes until termination of the program in July 1990.

Besides such advance planning efforts, the SSC also computed for each month definitive files of

- the location of ACTIVE,
- the magnetic foot-point of ACTIVE using two different models (quiet and super-disturbed) of the field,
- the magnetic field conjunctions of ACTIVE with DE 1, AKEBONO, and SCATHA, invoking again two different models of the magnetic field.

These files amounted to nearly 70 MBytes, again globally accessible through the anonymous account. All the ephemeris files, predicted and definitive, generated as inputs to the SSC computer codes totaled 120 MBytes.

IHS: At the request of the editor of the IHS newsletter, plots of the heliographic latitudes of Pioneers 10 and 11 and Voyagers 1 and 2 for the years from launch through 1999 were supplied; these appeared in the IHS newsletter No. 3.

Solar-Terrestrial Energy Program (STEP)/SOLTIP: At the request of the chairman of the SOLTIP working group, a composite, ecliptic plane projected plot of all heliospheric spacecraft for mid-1990 through mid-1991 was prepared. In addition, SSC personnel provided a list of time intervals during which any pair of heliospheric spacecraft would be radially aligned with the Sun during the December 1990-January 1991 MAX91 campaign. The list was incorporated in to the November 1990 MAX91 newsletter, distributed by NOAA/SEL in Boulder, Colorado.

Seismic Research: SSC hosted for a month a Soviet visitor (O. Pokhotelov), sponsored by the United States Geological Service (USGS), and provided him with special runs of codes to select instances when DE 1, AKEBONO, or ACTIVE and San Marco could have been on the same flux tubes that emanated from hundreds of seismic epicenters.

CONTINUING COSPAR/IUWDS *SPACEWARN BULLETIN* ACTIVITIES

A total of 4800 telexes from USSPACECOM and Foreign Broadcast Information Service (FBIS) were obtained to extract information for the monthly publication, the *SPACEWARN Bulletin*.

A total of 90 telexes was sent to the COSPAR distribution list, announcing new launches of 174 spacecraft around the world.

On-line access to the *SPACEWARN Bulletin* was initiated with the December 1990 issue. It was loaded into the anonymous subdirectory ACTIVE.SPX. The version of the *SPACEWARN Bulletin* is sent to over 600 scientists throughout the world.

3. The Astronomical Data Center (ADC)

The Astronomical Data Center (ADC) at the NSSDC is one of six major international astronomy data centers. The ADC works to provide scientists with machine-readable astronomical catalogs. Over 600 catalogs have been made available through the ADC. Figure 1 shows the number of catalogs in the archive from 1978, when the NSSDC and ADC were founded, each year to 1990. In reading these statistics, please note that many new catalogs supersede previous editions. These catalogs have been acquired through exchanges with other data centers, such as the Centre de Donnees astronomiques de Strasbourg, and directly from scientists within field.

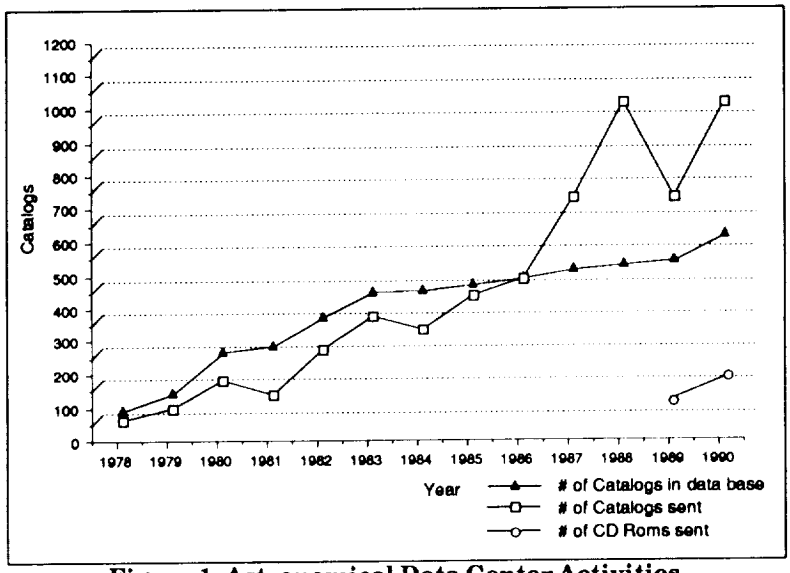


Figure 1. Astronomical Data Center Activities

In 1990 the ADC received 655 requests for which over 1000 catalogs were distributed. In addition to basic acquisition and redistribution, the ADC provides additional services, such as verification, documentation, and updating of catalogs. These services enhance the value of the catalogs to the astronomical community. The ADC serves as a focal point for scientists' feedback on errors and problems with catalog entries discovered during their use.

In 1989 the ADC released its first CD-ROM and the end of that year, 108 copies had been distributed. In 1990 over 170 copies were distributed. Following the 1989 release of the first ADC compact disc (CD-ROM) containing 31 astronomical catalogs, work began in 1990 on a two disc set to hold over 100 of the most requested catalogs. These will be recorded in both FITS format and plain-text ASCII to provide users with the ability to access the data in the more convenient formats. Up to 200 sets may be produced in the initial run.

The preparations for the new CD-ROM set will also help the ADC to ready catalogs for distribution via the NASA Astrophysics Data System (ADS). After that system comes online, the NSSDC will establish its ADS node. ADC catalogs will be among the first of the NSSDC's holdings to be made available through the ADS.

4. ROSAT Mission Information and Planning System (MIPS)

The ROSAT (German X-ray research satellite) project is a cooperative program between the Federal Republic of Germany, the United States, and the United Kingdom. The mission of ROSAT is to advance the science of astrophysics through the study of X-ray emissions from non-solar celestial objects. The study will be performed with an X-ray observatory that initially will survey the sky for X-ray sources and then will point at specific sources for extended periods of time.

The main instrumentation of ROSAT consists of a Wolter type I X-ray telescope with a carousel plane assembly carrying a Position Sensitive Proportional Counter (PSPC) instrument designed and built by the Federal Republic of Germany, and a High Resolution Imager (HRI) instrument designed and built by the United States. The X-ray telescope will be supplemented by an extreme ultraviolet (EUV) telescope with a Wide Field Camera (WFC) instrument designed and built by the United Kingdom. The United States launched the ROSAT observatory on a Delta 2 on June 1, 1990. The satellite is in a near perfect orbit of 584.6 km x 577.8 km and 53.004 degrees inclination.

The U.S. ROSAT Science Data Center (USRSDC) has been developed to support the U.S. portion of the ROSAT program. One function of the USRSDC is to provide mission information and proposal support to the U.S. investigators, the primary task of which is to assist guest observers in the development of pointed observation proposals for ROSAT. As part of this function, target lists for approved pointed observations by U.S. guest observers are provided to the International Users Committee at MPE. To effectively carry out this task, there have been many activities performed together by the USRSDC and MPE, such as the creation and maintenance of several data bases and software packages that will support the mission planning tasks and also provide assistance to the guest observer. The mission planning software coordinates and manages incoming requests from NASA selected guest observers for observing time on ROSAT instruments. It provides all necessary information and reports to NASA Headquarters, to the National User Committee, to the Max Planck Institute, and to guest observers. It directly interfaces with the West German Mission Planning software at MPE. In addition, the mission planning support staff extracts technical information from proposals at the request of U.S. ROSAT proposal review committees and provides other support including evaluating targets based on possible observing times and viewing windows. The information and reports are available in an on-line information system for mission planners. Guest observers may interact with the on-line information system in order to acquire data concerning the ROSAT instrumentation approved ROSAT proposals. The mission planning and mission information support function is provided to the community by the ROSAT Mission Information and Planning System (MIPS).

The Mission Information and Planning System (MIPS) is an on-line information retrieval system devised for the U.S. ROSAT Science Data Center and its users. MIPS was designed and implemented by the ROSAT Mission Planning Team at the NSSDC. MIPS is a menu-driven system built using the INGRES data base management system (DBMS) and its utilities.

The requirements for MIPS were assessed after collaboration with EINSTEIN investigators at the onset of the GSFC involvement in the ROSAT project in November 1986. In this evaluation, it was determined that the general user community or guest observers require the following information:

- ROSAT approved targets and selected information from approved proposals.
- Ability to formulate a ROSAT proposal for submission.
- EINSTEIN sequences and targets.
- EXOSAT observations.
- Technical specifications for PSPC and HRI.
- Ability to calculate exposure times for targets, viewing windows, and coincidences.
- Immediate information concerning ROSAT through a bulletin board.
- Correspondence among fellow investigators.

MIPS is arranged primarily in a menu-driven system providing the user maximum flexibility despite the disparity of user knowledge and equipment (see Figure 1). MIPS resides on a DEC MicroVAX II running VMS 5.3 and is available to users 24 hours per day, seven days per week. This computer is accessible through the NASA Science Internet networks and is known as the ROSAT node. Access to the MIPS MicroVAX is also available through the GTE Telenet system and through direct dial-in telephone lines.

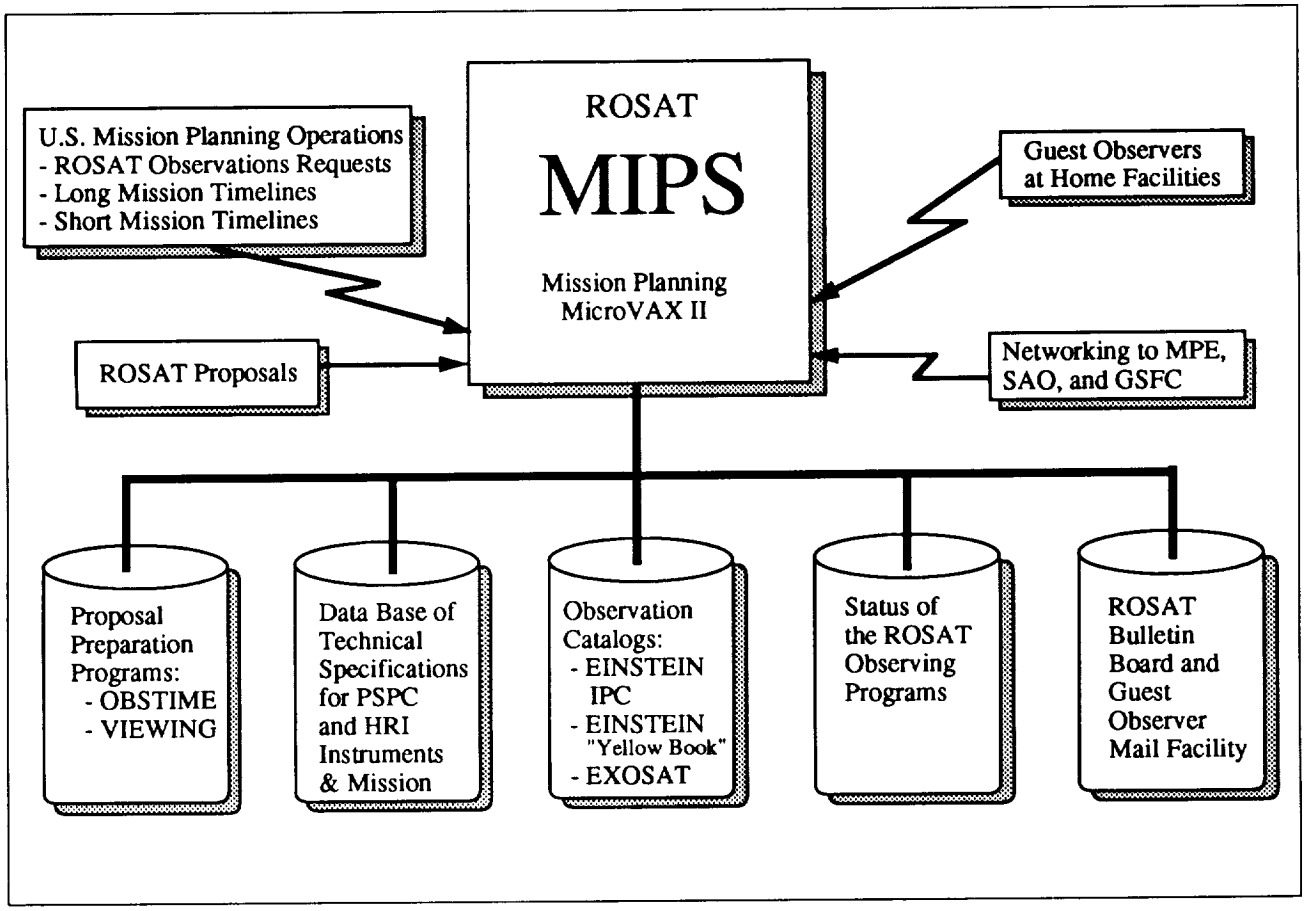


Figure 1. Conceptual View of the ROSAT MIPS

ROSAT Mission Planning covers many aspects of the ROSAT mission including MIPS. Most activity on MIPS centers around the ROSAT proposal cycle. The first NASA NRA for ROSAT was distributed in March 1989. At that time, MIPS registered 151 users and by the end of 1990, MIPS had registered 211 users. (See Figure 2.) Access to MIPS is usually heaviest during the proposal period. During 1990 MIPS was upgraded to provide better support for the second proposal cycle, which was scheduled for February 1991. Changes requested by users were incorporated into the new version (5.0), which was released in November 1990. A copy of the MIPS 5.0 was also distributed to the Max Planck Institute in December 1990. Other highlights for 1990 include the successful launch of ROSAT. In response to the imminent launch, NASA Headquarters held a launch readiness review in March 1990. At that time, the ROSAT Mission Planning activities including MIPS were recognized as being successfully completed.

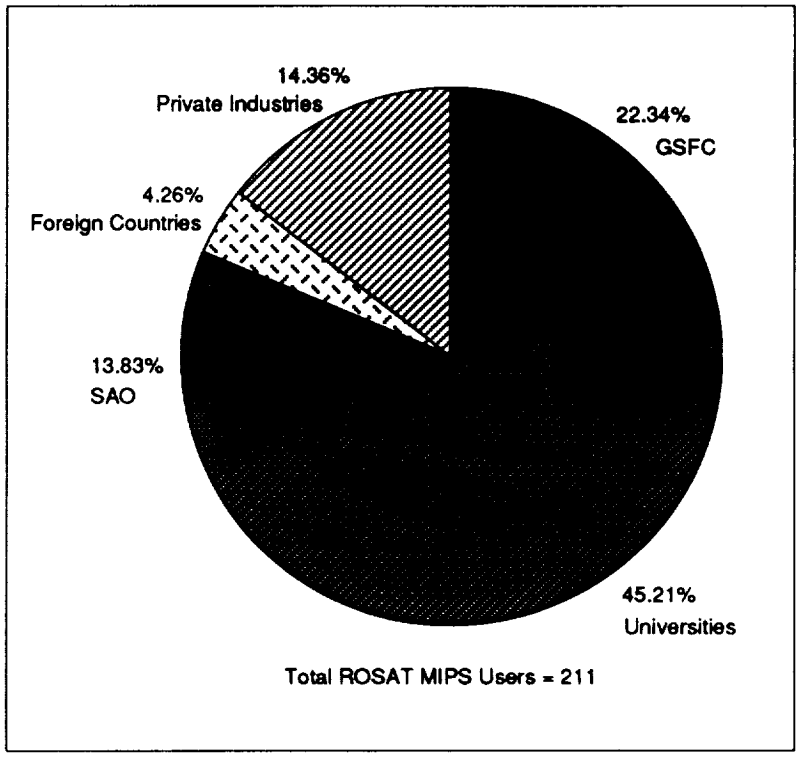


Figure 2. ROSAT MIPS Version Operational at GSFC Profile

Standards and Technologies

1. NASA/OSSA Office of Standards and Technology

The NASA/OSSA Office of Standards and Technology (NOST) at the NSSDC has been established by the Office of Space Science and Applications (OSSA) at NASA Headquarters to serve the space and Earth science communities in evolving cost-effective, interoperable data systems. It has been recognized that research organizations that promote the use of cost-effective standards for their operations will have relatively more resources available to devote to the generation of truly unique and significant advances in science and technology. To this end, NOST performs a number of functions designed to facilitate the recognition, development, adoption, and use of standards by the space and Earth science communities.

NOST is organized into four distinct functional areas, all operating under the guidance of its Executive Board. These areas are known as NOST Administration, Standards Library, Standards Development, and Standards Conformance and Support (see Figure 1). The Administration operation is concerned with managing the activities of the other three NOST areas, administering the office's policies and procedures, and providing an active interface to other standards organizations within and outside NASA to foster both the exchange of standards information and the development of new standards. The Library is concerned with collecting, updating, and disseminating information about existing and emerging standards of relevance to

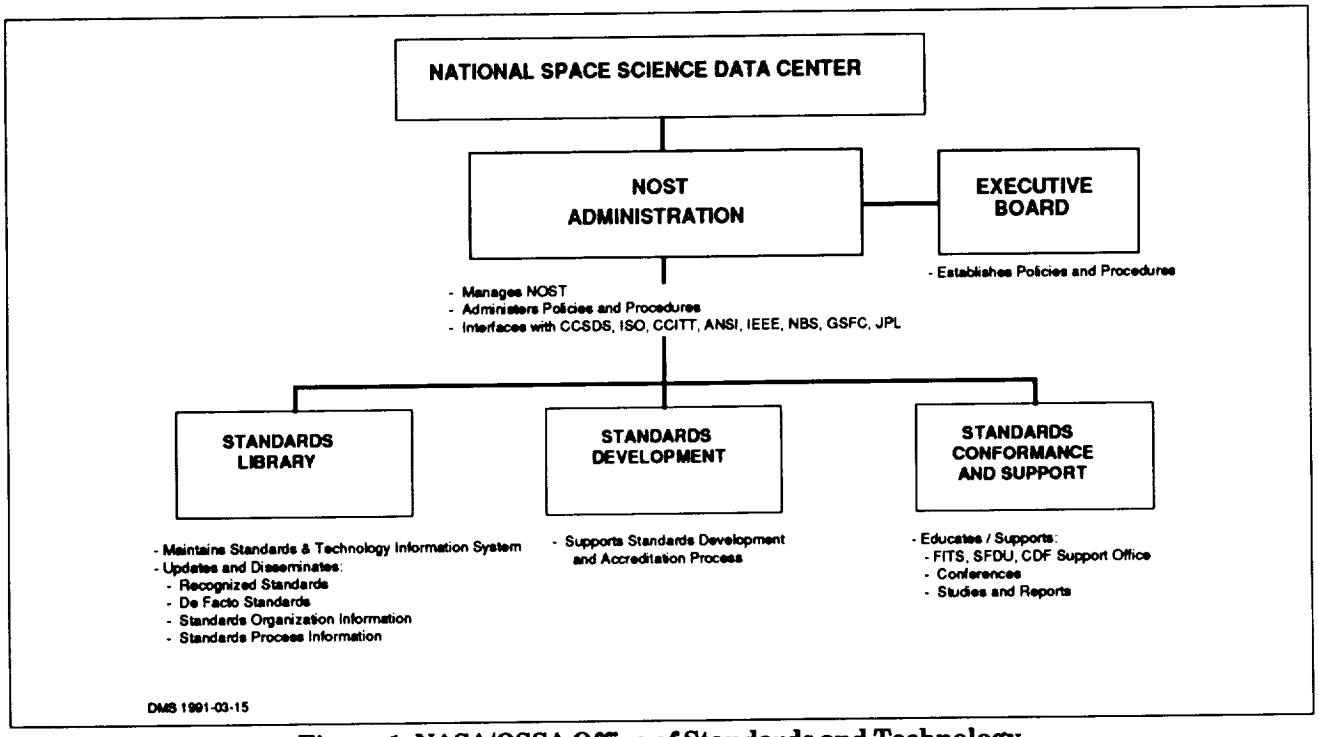


Figure 1. NASA/OSSA Office of Standards and Technology

NASA and NASA-related data systems. Information on recognized standards (i.e., standards documented by recognized standards organizations such as the International Standards Organization [ISO], American National Standards Institute [ANSI], and Consultative Committee for Space Data Systems [CCSDS]), and de facto standards (i.e., specifications/systems in wide and stable use) are the primary categories maintained in the Library, with each broken into a number of subcategories to facilitate searching and understanding. Other categories include information on the various standards organizations and on the standards creation process. Some standards specifications are available on request, while others must be obtained from commercial organizations. Requests for standards information may be satisfied through the Standards and Technology Information System (STIS)—an easily used NOST on-line data base and software system for accessing information on standards and technology—electronic mail to the NSSDC account known as NCF::NOST or nost@nssdca.gsfc.nasa.gov, or by mail request to the NSSDC. The overall Library operation, including STIS, provides an educational service to the space and Earth science community.

The Standards Development operation is concerned with the establishment, maintenance, and use of policies and procedures for the development of new standards, and the adoption of existing standards as NOST standards. These policies and procedures cover the establishment of technical panels to develop standards, the review processes through which draft standards must pass, and the logistical support available from NOST. The overall Standards Development operation provides a mechanism for the development and accreditation of standards by the space and Earth science communities.

The Standards Conformance and Support operation is concerned with support for existing and emerging standards. This support ranges from providing information to potential users on experience with commercial standards to a full support office for the use of a particular standard. Where a commercial vendor is not available to support a particular standard, testing and validation of an implementation of the standard may be provided by this operation. The actual operations at any one time will depend on the needs of the community and the availability of resources. The overall Standards Conformance and Support operation provides a broad range of educational and supportive services to the space and Earth science communities.

2. The Standards and Technology Information System (STIS)

Using standards is an effective and efficient method for controlling time and dollar costs incurred while performing many functions. Data systems developed using standards are often less expensive to develop and maintain. They are easier to understand and more adaptable to changing requirements. The use of widely acknowledged standards results in users' not being dependent on a single vendor and allows users to produce their data systems with less risk. Often the use of standards is mandated by higher authorities or required by contractual agreements.

The Standards and Technology Information System (STIS) is a centralized electronic library that lets users know about available standards. The STIS is supported by the NASA/OSSA Office of Standards and Technology (NOST) and is a tool to help NOST accomplish its mission to facilitate the recognition, development, adoption, and use of standards by the space and Earth science communities. Besides the information on the actual standards and related documents, this library also contains information about emerging technologies where standards may not yet have been developed. This referenced material may have originated from a variety of sources such as books, technical or popular press articles, government or industry reports, and reports created by the NOST staff or NOST adjunct members. NOST encourages individuals within the community who have an interest in a particular standard or new technology area to register as NOST adjunct members. By doing so they agree to provide reports as new information comes to them for incorporation into the STIS under their authorship.

The information displayed for these documents includes standards identifiers (e.g., ISO 9660), title, source, publication and copyright data, the names of any identified authors or editors, and the organization responsible for the document. The staff also classifies the documents with topic and content codes, assigns a number of keywords to aid the user in searching for the documents and often prepares an abstract or comments on the document. If copyright provisions can be accommodated, the full text of many of the shorter documents is provided. Future implementations of the STIS are planned to include the display of information needed to order copies of documents directly from the source. At all times NOST may be contacted for ordering information.

The STIS also contains information on the policies and procedures of NOST. This provides the user with on-line information regarding NOST functions and services.

The STIS is also able to display information on a number of organizations active in the standards development field, including information on the areas in which these organizations are working. Contact points within those organizations are provided for users who need further information.

All the information in the STIS is presented through a series of user friendly menus. Most users find they can use the system without any help or training. Comments and requests to NOST/STIS may be directly entered by users at virtually any point.

The STIS may be accessed through the NSSDC On-Line Data and Information Services (NODIS), which is described elsewhere in this document.

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NSSDC ACRONYMS AND ABBREVIATIONS LIST

ADC	Astronomical Data Center
ADS	Astrophysics Data System
AGU	American Geophysical Union
AEM	Atmospheric Explorer Mission
AIAA	American Institute for Aeronautics and Astronautics
ANSI	American National Standards Institute
ARC	Ames Research Center (NASA)
ARPAnet	Advanced Research Projects Agency Network
BITnet	Because It's Time (or There) Network
BMFT	Bundes Ministerium Forschung und Technologie
CCRS	Canadian Centre for Remote Sensing
CCSDS	Consultative Committee for Space Data Systems
CCRS	Canadian Centre for Remote Sensing
CDAW	Coordinated Data Analysis Workshop
CDDIS	Crustal Dynamics Data Information System
CDF	Common Data Format
CDP	Crustal Dynamics Project
CD-ROM	Compact Disc-Read Only Memory
CDS	Centre de Donnees de Strasbourg
CEOS_PID	Committee on Earth Observations Satellites Prototype International Directory
CFA	Harvard Smithsonian Center for Astrophysics
CFC	Chlorofluorocarbons
CI	Catalog Interoperability
CIRA	COSPAR International Reference Atmosphere
COADS	Comprehensive Ocean Atmosphere Data Set
CODD	Central On-Line Data Directory
COSPAR	Committee on Space Research
CRRES	Combined Release and Radiation Effects Satellite (joint NASA/USAF mission)
CRUSO	Coordinated Request and User Support Office
CTIO	Cerro Tololo Inter-American Observatory
CZCS	Coastal Zone Color Scanner
DAB	Data Announcement Bulletin
DADS	Data Archive and Distribution System
DADS	Document Availability and Distribution Services
DAN	Data Analysis Network (Canada)
DAVID	Distributed Access View Integrated Database
DBMS	Data Base Management System
DEC	Digital Equipment Corporation
DECnet	DEC Networking Products (generic family name)
DIF	Directory Interchange Format
DLR	Deutsches Forschungs Anstaltfuer Luft und Raumfahrt
DSUWG	Data Systems Users Working Group

ECMWF	European Center for Midrange Weather Forecasting
EDC	EOS Data Center
E-HEPnet	European High Energy Physics Network
ELSET	Element Set
EOS	Earth Observing System
EOSDIS	EOS Project Data and Information System
ERB	Nimbus 7 Earth Radiation Budget Instrument
ERBE	Nimbus 7 Earth Radiation Budget Satellite
ERBF	Earth Resources Browse Facility
ERBS	Nimbus 7 Earth Radiation Budget Satellite
EROS	Earth Resources Observation System
ESA	European Space Agency
ESDD	USGS Earth Science Data Directory
ESO	European Southern Observatory
ESOC	European Space Operations Centre
E-SPAN	SPAN in Europe
EUROHEPnet	European High Energy Physics Network
EUV	Extreme Ultraviolet
EXOSAT	European X-Ray Observation Satellite (ESA)
FBIS	Foreign Broadcast Information Service
FGGE	First GARP Global Experiment
FIFE	First ISLSCP Field Experiment
FIRE	First ISCCP Regional Experiment
FNOC	U.S. Navy's First Numerical Oceanography Center
FRG	Federal Republic of Germany
FTP	ANONYMOUS File Transfer Protocol
GCMD	Global Change Master Directory
GGS	Global Geospace Science
GIS	Geographic Information System
GOES	Geostationary Operational Environmental Satellite (NASA-NOAA)
GPS	Global Positioning System
GSFC	Goddard Space Flight Center (NASA)
HEPnet	High Energy Physics Network (also known as PHYSnet)
HRI	High Resolution Interferometer
IACG	Inter-Agency Consultative Group
IAGA	International Association of Geomagnetism and Aeronomy
ICE	International Cometary Explorer
ICSU	International Council of Scientific Unions
IDL	Interactive Data Language
IDM	Intelligent Data Management
IGRF	International Geomagnetic Reference Field
IIFS	Intelligent Information Fusion System

IMP	Interplanetary Monitoring Platform
IMS	International Magnetospheric Study; Ion Mass Spectrometer
IRAP	ISLSCP Retrospective Analysis Project
IRAS	Infrared Astronomical Satellite (The Netherlands-NASA-U.K.)
IRI	International Reference Ionosphere
ISCCP	International Satellite Cloud Climatology Project
ISLSCP	International Satellite Land Surface Climatology Program
ISO	Information Systems Office
ISO	International Standards Organization
ISTP	International Solar-Terrestrial Physics
IUE	International Ultraviolet Explorer (satellite, NASA-U.K.-ESA)
IUESIPS	IUE Spectral Image Processing System
IUI	Intelligent User Interface
IUWDS	International URSIGRAM and World Days Service
JIMS	CYGNET's Jukebox Interface Management System
JPL	Jet Propulsion Laboratory (NASA)
JSC	Johnson Space Center (NASA)
KSC	Kennedy Space Center (NASA)
LAS	Land Analysis Software
LAS	Land Analysis System
LAS 4	Level of Archive Services 4
LLR	Lunar Laser Ranging
Magsat	Magnetic Field Satellite
MD	Master Directory NASA
MIDAS	Munich Image Data Analysis System
MIPS	Mission and Information Planning System
MIT	Massachusetts Institute of Technology
MPE	Max Planck Institute (Federal Republic of Germany)
MPP	Massively Parallel Processor
MSFC	Marshall Space Flight Center (NASA)
MSIS	Mass Spectrometer Incoherent Scatter (atmosphere model)
NACS	Network Assisted Coordinated Science
NASA	National Aeronautics and Space Administration
NCDS	NASA's Climate Data System (formerly PCDS)
NCF	NSSDC Computer Facility
NCS	Network Computing System
NDADS	NSSDC Data Archive and Distribution System
NESDD	NOAA Earth System Data Directory
NGS	NSSDC Graphics System
NIC	Network Information Center
NLQP	Natural Language Query Processor

NOAA	National Oceanographic and Atmospheric Administration (formerly ESSA)
NODIS	NSSDC On-Line Data and Information Services
NODS	NASA Ocean Data Systems
NORAD	North American Air Defense Command
NOST	NASA/OSSA Office of Standards and Technology
NPSS	NASA Packet Switched System
NRAO	National Radio Astronomy Observatory
NSDSSO	NASA Science Data Systems Standards Office
NSF	National Science Foundation
NSI	NASA Science Internet
NSN	NASA Science Network
NSSDC	National Space Science Data Center (NASA)
ORACLE	Relational Data Base Management System
OSSA	Office of Space Science and Applications
PDS	Planetary Data System
PHYSnet	High Energy Physics Network (also known as HEPnet)
PI	Principal Investigator
PIMS	Personnel Information Management System
PLDS	Pilot Land Data System
PRA	Planetary Radio Astronomy
PROMIS	Polar Regions Outer Magnetosphere International Study
PSCN	Program Support Communications Network
PSN	Packet Switched Network
PSPC	Position Sensitive Proportional Counter
RAND	Request Activity and Name Directory
RAPSE	Report on Active and Planned Spacecraft and Experiments
RINEX	Receiver INdependent EXchange
ROR	ROSAT Observation Request
ROSAT	Roentgen Satellite (German X-ray research satellite)
SAO	Smithsonian Astrophysical Observatory (Smithsonian Institution)
SBP	Sedimentary Basins Project
SDSD	NOAA's Satellite Data Services Division
SEASAT	Sea Satellite (NASA)
SERC	Science and Engineering Research Council
SIMBAD	Set of Identifications, Measurements, and Bibliography for Astronomical Data
SLR	Satellite Laser Ranging
SMM	Solar Maximum Mission
SOAR	Software for Optical Archival and Retrieval
SPACEWARN	World Warning Agency for Satellites
SPAN	Space Physics Analysis Network
SPAN_NIC	SPAN Network Information Center
SQL	Standard Query Language

SSC	Satellite Situation Center
SSL	Space Science Laboratory
STARCAT	Space Telescope Archive and Catalog
STE LAB	Solar-Terrestrial Environment Laboratory
ST-DADS	Space Telescope Data Archive and Distribution Services
ST/ECF	Space Telescope/European Coordinating Facility
STIS	Standards and Technology Information System
STP	Solar-Terrestrial Physics
TAE	Transportable Applications Executive
TCP/IP	Transmission Control Protocol/Internet Protocol
Telenet	Public packet switched network owned by GTE
THEnet	Texas Higher Education Network
TMO	Table Mountain Observatory
TOMS	Total Ozone Mapping Spectrometer
UARS	Upper Atmosphere Research Satellite (NASA)
U.K.	United Kingdom
UNEP/GRID	United Nations Environmental Programme/Global Resources Information Data Base
ULDA	Uniform Low Dispersion Archive
URSI	International Union of Radio Science
USGS	United States Geological Survey
US-HEPnet	U.S. High Energy Physics Network
USRSDC	U.S. ROSAT Science Data Center
US-SPAN	SPAN in the U.S.
VAX	Virtual Address Extension (DEC minicomputer)
VICAR	Video Image Communication and Retrieval
VLBI	Very Long Baseline Interferometry
VOD	Virtual Optical Disk
VRF	Visual Reproduction Facility
WAN	Wide Area Network
WDC-A-R&S	World Data Center A for Rockets and Satellites
WFC	Wide Field Camera
WORM	Write-Once, Read-Many
WWAS	World Warning Agency for Satellites
XDR	eXternal Data Representation