NATIONAL SPACE SCIENCE DATA CENTER
NEWSLETTER
NSSDC
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NSSDC'S ON-LINE DATA CATALOG SYSTEM

PURPOSE OF NODCS

With the advent of powerful yet affordable computing equipment, there is a much greater tendency to have space science data sets distributed throughout the scientific community rather than centralized at large computing facilities. A scientist who wishes to know what data might be relevant or useful to a research effort has an increasingly difficult task in obtaining information about these scattered data. Once interesting data sets have been located, it may be a long process to determine first, if data exist in a usable form for the time of interest and, second, how to obtain the data for study. The NSSDC On-line Data Catalog System (NODCS) is intended to provide computer-aided assistance that will allow a user to find and gain access to data of interest within a short period of time.

NODCS USAGE

NOCDS consists of two major parts: the Central On-line Data Directory (CODD) and the Distributed Data Catalog System (DDCS). Figure 1 shows the relationship of these two parts to the users and to the data sets. Normally, a NODCS user will first connect to the CODD either through a computer network (such as SPAN) or a dial-up line. CODD has been developed on the NSSDC VAX 11/780 computer and uses the ORACLE database management system. In the near future, CODD will be migrated to a Britton-Lee IDM 500 database machine and accessed through OMNIBASE software. This migration will have a minimal impact on the user interface. CODD contains general information about the data sets as a whole such as data set content (overall time span, parameters contained, time resolution, history, and quality) and data set storage (storage medium and characteristics, quantity of media, cost for copies, and contact person). CODD also includes associated catalog information (description and access procedure), experiment information (principal investigator, objectives, experiment description, parameters measured, measurement cycle, performance, and data processing cycle), and even spacecraft information (description, performance, and orbital or trajectory characteristics). From this information, the user should be able to determine if further investigation is warranted for particular data sets.

(Continued on page 10)

A Message from the Director:

THE FUTURE OF NASA DATA SYSTEMS

The ISTP data system (see article, page 6) will be the most forward looking NASA data system of its kind. This radical departure from a traditional NASA data system just shows how far behind we have gotten by not putting in the proven technology. The concepts of standard formats, networking (SPAN has been operational for 5 years, Arpanet for 15 years), distributed processing, and data center distribution and service functions have all been around for well over a decade and could have easily been applied to several NASA missions of the past. Now we have to play catch-up with one data system.

How do we get there from here? We all have a major learning curve to come up. The Data Center has already started to reach some of these goals by working with the Dynamics Explorer (DE) Project's PIs and CoIs. Through that Project and the Data Center, optical disk systems are being investigated with a future procurement planned for all DE principal investigators on SPAN. The data center is investigating the application of uniform network graphics and common data formats for DE data like the CDF and the SFDU. It would be ideal for all DE data to return from the remote PI's on optical disks to the data center written in random access file structure, with a data management header tacked on the front of each file. The disks will be copied and returned.

The data management headers will be loaded into the developing NSSDC information system (CODD, specifically) and put online for all to know what we have in our inventory and get access to it. (See article on page 1.) New concepts are being developed now that involve SPAN remote investigator software, and data for network-assisted CDAW's in solar terrestrial physics. SPAN now has a node at ESOC in Darmstadt, Germany and it is providing automated message and data exchange. (See upcoming article in *Eos* entitled, "Behind the Scenes during a Comet Encounter.") ESA and ESOC are planning a major SPAN-like network in Europe. Plans are underway to move the Satellite Situation Center from the MODCOMP to the NSSDC SPAN node for use over the network. If we are going to do correlative space plasma physics during ISTP (in 5 years) with nine spacecraft from three countries in 5 years, we have got to get started now to implement advanced data system techniques.

I don't know about you, but I am tired of the "old data system tools". The ISTP data system will be an incredible challenge but oh, what fun science will be if we can fully implement or upgrade networking, standard formats, advanced data management, appropriate mass storage devices, and NASA interactive correlative data analysis facilities (the NSSDC).

James L Green

NSSDC INFORMAL INFORMATION EXCHANGE SEMINAR SERIES

You are invited to join us at NSSDC (Bldg. 26; Rm. 105) for the following seminars:

TOPIC	DAY/DATE/TIME	SPEAKER(S)
View Integration	Thurs., Jan. 23 at 2:30	Barry Jacobs
Data Synthesis-Solar Wind	Thurs., Feb. 20 at 2:30	David Couzens
Dynamics Explorer Support	Mon., Mar. 3 at 9:30	Barbara Lowrey/Brian Lopez-Swafford/James Thieman/ Swami Reddy/Michael Gough
IDM Database Machine Capabilities	Thurs., Mar. 20 at 2:30	Regina Sylto/James Pritchard
Optical Disk Activities	Thurs., Apr. 3 at 2:30	Barbara Lowrey/Brian Lopez-Swafford
CDAW 8 and CDAW System Status	Thurs., Apr. 17 at 2:30	Don Sawyer/Patricia Astill
Advanced Graphics	Thurs., May 1 at 2:30	Lloyd Treinish
Intelligent Data Management	Thurs., May 15 at 2:30	William Campbell/Lawrence Roelefs
Central On-line Data Directory	Thurs., May 29 at 2:30	James Thieman
PLDS Status	Thurs., June 12 at 2:30	William Campbell/Carey Noll

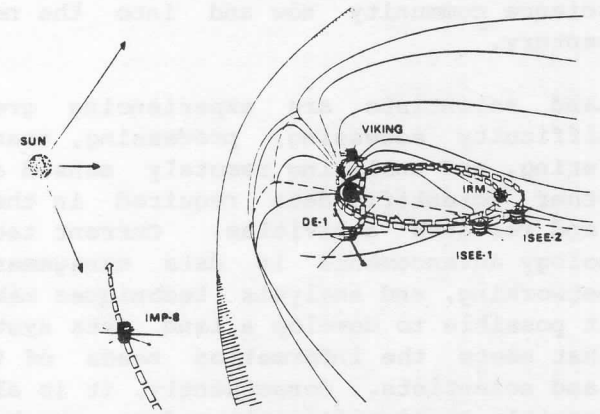
NSSDC Supports PROMIS

In the early years of the Space Age, phenomenological and morphological discoveries could often be made by means of data from any single instrument on board a spacecraft in the magnetosphere. Such discoveries were then synthesized to a higher level of comprehension by invoking data from other instruments on board. In later years, a new generation of magnetospheric questions began to emerge to a level that simultaneous data from several spacecraft in different orbits were needed to answer or sharpen those questions. The many CDAW's (Coordinated Data Analysis Workshop) that were sponsored and hosted by NSSDC illustrate that trend. The CDAW experience revealed that a much more meaningful and a larger data base for such analyses would be available if the tracking schedules of the various spacecraft were preplanned, so as to ensure simultaneous data from them, with each located in one of the salient regions of the magnetosphere. The Satellite Situation Center (SSC) of the NSSDC has the capability to produce orbital trajectories of any spacecraft, several months ahead of time. The SSC is more-fully described in the Issue No. 4 of the *Newsletter*.

By 1985, there was enough consensus for such a preplanned and coordinated tracking effort that a program, named Polar Region and Outer Magnetospheric International Study (PROMIS), was originated at the 1985 IAGA (International Association of Geomagnetism and Aeronomy) meeting in Prague, Czechoslavakia. Soon, NSSDC was approached by Dr. Edward Hones Jr. (International Coordinator for PROMIS) of Los Alamos National Laboratory, to select meaningful time intervals in March-June, 1986 for spacecraft tracking and proceed further to identify periods of favorable spacecraft locations so that spacecraft telemetry acquisition could be prioritized.

As illustrated in the accompanying figure, there are times when ISEE-1, 2 and AMPTE-IRM will be monitoring the Plasma Sheet, while IMP-8 will be monitoring the solar wind (and its embedded magnetic field). Concurrently DE-1 will monitor the southern polar cap and auroral oval while VIKING (to be launched in February/March 1986) will do likewise in the north. Of special interest to PROMIS is the capability of DE-1 and VIKING to provide images of the two auroral ovals that are topologically and dynamically related to the Plasma Sheet. Not shown in the figure are spacecraft such as CCE and SCATHA which orbit nearer to earth, in the equatorial plane, and can provide additional data.

PROMIS SPACECRAFT CONFIGURATION



After extensive discussions with interested magnetospheric scientists, the NSSDC has now prepared a list of time intervals, spanning days 88-167 of 1986, in two categories. Category I contains intervals (totaling 515 hours) when concurrent ISEE data on the Plasma Sheet and the IMP data on the solar wind would be available to examine, correlatively, the auroral images of one or both of the polar regions. In Category II intervals (totaling 638 hours), little or no solar wind data will be available. In either category, there are several hourly segments when AMPTE-IRM could provide supplementary, Plasma Sheet data.

The list of intervals has been mailed to about 200 scientists around the world and after their comments are received, NSSDC will be approaching the NASA tracking officials with a (possibly revised) list of intervals. It is expected that by February 1986, NSSDC should be in a position to advise the scientific community of a list of intervals during which the spacecraft are most likely to be tracked. NSSDC anticipates a significant future role in the data analysis phase of the PROMIS program, possibly by sponsoring a coordinated workshop.

R. Parthasarathy

DISTRIBUTED DATA MANAGEMENT

The goal of the Pilot Land Data System (PLDS) is to establish a prototype state-of-the-art data and information system to support research in the land-related sciences that will lead to a permanent research tool. This system is designed to be a limited scale, distributed information system that will also explore scientific, technical, and management approaches to satisfy the needs of the Land Science community now and into the next century.

Land scientists are experiencing great difficulty accessing, processing, transfering, and analyzing remotely sensed and other scientific data required in their land research activities. Current technology advancements in data management, networking, and analysis techniques makes it possible to develop a land data system that meets the information needs of the land scientists. Consequently, it is also possible to significantly reduce the burden on scientists who are forced to spend long periods of time and effort searching, acquiring, and analyzing data. In response to these needs and technological developments, NASA has established the PLDS. PLDS is managed by the Data Management Systems Facility of the NSSDC with the Ames Research Center (ARC) , the Jet Propulsion Laboratory (JPL), and several universities actively participating.

The initial PLDS concept was to develop an advanced information system that would use new and emerging technologies to achieve levels of operational performance that, until recently, were felt to be unachievable. The system design was based on a distributed architecture that would utilize powerful microcomputer workstations, super computers, and high-speed digital communications to form an operational capability with intelligent value-added services. The expectation was that such services would allow system operations to be goal-oriented rather than procedure-oriented, thus freeing the scientist from spending a disproportionate amount of data processing and data manipulation time and effort. A PLDS based on the above concept would be able to support the most technically demanding computer operations with minimal user knowledge of, or experience on, the system. The overall goal of this concept was to reduce the time and effort spent on locating, accessing, ingesting, and otherwise processing data, thereby reducing this burden on scientists without compromising their ability to conduct scientific investigations.

This concept was based on three sources of information:

a. Science research projects and land scientists' recommendations
b. System engineering design concepts
c. Information science technologies

A preliminary system design was formulated based on existing technologies and resources that currently supported land research. This preliminary system design supported the above system description and the use of the identified technologies so that the system would be distributed with very powerful computing capabilities as well as being goal-oriented (as opposed to procedure-oriented). This design was made up of four major subsystems:

* Land Data Management
* Networking and Communication
* Large Scale Processing
* User Interface

The PLDS Project Office asked the Headquarters-sponsored Science Steering Group (SSG) to help identify what PLDS tasks will be accomplished first to meet the needs of the Land Science Community. The Science Steering group's charter is to insure that PLDS meets the needs of the Land Science community and consists of six members who meet twice yearly to review PLDS. Given the current resources, the SSG recommended that PLDS limit its initial efforts to the development of two key parts of the complete system: an electronic data directory and catalog system and a data information network. These include implementation of the catalog functions using dis-persed elements, "data access", and the inclusion of processing software and documentation in the concept

of "information".

Based on these recommendations, the near-term (FY 86 and 87) execution phase of PLDS will address the following technical areas:

1. Data Management consists of four subsystem components. The first is Information Data Management which will develop a catalog and inventory system specifically to support the Land Surface Climatology Project at GSFC and a catalog and inventory system to support the Sedimentary Basin Project at JPL. A central directory will also be designed that will provide information about databases resident within and outside of PLDS with pointers to get access to this information.

   The second subsystem is Spatial Data Management, which will develop an automatic data ingest plan that will include the requirements for the update of the information database as a result of algorithms applied by the spatial data management subsystem. Multisource data subsetting software will be designed to permit the subsetting of arbitrary point, line, and region subsets of images based on the specifications of spatial coordinates.

   The third and fourth subsystems will provide data storage and access capabilities and the creation of a user support office, which will provide, along with other services, a collection of analog maps and images for user browsing.

2. Networking and Communication will address and resolve the networking and communication needs with computer communications, remote log-in and file transfer. The networking architecture will support the design of PLDS requirements based on the identified nodes to be served as well as remote databases requiring access. It will also provide immediate support by identifying the required hardware (modems/boards) and external links to universities and purchase and aid in the installation and implementation of these links.

3- System Access Capabilities will address data display, user interaction with software, and the selection and implementation of workstation hardware and software as well as the configuration of a prototype PLDS workstation that will enable a user to have full access to PLDS capabilities and services.

4- Land Analysis Software will provide access to software tools to facilitate research in land sciences. Much of this software exists at various NASA centers as well as in universities involved in NASA-related research. This information will become available and, where an algorithm is needed as determined by the science community, the Land Analysis Software technical area will develop, test, and disseminate this software to the community.

A series of system demonstrations is planned at GSFC and JPL for 1986 that will lead to the first prototype PLDS by mid 1987. This limited prototype will have a capability for allowing a PLDS user to perform the identification, selection, transfer, and processing of land-related data in a distributed environment. Future PLDS development will result in some design and development risks; but, given that the risks can be minimized, its successful implementation will have significant impact on the overall system design and thus on the system's performance. As a result of the development of an "advanced technology" PLDS, there will occur the development of an information system that has the ability to support land-related research well into the twenty-first century.

W.J. Campbell

A Preview of the ISTP Ground System

INTRODUCTION

The International Solar Terrestrial Physics (ISTP) program is an extremely ambitious program involving spacecraft built and managed by three international agencies: NASA, the European Space Agency (ESA), and the Institute of Space and Astronautical Science (ISAS) in Japan. ESA and ISAS will soon start the development phase of their programs. NASA is currently waiting for their part of this international program to be in the approved Congressional budget in January 1986 before it can launch into the development stage. However, considerable planning is being done out of the Goddard ISTP Project Office. The purpose of this article is to provide an initial overview of the ISTP ground data system stressing the current thinking and the areas in which NSSDC will be directly involved. Future ISTP data system articles are planned for the *NSSDC Newsletter*, which will discuss the details of the individual NASA, ESA, and ISAS data systems, after the ISTP mission enters into the development stage.

THE MISSION

ISTP is a planned major new initiative to study the energetics of the near-Earth space environment or geospace from a set of integrated flight missions or spacecraft. The intent of the program is to utilize the worldwide scientific community in a coordinated study of Sun-Earth plasma interactions, solar and heliospheric physics, and global geospace physics, in addition to extending our current knowledge of basic space plasma physics. The specific goals of the NASA geospace spacecraft are briefly summarized as follows:

(1) To assess the amount of energy flow, mass flow , and momentum transfer from the solar wind into the magnetospheric/ionospheric geospace;

(2) to improve the understanding of plasma processes that influence our geospace, tracing the causes and effects of these processes.

(3) to assess the importance of the variation in energy input into the atmosphere by the geospace plasma processes; and

(4) to unambiguously determine the three dimensional shape and dynamics of the Earth's geospace during various periods of activities.

The success of this effort is based on the ability to correlate the simultaneous observations from nine spacecraft, each having separate observational functions. The Table below summarizes the spacecraft, orbits, and science objectives of the ISTP armada. The three NASA spacecraft are called Wind, Polar, and Equator. ISAS will be responsible for the Geotail mission, with ESA having a total of five spacecraft (four from the Cluster mission, and one from the Soho mission). As shown in the Table, simultaneous observations from all these missions will occur in the early 1990s.

ISTP MISSION SUMMARY

MISSION	AGENCY	LAUNCH DATE	ORBIT	SCIENCE
WIND	NASA	3/91	DOUBLE LUNAR SWING-BY AND L1 HALO ORBIT	MAGNETOSPHERE, HELIOSPHERE SOLAR WIND, PLASMA
POLAR	NASA	9/91	POLAR ELLIPSE (APOGEE ABOVE NORTH POLE)	IONOSPHERE,PLASMA
EQUATOR	NASA	3/92	EQUATORIAL ELLIPSE	MAGNETOSPHERE, PLASMA, IONOSPHERE TAIL
GEOTAIL	ISAS	9/93	DOUBLE LUNAR SWINGBY AND LUNAR ORBIT PLANE ELLIPSE	GEOMAGNETIC TAIL, PLASMA
CLUSTER	ESA	9/93	POLAR ELLIPSE (APOGEE NEAR EQUATOR)	MAGNETOSPHERE, 3-D MAGNETIC STRUCTURE
SOHO	ESA	12/93	L1 HALO ORBIT	SOLAR LUMINOSITY, SOLAR STRUCTURE, SOLAR WIND

ISTP DATA SYSTEM OVERVIEW

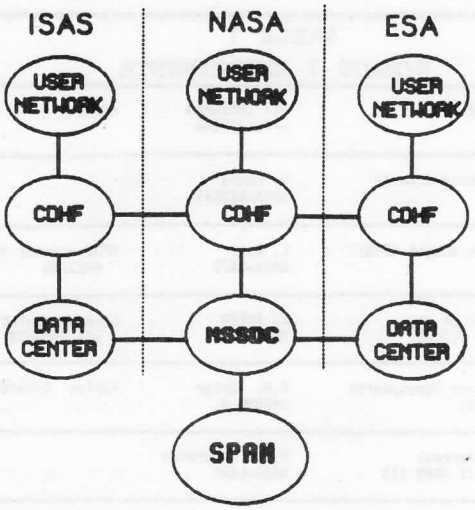
The importance of the ISTP data system, in order to accomplish the previously-stated missions objectives, is obvious. GSFC has the responsibility for the design and development of the NASA ground system for the ISTP project as well as tying the total system together. New technologies must be brought to bear on the data system

in order to coordinate the observations and provide correlative data in a timely fashion to investigators in the different countries. Networks and standard formats will play key roles in this project.

The Deep Space Network (DSN) is responsible for tracking the Wind, Polar, Equator, and Geotail spacecraft. Although Japan will have the major responsibility for the tracking of Geotail, NASA DSN tracking will be used to acquire all of the data recorded by the on-board tape recorders.

The Figure below gives an overview of the ISTP international data system. The Central Data Handling Facility (CDHF) for each country will be the major user interface to the incoming ISTP data. Although it is expected that all the ISTP CDHF functions will be similar, some of the details may differ. In the following, only the NASA CDHF will be discussed.

POTENTIAL ISTP NETWORK, 1989



The NASA CDHF provides science data processing, staging, temporary storage, and data distribution to Principal Investigators. The NASA CDHF receives the raw data from its spacecraft, merges them with predicted orbit and attitude data, time orders the result, and produces a "key" science parameter file. The key parameters file contains summary information necessary for investigators to decide on selected events to study for detailed analysis. At the end of a 90-day temporary storage interval, the CDHF will transmit ISTP production data files to the NSSDC for archival and further distribution.

NSSDC will provide the permanent archive service for the key parameter and processed event data and will serve as the primary collection source for all ISTP scientific data. The archived data will be made readily available to a worldwide community. NSSDC plans to work with the ISTP community in the development of an electronically-accessible directory/catalog that describes the ISTP data holdings. The NSSDC developmental CODD system is expected to be a model for ISTP catalog development.

It is anticipated that each agency will have its own ISTP Principal Investigator (PI) Network, labeled "User Network" in the Figure. In the United States, plans are being made for heavy use of the Space Physics Analysis Network (SPAN). SPAN will easily allow the ISTP Co-Investigators access to the ISTP archive at the NSSDC and directly to PIs. It is anticipated that requests for data will be coordinated with the NSSDC, ESA, and ISAS Data Centers, as appropriate, over SPAN communication links to Europe and Japan. NSSDC is the designated NASA ISTP Data Center. The ISAS and ESA Data Centers have not yet been named.

Another major area in which NSSDC will be involved is the science planning for ISTP. The NASA ISTP Science Operations Facility (SOF) at GSFC will receive science planning inputs from approximately 25 remote PI locations, over SPAN and the ISTP networks, for all the ISTP spacecraft. It is expected that the NSSDC's Satellite Situation Center (SSC) will be used extensively by ISTP Investigators in the US, Europe, and Japan over the networks to aid in science planning operations in addition to aiding the scientists in determining events to study in detail.

It is clear that major international cooperation is needed to bring about a successful ISTP mission. The result of this cooperation will have long lasting effects on NASA international projects of the future. NSSDC is pleased to be such an important element in the ISTP data system and is dedicated to work toward the mission's international science goals.

J. Green/ H.K. Hills

NIMBUS 7 DATA PRODUCTS: Part 1-ERB Data

The Nimbus 7 satellite is the last in a series of research-and-development satellites that collect experimental data related to the Earth's atmospheric and oceanic processes. Launched in October 1978, Nimbus 7 is now in its eighth year in orbit, returning data from all but three instruments. The designed lifetimes for both spacecraft and experiments are well exceeded. In fact, the mission is so successful that advanced operational satellites now in use by NOAA for weather and land observations have included some instruments and systems based on Nimbus designs.

There is a total of eight experiments on Nimbus 7, each conducted by a Nimbus Experiment Team (NET) (See Table 1). Since 1982, over 60 types of data have been produced by the experiments. Except for the Coastal Zone Color Scanner (CZCS) data, which are available through National Oceanic and Atmospheric Administration/-National Environmental Satellite Data and Information Service (NOAA/NESDIS), all Nimbus 7 data products are archived at and distributed by NSSDC to the scientific and commercial communities. The number of requests to NSSDC for Nimbus 7 data averages more than 100 per year, topped by (in decreasing order) Solar Backscatter UV/Total Ozone Mapping Spectrometer (SBUV/TOMS), Scanning Multispectral Microwave Radiometer (SMMR), Temperature Humidity Infrared Radiometer (THIR), and Earth Radiation Budget (ERB) data products. In the following paragraphs and future issues of the *Newsletter*, NSSDC's holdings of data products from selected Nimbus 7 experiments are described. Unless otherwise stated, all digital data are available on 1600-bpi, 9-track, magnetic tapes.

Six years of continuous (chiefly 3-days on/1-day off) data from the ERB experiment are available from NSSDC. (See Table 2). A seventh year of data is presently being processed. The data can be subdivided into three complementary categories: Earth radiation budget data, solar data, and shortwave and longwave radiance data suitable for bidirectional reflectance studies. Solar radiation is measured by a 10-channel telescope. Earth radiation is measured by two separate groups of sensors: a 4-channel, fixed, wide-field-of-view (WFOV) array, and an 8-channel, narrow-field-of-view (NFOV) scanning radiometer (failed: 6/23/80), that monitors both shortwave (reflected) and longwave (emitted) radiation. It is through the combinations of both the WFOV and NFOV measurements that longwave flux, Earth albedo, and net radiation are derived. (See "The Status of the Nimbus-7, Earth Radiation Budget Data Set" by H.L. Kyle, *et al.*, *Bull. Amer. Meteor. Soc.*, *vol. 66*, pp. 1378-1388, 1985.)

All the ERB raw digital data, calibrated radiances and irradiances, and associated housekeeping data, are available on the Master Archive Tapes (MAT). Most of the data are generated on 6250-bpi tapes, with 3 data days per tape.

TABLE 1
NIMBUS 7 EXPERIMENTS

EXPERIMENT NAME	NET CHAIRMAN AFFILIATION	REMARKS
Coastal Zone Color Scanner (CZCS)	W. Hovis NOAA-NESDIS	
Earth Radiation Budget (ERB)	L. Kyle NASA-GSFC	NFOV scanner failed 6/23/80
Limb IR Monitor of the Stratosphere (LIMS)	J. Gille NCAR	Cryogen depletion, off 5/00/79
Stratospheric and Mesospheric Sounder (SAMS)	F.W. Taylor OXFORD U	Failed 6/13/83
Stratospheric Aerosol Measurement II (SAM II)	M. P. McCormick NASA-LARC	
Solar Backscatter UV/ Total O3 Mapping Spactrometer (SBUV/TOMS)	D. Heath NASA-GSFC	
Scanning Multispectral Microwave Radiometer (SMMR)	P. Gloersen NASA-GSFC	21-GHz channel turned off 3/18/85
Temperature Humidity Infrared Radiometer (THIR)	L. Stowe NOAA-NESDIS	Turned off 5/15/85

Monthly Post MAT Calibration Tapes (DEL-MAT) have been generated by the NET since the scanner failure and are archived at NSSDC. They contain new calibration adjustment quantities to be used in other ERB data products such as MATRIX and SEFDT (described below) for WFOV channel calibration optimization.

Time-and space-averaged Earth radiation budget products, derived from the MAT with the aid of angular dependence models, are available on the Mapped Data Matrix Tapes (MATRIX). These include the WFOV and NFOV albedo, emitted longwave, and net radiation. The products are stored on 2070 (500 km x 500 km) world grids of approximately equal area. They are also stored on mercator and polar grids that are used to generate contour maps (MATRIX MAPS) on microfilm. Daily, 6-day, and monthly averages are given in tape format, and 6-day and monthly averages are given in microfilm format. MATRIX tapes are available (1 month of data per tape) as well as 5 years of data on microfilm. The microfilm products stopped after 5 years.

Similar to the MATRIX are the Seasonal Average Tapes (SAVER) that contain, on each tape, 3-month averages of all the products found on the MATRIX tapes. The winter season starts with December. Analyzed contour maps of 5 years of these data (SAVER MAPS) are also available on microfilm from NSSDC.

For climatologists who may not be interested in all the details contained on the MATRIX or SAVER tapes, there is an ERB MATRIX Summary Tape (EMST) in NSSDC's holdings. It provides 5 years of monthly averages of Earth radiation budget measurements subsetted from the MATRIX tapes and the 20 months of NFOV data. Only the 2070 world grid is used on this tape.

NSSDC has the monthly Solar and Earth Flux Data Tapes (SEFDT), which contain solar and WFOV Earth measurements copied from the MAT. Besides the latitudes and longitudes of the Earth pixels, both raw counts and calibrated radiances and irradiances are given.

Also available are the Zonal Means Tapes (ZMT). They contain tabular listings of mean solar irradiances and zonal averages of the solar insolation for daily, 6-day, monthly, and 3-month time periods. In addition, there are monthly and seasonal zonal averages of Earth-emitted flux, albedo, and net radiation derived from the regional data on the MATRIX tapes. Spatial coverage is from pole to pole, with 40 latitude zones, each being 4.5-deg wide. There is one ZMT per 6-month period. The same data are also available as TABLES on microfilm for the first 5 years only.

A 6-year summary ERB Solar Analysis Tape (ESAT) has been archived at NSSDC. It contains calibrated orbital and daily mean solar irradiances as well as some correlative solar activity indicators that include a complete 6-year record of relative Zurich sunsport numbers and the Ottawa 2800-MHz solar flux. They also include some solar plage region data, daily calcium plage index, and geomagnetic Ap index.

TABLE 2
ERB DIGITAL DATA PRODUCTS

MAT	Master Archive Tapes
DELMAT	Post MAT Calibration Tape
EMST	ERB MATRIX Summary Tape
ESAT	ERB Solar Analysis Tape
MATRIX	Mapped Data Matrix Tapes
SAVER	Seasonal Average Tapes
SEFDT	Solar and Earth Flux Data Tapes
STRT	SubTarget Radiance Tapes
ZMT	Zonal Means Tapes

NSSDC has a copy of the SubTarget Radiance Tapes (STRT), which were generated by NOAA for bidirectional reflectance studies. The 2070 world grids defined for the MATRIX data are each divided into 9 subtarget areas, approximately 160 km x 160 km. The subtarget areas are also classified by a predominant surface type with the use of auxilary data such as the Nimbus 7 THIR cloud data. Because of the short life of the scanner, there are only 272 data days included in the data set; each STRT tape covering 6 data days.

Besides the THIR cloudcover data, other Nimbus 7 data products useful for correlative studies with the ERB data include the SMMR data, which will be described in an upcoming issue of the *Newsletter*. To obtain any of the archived Nimbus 7 data, or for more information about them, please refer to the back page of the *Newsletter*. Normally, it takes NSSDC 2 weeks to process a request unless a large volume is involved and/or tapes are stored in the Federal Record Center. In such cases, the processing time may be longer.

C. Ng

NSSDC'S ON-LINE DATA CATALOG SYSTEM

(Continued from page 1)

More detailed information is then obtained by accessing the catalog within DDCS that is associated with the data set, if one exists. Access to the catalog may be obtained automatically through CODD, or it may be necessary to follow a procedure given in CODD. The user should be able to determine from the catalog whether data exist for the time, place, object, phenomenon, etc. of particular interest. Data access and various methods of data retrieval, both on- and off-line, are being studied.

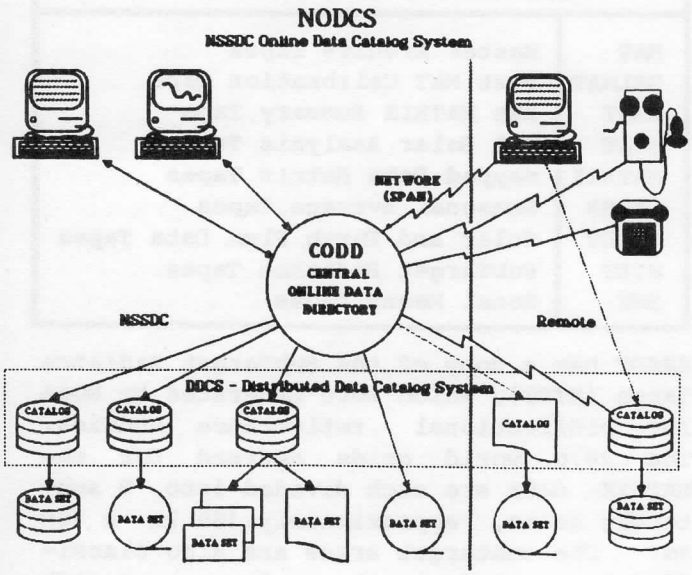


Figure 1. *Relationship of CODD and NODS*

CODD SEARCHES

CODD searches for data sets may be done through several approaches as shown in Figure 2. If the user knows spacecraft series, spacecraft, experiment, and/or investigator names for the data sets of interest these may be directly entered and a search can be initiated based on those criteria. As an alternative, a search may be made based on keywords such as those describing scientific disciplines (solar terrestrial, planetology, oceanography, etc.). Subdiscipline keywords can be specified within a particular discipline. Other keywords would describe the quantity measured (electrons, magnetic fields, etc.) energies, wavelengths, or associated phenomena. The capability to specify times of interest will also be provided.

Because the system is still in development, not all of these capabilities currently exist. Some of the possibilities may change as it is determined which functions are more useful to the general community. For this reason, we place special emphasis on receiving feedback from those who use the system as will be mentioned further in the final section.

The general categories of information that are available in CODD are shown in the boxes in Figure 2. First, a list of valid entries for the series, spacecraft, experiment, or investigator may be obtained by requesting help for each category. To help in choosing a spacecraft or experiment, it is also possible to obtain additional information about the choices in the list. Once a data set has been chosen, the user will be able to obtain the information about the data set and the associated catalog, if any, as mentioned above. The option for direct connection to the catalog could be implemented at that time. The user may also request information on the spacecraft and experiment

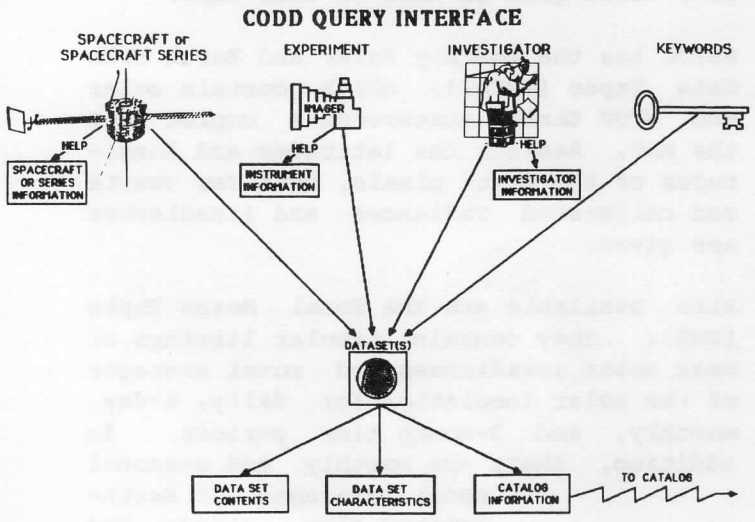


Figure 2. *General catagories of information available through CODD.*

at that point, if desired.

In the future, CODD will be generalized to accommodate data from sources other than experiments aboard spacecraft and from disciplines other than solar-terrestrial and planetary, which have been the prime focus for the initial development.

CATALOGS

DDCS is now in its first stages of development. Initially, this part of NODCS will contain catalogs that had already been created for the data sets. The first catalogs to be specifically included in this effort will be those with the Dynamics Explorer (DE) project. All types of catalogs currently in existence within the DE project will be described and, if possible, accessed.

In the future, it will be important to establish standards for all catalogs and data sets within a project from its inception. This will make it possible to write software for automatic catalog creation and update, and it will facilitate data interchange, correlation, manipulation, and plotting with standard, transferrable software. An example of this is the Pilot Climate Data System (PCDS -see *NSSDC Newsletter*, No. 2) in which all data sets are available in the Common Data Format (CDF). PCDS contains many climatological data sets as well as catalog information about these data. Pilot data systems like this exist or are in development for several scientific disciplines. (Information about access to these systems will also be available from CODD in a directory of directories.)

Note that the catalogs usually reside at the institution where the data set is currently stored. Transfer of data set and catalog to NSSDC usually occurs near the end of the project lifetime. Optical disks may help to change this approach. It is proposed that , as future data sets are created, they would be stored on optical disks in standardized formats, which would permit automatic catalog updating. Periodically, the optical disks would be sent to NSSDC for duplication and then returned. As a result, data archival would not wait until the demise of a project when funds are limited, manpower is scarce, and interest has waned. Consequently, the increasingly important national resource of space science data would be assured availability to the entire scientific community in a timely fashion after proprietary periods.

COMMUNITY INVOLVEMENT

The success of NODCS will depend on its usefulness to the general community. The system must be developed and evolve according to the needs expressed by that community. NODCS development has been guided by a steering committee, which will convene at NSSDC in February. However, it is also important that the general user be involved in this development. For this reason, we are providing access to CODD over the SPAN network. To access it from a computer connected to SPAN, the user needs to have a VT100-compatible terminal (other types of terminals will be accommodated in the future) and network privileges. The command SET HOST NSSDC should be issued followed by the entry of NSSDC to the 'Username:' prompt. No password is required. Entry to NODCS is made through option 2 of the initial NSSDC services menu. In the future, direct dial-up and Telenet access will be available for those without access to SPAN.

The user should understand that the system is still in development and, consequently, does not have all capabilities developed or debugged. Presently, the information in the database is small, comprising a limited number of data sets from the DE, International Sun-Earth Explorer (ISEE), IMP, Voyager, and Pioneer projects. The database will expand rapidly once a separate system for data entry by scientists external to NSSDC is completed. The emphasis on present use of the system will be to obtain suggestions for improvement of the design and content (interface friendliness, information available, etc.). The user may enter comments while using or upon leaving CODD. If you have the time to access the system, we would appreciate your contribution.

J. Thieman

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OPTICAL DISK SYSTEM FOR THE DE COMMUNITY

NSSDC personnel made presentations to the Dynamics Explorer (DE) Team's Computer Users Committee meeting held at Goddard on November 12, 1985. NSSDC reviewed the status of and future plans for its optical disk system; the role of the Common Data Format (CDU) in storing, accessing, and manipulating data on the optical disk; and plans for accessing information about the data on the optical disk for inclusion in the NSSDC Central On-Line Data Directory (CODD). Because of the high density of data that can be stored on the disk platter, the relative ease of distribution, and the reliability of the data over time, NSSDC is planning to have scientific data from the DE mission sent to the Data Center on optical disks for archiving. The DE Project has agreed to work closely with the Data Center in obtaining compatible optical disk units for eight to ten Principal Investigators.

NSSDC is working with the DE community of scientists in advanced data management techniques while the DE project is still operational. In this way, the lessons learned can be directly applied to the NSSDC/International Solar Terrestrial Physics (ISTP) relationship at the beginning of tht Project. Many DE Investigators will also be ISTP Investigators.

NSSDC MAKES PRESENTATION TO SESNET GROUP

On December 19, 1985, Dr. James Green made a comprehensive presentation to the SESNET Working group on the NSSDC Space and Earth Science Networks. Topics included the motivation for the creation of a NASA network; a brief history, current status, and future goals for SPAN; the Astrophysics Network and proposed astrophysics data exchange; the Earth Science Network (ESN); the SPAN/Ocean Network; and a visual summary of all NSSDC network activities. Three major future goals were highlighted: (1) taking advantage of the PSC, (2) developing a SPAN and ESN gateway at NSSDC, and (3) looking for ways to merge SPAN and ESN into a unified NASA Science Network.

PCDS GOES TO PENN STATE

The Meteorology Department at Penn State University currently uses the PCDS as a tool in its research and teaching activities via a direct communications link between its DEC VAX-11/730 computer and the NSSDC DEC VAX-11/780 computer on which PCDS operates. This connection has been established via SPAN.

On November 4-5, 1985, NSSDC staff visited Penn State at the invitiation of the Meteorology Department Head, Prof. John Dutton. During this visit with faculty, staff, and students, a seminar, a remote demonstration via SPAN, and a tutorial on PCDS were given. Graduate students, who are using PCDS as an integral part of an experimental classroom curricula, were given individual problem-solving instructions on the use of PCDS. Discussions were held concerning the Department's current and future hardware and software requirements. Appropriate engineering solutions to their problems were offered to maximize the cost-effective growth of the facilities. As a result of this visit, the PCDS use by the graduate students during the hours that the NSSDC VAX is available has greatly increased.

EARTH SCIENCE PILOT COORDINATION

NSSDC hosted the first Earth Science Pilot Coordination Meeting on December 2, 1985. Presentations were given by representatives from the Jet Propulsion Laboratory's (JPL) NASA Ocean Data System (NODS, formerly PODS), from the NSSDC's PCDS, PLDS, CODD, SPAN, and optical disk system. Additional presentations were given on the Earth Science Network (ESN) and the recent Catalog Workshop. The purpose of this and future pilot coordination meetings is to encourage maximum coordination and technical information exchange between the Pilot Systems in the areas of directories, catalogs, data formats, data management, and network communications. As a result of this meeting, there was general agreement toward the development of a common directory and expressions of a need for an ESN. This group plans to reconvene in April at NSSDC.

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SECOND PCDS WORKSHOP TO BE HELD

The second PCDS Workshop will be held at NSSDC on January 29-30, 1986. The Workshop will feature a demonstration of system capabilities, presentations by users of the system, and discussions of plans for system enhancements. Participants will be given the opportunity to provide input on future enhancements and to discuss their particular data needs. A variety of commonly-used personal computers and computer terminals will be available to encourage "hands-on" experience with the system.

Although PCDS is targeted primarily for use by the climate research community, its applications are, in fact, multidisciplinary. Therefore, the Workshop would be of interest not only to the climate community, but also to scientists and database managers in oceanography, meteorology, space physics, and other scientific disciplines.

For additional information about this Workshop, call (301) 794-5209.

SIR-B DATA AVAILABILITY UPDATE

NSSDC has received numerous inquiries concerning the availability of SIR-B data. Thus far, with the exception of press released images, the data are still in proprietary use by the Investigators. NSSDC is still awaiting a policy decision concerning the eventual availability and source of these data. We have been informed by NASA Headquarters that the archiving and distribution of both the SIR-B data and the Large Format Camera data, acquired on the same shuttle flight, are being let in competitive bids.

NASA's comments on the Commercialization Act of 1984 (see SIR-A/SIR-B article in *Newsletter* Issue No. 1) are being considered by Congress, and a revision is expected early in 1986. Look for updates on SIR-B data availability and the revised Commercialization Act, as Newsbriefs in future Issues of the *Newsletter*.

MEETING HELD AT NSSDC TO DISCUSS SFDU

A NASA Working Group Meeting on the Standard Formatted Data Unit (SFDU) was held at NSSDC on December 5-6, 1985, and was chaired by Dr. James I. Vette. The meeting was one of a series supporting development of the SFDU concept under the auspices of the Consultative Committee for Space Data Systems (CCSDS), Panel 2, which is an international committee composed of representatives from the space agencies of several nations. The NASA Working Group is developing agency positions for draft standards supporting the SDFU concept. NSSDC contributed extensive draft material giving an evolution of operational scenarios and presenting the roles of the control authorities.

The meeting outcome was a draft of the Agency position for submission to the CCSDS Panel 2 meeting to be held in Toulouse, France, January 27-28, 1986. The draft defines the purpose of the SFDU, develops operational scenarios on the use of an SFDU, provides a "capabilities" list for SFDUs (functional requirements), and recommends the adoption of a new, concrete structure for standardization. The meeting was adjourned with a solid feeling that constructive progress had been made.

NSSDC PROVIDES PHOTO SUPPORT FOR NRL

NSSDC Photographic Section staff has been working closely with Naval Research Laboratory (NRL) personnel for approximately 2 years to reproduce images of selected observations from an extreme ultraviolet slitless spectroheliograph. This experiment was part of the solar observatory on three Skylab missions.

NSSDC has assisted in preparing the four-volume Skylab Atlas by producing more than 2400 black-and-white, 20 x 24-inch prints. The first three volumes are complete, and the fourth is nearing completion. Each figure in the Atlas treats a selected event on the Sun. To cover the entire spectrum, six 24-inch long enlargements are needed. The photographic work required the accurate enlargement of the data to 9.5 times its original size.

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NSSDC PLAYS ROLE IN ASTROPHYSICS NET

An Astrophysics Network meeting was held December 12-13, 1985, at the Space Telescope Science Institute in Baltimore, Maryland. Representatives from the European Space Agency (ESA), NSSDC, and nine major astronomy and astrophysics institutions across the country gave status presentations on their institutions. Dr. James Green, NSSDC, presented the current status and future plans of SPAN and the Earth Science Network (ESN). NSSDC is considered to be an equal member with the other institutions in the development of an astrophysics network. ESA representatives stressed their major commitment to SPAN by presenting their plans to add three nodes (Meudon, European Space Technology Centre [ESTEC], and ECF/ST) by January 1986 to the existing SPAN node at the European Space Operations Centre (ESOC). ECF/ST is the European Coordinating Facility and will be responsible for the dissemination of Space Telescope (ST) data in Europe. Representatives of Goddard Code 543 discussed the technical aspects of the Program Support Communications Network (PSCN), which will provide the basic communication service for the astrophysics network.

For the first time, an initial plan has been devised for networking several astronomy and astrophysics institutions and NSSDC together. The initial astrophysics network will make heavy use of the PSCN/NASA Packet Switch Network System (NPSS) and NSSDC/SPAN. Three of the ten astrophysics sites (University of California at Berkeley, University of Colorado, and the Space Telescope Science Institute) and NSSDC will be connected to both NPSS and SPAN. NSSDC will become the gateway to the developing European Network. The first communication links of the Astrophysics network are expected to start in April 1986 with full operation by September. It was recognized that experience gained with such a system will have a major impact on the development of a plan for a more comprehensive Astrophysics Network in FY87.

IDM 500 DATABASE MACHINE ARRIVES AT NSSDC

On December 12, 1985, the Britton Lee IDM 500 database machine arrived at NSSDC. It has four megabytes of memory, three disk drives, and one tape drive. The IDM 500 was connected to the NSSDC VAX 11/780 computer through an IEEE 488 I/O interface. Front-end software was installed on the VAX at the end of December. This front-end serves as the interface between the VAX and the IDB 500. Acceptance testing began on December 29, 1985, and will continue through January 29, 1986. The acceptance testing includes measurements of database creation times, database input rates, database query response times, the effect of multiple-user contention on database query reponse times, and the effect of multi-database use on database query response times. After successful completion of the acceptance tests,the machine will be used to support many NSSDC programs including the Pilot Climate Data System, Crustal Dynamics, and Central Online Data Directory. The database processing for these applications will be off-loaded from the VAX to the IDM 500. Because the IDM 500 is dedicated to database operations, database processing will be enhanced. This addition will be a vast improvement for the overall NSSDC computer operations.

NEW CDSF SECRETARY JOINS NSSDC STAFF

NSSDC welcomes Cynthia Elaine Stevens as the new secretary of the Central Data Services Facility (CDSF). Elaine came to us in December from the Space and Earth Sciences Procurement Office at Goddard. She Joins Margie Garner and Mary Ford as the NSSDC civil service secretarial staff.

THE *NEWSLETTER* IS A QUARTERLY

The *NSSDC Newsletter* is now being published on a quarterly basis. The expanded 16-page issues will continue to contain feature articles on NSSDC projects, data holdings, systems, and developments as well as newsbriefs, the calendar, recent publications, and Messages from the Director.

RECENT NSSDC PUBLICATIONS

"Destiny of Earthward Streaming Plasma in the Plasmasheet Boundary Layer," J.L. Green and J.L. Horwitz, *Geophys. Res. Letts., 13*, 76, 1986.

"Behind the Scenes during a Comet Encounter," J.L. Green and J.H. King, accepted for publication by *Eos*.

"Observations of Ionospheric/Magnetospheric Coupling: DE and Chatinika Coincidences," J. Green et al., accepted by *J. Geophys. Res.*

"Near-Realtime Transatlantic Transmission of ICE Spacecraft Data Using the SPAN Network," T.R. Sanderson, S.T. Ho, N.V.D. Heijden, E. Jabs, and J.L. Green, accepted by *ESA Bulletin*.

"Advancements in Land Science Data Management Pilot Land Data System," W.J. Cambell, P.H. Smith, R. Price, L. Roelofs, accepted by *STOTEN 1085*.

"Pilot Climate Data System: Common Data Format," PCDS Team, NSSDC, December 1985.

"An Interplanetary Magnetic Field Ensemble at 1 AU," W.H. Matthaeus, M.L. Goldstein, and J.H. King, *J. Geophys. Res., 91*, 59, 1986.

"Solar Wind Parameters and Magnetosphere Coupling Studies," J.H. King, accepted for publication in the Proceedings of the Chapman Conference on Solar Wind-Magnetospheric Coupling.

"Infrared Radiation Models for Atmospheric Methane," R.D. Cess, D.P. Kratz, S.J. Kim, and J. Caldwell, submitted to *J. Geophys. Res.*

"Heat Balance of the Ionosphere: Implications for the International Reference Ionosphere," D. Bilitza, accepted for publication in *Advances in Space Research*.

"Implementation of the New Electron Temperature Model in IRI," D. Bilitza, accepted for publication in *Advances in Space Research*.

"DSUWG Meeting Report," J. Green and R. Zwickl, accepted by *Eos*.

"Comparison of Measured and Predicted F2 Peak Altitude," D. Bilitza, accepted for publication in *Advances in Space Research*.

"What D to H Ratio and the Origin and Evolution of Titan's Atmosphere," J.P. Pinto, J.I. Lunine, S-J. Kim, and Y.L. Yung, accepted for publication in *Nature*.

"The Jovian Stratosphere in the Ultraviolet," R. Wagener, J. Caldwell, T. Owen, S-J. Kim, T. Encrenaz, and M. Combes, accepted for publication in *Icarus*.

"The Preparation and Archiving of Machine-Readable Astronomical Data," W.H. Warren Jr., *Mem. S.A.It., 56*, 285, 1985.

"New Developments at the NASA Astronomical Data Center," W.H. Warren Jr., *Bull. Abastumani Astrophys. Obs., 59*, 31, 1985.

Abstracts submitted:

"The Handling of Data in Solar-Terrestrial and in Planetary Physics," J.I. Vette, *Mem. S.A.It., 56*, 269, 1985.

"The Treatment of Catalog Data in Astronomy and Astrophysics," W.H. Warren Jr., abstract submitted to CODATA '86.

"Space Data Catalogs: Conceptual Model for Representation and Automated Update," D.M. Sawyer Jr., abstract submitted to CODATA '86.

"NASA/NSSDC Central Online Data Directory (CODD), J.R. Thieman and J.H. King, abstract submitted to CODATA '86.

"A Plan for Disseminating and Coordinating the Data from the Diverse Experiments of the Dynamics Explorer Satellite System," B.E. Lowrey, submitted to CODATA '86.

"NASA's Pilot Land Data System Development Program," R.D. Price and P.H. Smith, IAF '85.

PUBLICATIONS ARE AVAILABLE UPON REQUEST

Calendar of Upcoming Events

January 27-31	Consultative Committee for Space Data Systems Panel 1 and 2 Meeting, Centre National D'Etudes Spatiales, Toulouse, France.
January 29-30	Second Pilot Climate Data System (PCDS) Workshop at NSSDC.
February 10-11	Space Science Board Committee on Solar and Space Physics, 33rd Meeting, Washington, D.C., Dr. S.M. Krimigis, Chairman.
February 11-12	Pilot Land Data System Team Meeting at JPL.
February 19	Central On-line Data Directory (CODD) Steering Committee Meeting at NSSDC.
March 4-5	Dynamics Explorer Science Working Group (DESWG) Meeting at Goddard.
March 26-27	Crustal Dynamics Investigators Working Group Meeting at JPL.
April	Second Earth Science Pilot Coordination Meeting at NSSDC.
April 16-18	Satellite Ocean Data System Science Working Group Meeting at NSSDC.
May 5-6	Data Systems Users Working Group (DSUWG) Meeting at NSSDC.
May 15-16	Committee on Data Management and Computation (CODMAC) Meeting at KSC.
May 19-23	American Geophysical Union Spring Meeting, Baltimore, Maryland.

REQUESTING DATA, PUBLICATIONS, OR SERVICES

The services provided by NSSDC are available to any individual or organization resident in the United States and to researchers outside the United States through the World Data Center A for Rockets and Satellites (WDC-A-R&S).

For information on availability, costs, and ordering procedures, researchers residing in the U.S. should contact:

National Space Science Data Center
Code 633.4
Goddard Space Flight Center
Greenbelt, Maryland 20771
Telephone: (301) 344-6695
Telex No.: 89675 NASCOM GBLT
TWX No. : 7108289716

Researchers who reside outside the United States should contact:

World Data Center A for Rockets and Satellites
Code 630.2
Goddard Space Flight Center
Greenbelt, Maryland 20771 U.S.A.
Telephone: (301) 344-6695
Telex No.: 89675 NASCOM GBLT
TWX No. : 7108289716

SUBMITTING DATA TO NSSDC

NSSDC invites members of the scientific community involved in spaceflight investigations to submit data to the Data Center or to provide information about data sets that they prefer to handle directly. The Data Center assigns a discipline specialist to work with each Investigator or Science Working Team to determine the forms of data that are likely to be most useful to the community of users that obtain data from NSSDC.

The formats of data submitted to NSSDC are flexible, and usually no special processing is required.

For information on submitting data to the Data Center, please contact:

Dr. H. K. Hills
National Space Science Data Center
Code 633.8
Goddard Space Flight Center
Greenbelt, Maryland 20771
Telephone: (301) 344-8105

Researchers residing outside the U.S. may write to Dr. James I. Vette using the address of WDC-A-R&S given on left.

OBJECTIVES OF THE NSSDC NEWSLETTER

The primary objective of this *Newsletter* is to inform and expand our user community. Through regular columns and special features, the reader may become acquainted with the various data analysis systems at NSSDC, our computer facilities and services, popular and new data acquisitions, and major scientific satellite systems.

We will not only feature what is available at NSSDC, but will explore some systems and data that are available elsewhere that might be of interest to our readers.

Each issue will contain a calendar of upcoming events and a profile of some of the people who work at NSSDC. Information about requesting data from NSSDC and submitting data to NSSDC will be contained in every issue.

We welcome all comments and suggestion that you might have. Please forward them to the Editor:

Ellen Stemmer
National Space Science Data Center
Code 633
Goddard Space Flight Center
Greenbelt, Maryland 20771
Telephone: (301) 344-8105

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Editor: Ellen J. Stemmer
Photographic Services: Rudiger G. Pauley and Robert N. Tice
Consultants: James L. Green, Joseph H. King, and Paul H. Smith