SPACE SCIENCE DATA OPERATIONS OFFICE

1999 Overview

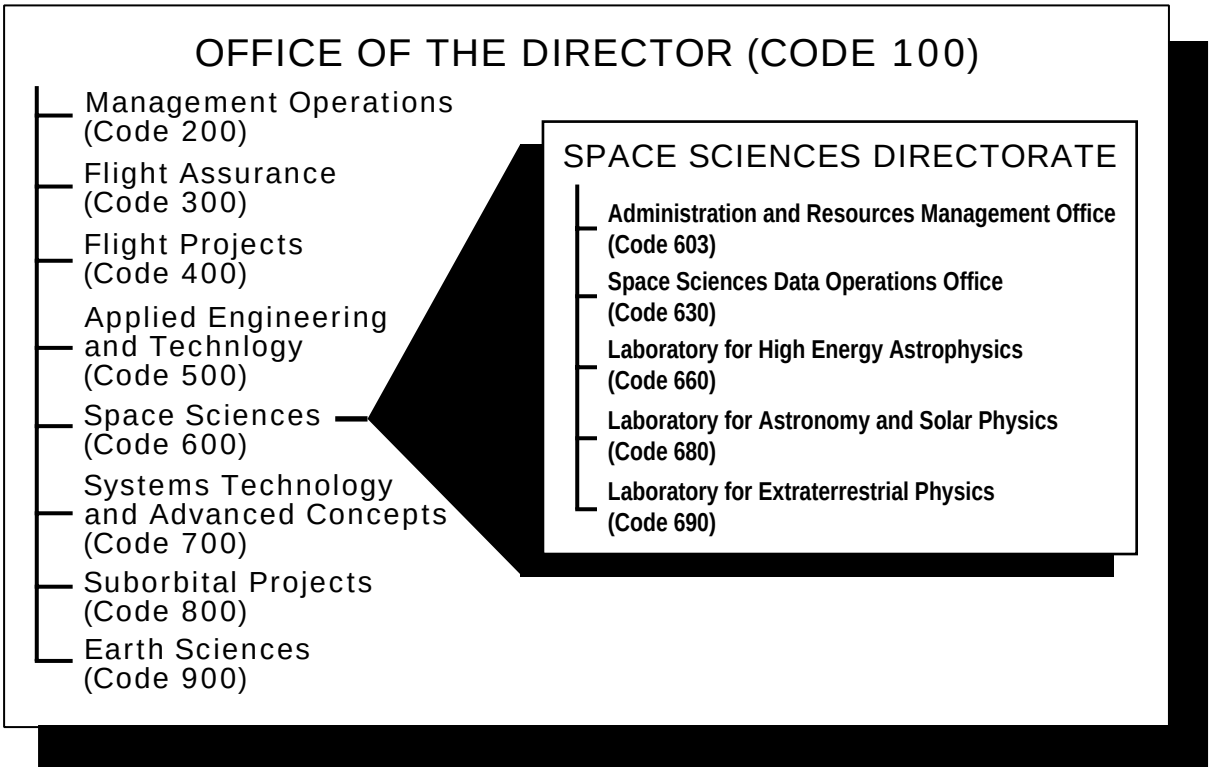
National Aeronautics and Space Administration

Goddard Space Flight Center
Greenbelt, Maryland

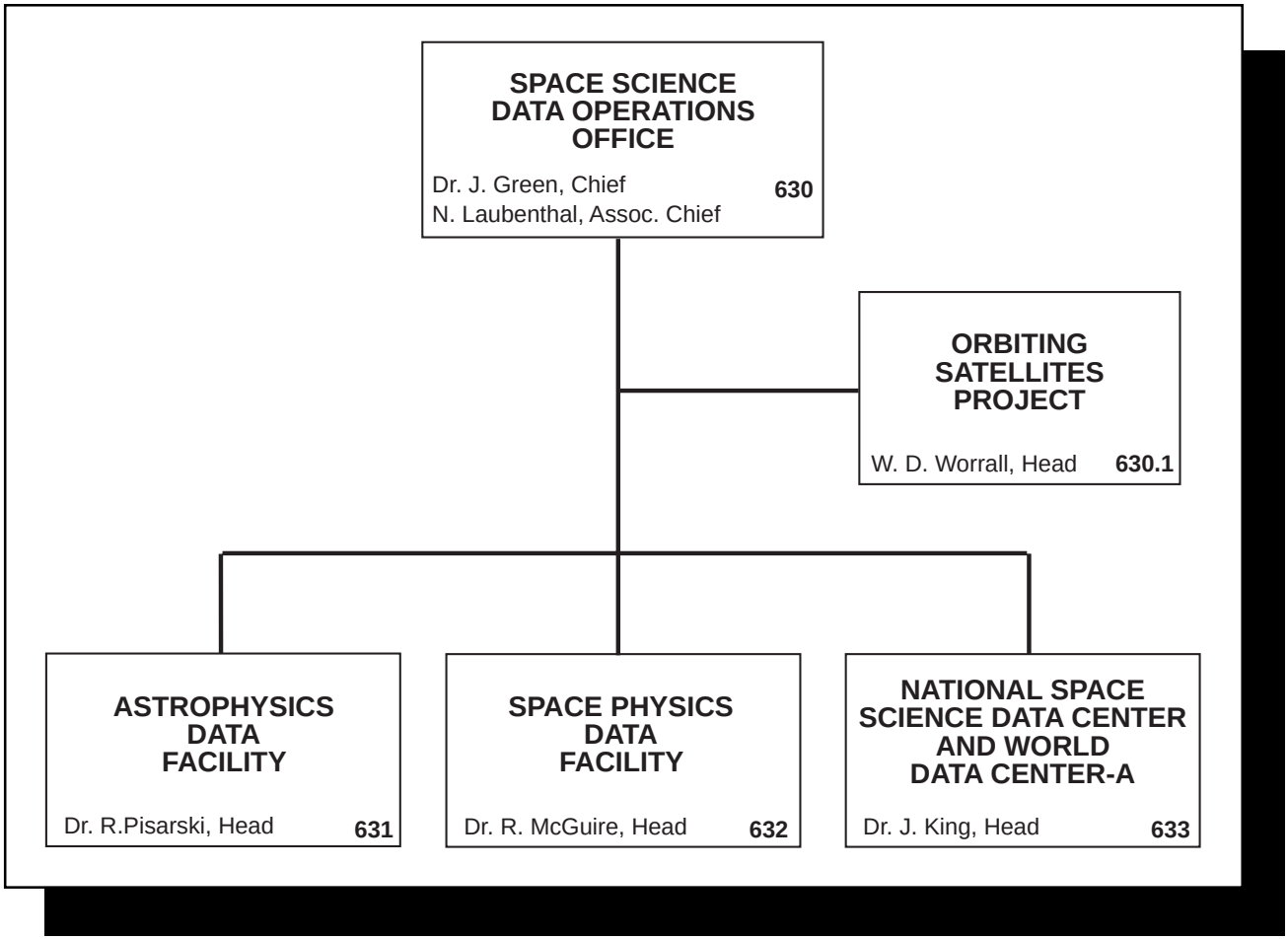
PREFACE

Goddard Space Flight Center's (GFSC) fundamental mission is to increase knowledge of the Earth, its environment, the solar system, and the universe through the development and use of spacecraft. GSFC has some of the world's leading groups of scientists, engineers, hardware and software developers, and administrative managers responsible for supporting NASA programs.

GSFC is organized into eight directorates as shown in the accompanying diagram. The Space Science Data Operations Office (SSDOO) resides within the Space Sciences Directorate.



SPACE SCIENCE DATA OPERATIONS OFFICE



CONTENTS

Preface v

I. Space Science Data Operations Office (Code 630) 1
- Overview 1
- Charter 1

II. Orbiting Satellites Project (Code 630.1) 3
- Overview 3
- Charter 3

III. Astrophysics Data Facility (Code 631) 5
- Overview 5
- Charter 5
- Major Activities 5
- Selected Recent Achievements 7

IV. Space Physics Data Facility (Code 632) 9
- Overview 9
- Charter 9
- Major Activities 10
- Selected Recent Achievements 12

V. National Space Science Data Center and World Data Center-A (Code 633) 17
- Overview 17
- Charter 17
- Major Activities 17
- Selected Recent Achievements 20

VI. SSDOO Personnel Kudos 23

VII. Research and Development Activities 25

VIII. Publications 27

IX. Acronyms 37

NSSDC/WDC-A-R&S 99-00

An Overview Of The

Space Science Data Operations Office

1999

SPACE SCIENCE DATA OPERATIONS OFFICE

CODE 630

OVERVIEW

GSFC has long been active in the planning, acquisition, processing, analyzing, archiving, and dissemination of data from space science missions. The National Space Science Data Center (NSSDC) has archived and distributed the data of many scientific disciplines and facilitated research (with archival data) for over 25 years. Currently, GSFC is responsible for over 30 missions. The future data products derived from NASA and NASA involved international space science missions are expected to grow substantially in volume and information content. This growth in data volume and complexity introduces unprecedented demands and new challenges on space science data operations and information management systems to archive, analyze, and distribute data to a diverse community of space scientists, educators, students, and the public at large. In June 1992 GSFC established the Space Science Data Operations Office (SSDOO) in order to meet these new challenges.

SSDOO has a large number of computer systems with public services that are all connected to open wide-area computer networks. These systems are heavily accessed by scientists as well as the general public. Because of this large investment in on-line data operations, systems, and services, the SSDOO is also responsible for the operation of the NASA-wide Automated Systems Incident Response Capability (NASIRC). This activity includes providing technical training in security awareness training, and developing and distributing computer security tool kits to NASA system managers and other computer users to adequately protect government computer resources.

The services of the SSDOO and its branches can be accessed over the World Wide Web starting at the URL:

http://ssdoo.gsfc.nasa.gov

CHARTER

The Space Science Data Operations Office manages and operates three major data intensive branches and the Orbiting Satellites Project. SSDOO performs various space data operations activities ranging from managing selected operating spacecraft to the development and operations of data and information systems that support processing, management, archiving, and distribution of space physics, astrophysics, and planetary physics data and information. The data systems provide support for many of the laboratory research needs within the Space Sciences Directorate and the scientific needs of the space science research community in general. SSDOO accomplishes its responsibilities through the archiving, cataloging, and dissemination of space science data and provides many specialized science support services and systems involving sensor algorithm development, processing, and mission administration and management.

The division is heavily involved in the science data operations of several key spacecraft and interfaces with the Flight Projects Directorate (Code 400), the Missions Operations and Data System Directorate (Code 500), the Space Sciences (Code 600) laboratories, and the space science community.

SPECIAL FACILITIES

Two of the stated goals of the Office of Space Science with regard to education and public outreach are to "use our missions and research programs and talents of the space science community to contribute measurably to the general elevation of scientific and technical understanding throughout the country," and to "share the excitement of discoveries and knowledge generated by Space Science missions and research programs by communicating clearly with the public." Perhaps the best - if not only - way to convene the qualities and dynamics of these complex phenomena to the non-scientist is to translate our scientific observations of these features into pictures and animations.

SSDOO has developed a Visualization Facility. The Facility is designed to create illustrations, develop and produce 2D and 3D animations, and produce videos and quick time movies. This work is accomplished by working closely with members of the Space Science Directorate, key members of the space science community, NASA Headquarters, and GSFC Public Affairs office. The finished products will be available to the media, the education community and the general public.

ORBITING SATELLITES PROJECT

CODE 630 .1

OVERVIEW

The Orbiting Satellites Project (OSP) was established to manage and administer the Mission Operations and Data Analysis (MO&DA) phase of GSFC operating satellites in the astrophysics and space physics disciplines. The OSP manages the Compton Gamma Ray Observatory (CGRO), Interplanetary Monitoring Platform (IMP-8), Rossi X-ray Timing Explorer (RXTE), Solar, Anomalous and Magnetospheric Particle Explorer (SAMPEX), the International Solar Terrestrial Physics (ISTP) Program (which includes Wind, Polar, and the NASA responsibilities on the Geotail and SOHO missions), and the Fast Auroral Snapshot Explorer (FAST) satellite, Submillimeter Wave Astronomy Satellite (SWAS), Transition Region and Coronal Explorer (TRACE), and the Advanced Composition Explorer (ACE). It is expected that OSP will be administering the future MO&DA mission phases for a number of missions such as the ISTP European Space Agency (ESA) four-spacecraft Cluster Mission, and Imager for Magnetopause-to-Aurora Global Exploration (IMAGE), as they are launched over the next several years.

http://ssdoo.gsfc.nasa.gov/c630_1/

CHARTER

The Orbiting Satellites Project provides project management and technical direction for the mission operations and data analysis phase of many of the Space Sciences satellites. These satellite programs are in support of the science research efforts of the Agency. They may be mission unique or part of a continuing series. In every case, they are satellites which have been launched and adequately commissioned by the Flight Project organization. The Director of Flight Projects and the Director of Space Sciences, after consultation with and approval by the Center Director, will officially transfer management of operating spacecraft to OSP. Responsibility includes overall business and technical management of orbital operations, contract maintenance and closeout scientific and technological experimentations, data processing and dissemination, project-wide planning and evaluation, monitoring and analyzing the status of spacecraft and experiment hardware, maintaining liaison with the data user community, and developing alternate modes of operation to maximize the scientific return of the mission.

ASTROPHYSICS DATA FACILITY

CODE 631

OVERVIEW

Space-based astrophysics missions are returning data sets of increasingly large volume and information content, challenging existing computational and data management systems and demanding new modes of operation. Specific Astrophysics Data Facility (ADF) functions include mission data system planning, data acquisition, data processing, algorithm development, guest investigator support, development of data access and visualization tools, and studies of new data technology utilization.

The ADF's primary customers are the providers and consumers of astrophysics data. These range from major NASA and international flight projects to individual researchers. Currently the ADF directly supports the High Energy Astrophysics Archive Research Center (HEASARC), guest investigators on the Roentgen satellite (ROSAT), Advanced Satellite for Cosmology and Astrophysics (ASCA), Rossi X-ray Timing Explorer (RXTE), and Cosmic Background Explorer (COBE) missions through processing and dissemination of mission data.

The ADF processes and distributes ROSAT, ASCA and RXTE data in collaboration with the Laboratory for High Energy Astrophysics (LHEA Code 660), and manages the COBE Guest Investigator Program in collaboration with the Laboratory for Astronomy and Solar Physics (Code 680).

The Astrophysics Data Facility:

- participates in data system planning and develops user support tools for the research community;
- processes level 0 data from both NASA and international astrophysics missions, and creates level 1 data products;
- develops and integrates state-of-the-art data systems necessary to carry out its mission; and
- functions as the scientific liaison between the NSSDC and astrophysics data providers identifying appropriate data from active and past missions.

http://hypatia.gsfc.nasa.gov/adf/adf.html

CHARTER

Science data expertise provided by the Astrophysics Data Facility (ADF) supports the processing, management, and dissemination of data obtained by past, current, and future NASA and international astrophysics missions. The ADF enables the effective use of those data (by providing IT tools and Computer Science methods) to the astrophysics community, educators, and the public.

MAJOR ACTIVITIES

Science Data Processing for ROSAT, ASCA and XTE - The ADF supports the U.S. ROSAT Science Data Center (USRSDC) through the processing, archiving and distribution of proprietary data to US observers. This includes the installation and configuration control of the German

provided processing software, receipt of telemetry tapes, production processing of all ROSAT data, quality assurance of the data products, distribution of the data, and development and operation of the optical disk based archive which contains the raw, intermediate and final proprietary data and products. These data sets are sent to the HEASARC for use by the public once the proprietary time period is over. The ADF also provides overall management of the USRSDC which includes both financial planning as well as contract management of the High Resolution Imager instrument contractor (SAO).

The ASCA mission is supported by the ADF in a similar fashion. The ADF processes all ASCA mission data into data products that are distributed to U.S. and European observers as well as to the HEASARC. Additional services include maintaining processing scripts, providing data management automation software, and providing World Wide Web (WWW) access to processing results information and documentation.

The ADF supports the XTE mission by providing processing, distribution and archiving using systems that were developed jointly for both ROSAT and ASCA. Level 0 data are processed and data products are generated that are provided to users. An additional requirement is for the ADF to provide the data to the instrument teams which are located at GSFC, UCSD and MIT so any anomalies can be identified and corrected. WWW access is also provided to help users determine the processing status of their data.

HEASARC Support - The HEASARC was established at GSFC in 1990 to support multi-mission X-ray and gamma-ray archival research. The HEASARC makes high-energy astrophysics data accessible to the research community and provides expert scientific support to guest investigators. It is a collaboration between the LHEA, the ADF, and the NSSDC. The HEASARC Director is a member of the LHEA. The ADF, is responsible for data management and interactions with other data centers, data producers, and science user support for some HEASARC supported missions (Rosat, ASCA, XTE, and Astro-E). The ADF works collaboratively with the HEASARC staff to help produce scientific analysis tools and simulations that are used by both the processing software and observers. This effort has been highly successful on ASCA and currently the ADF is supporting ASTRO E by doing an extensive X-ray mirror ray tracing simulation.

COBE Guest Investigator Support -Working closely with the COBE Principal Investigators in the Laboratory for Astronomy and Solar Physics, the ADF manages the COBE Guest Investigator Program, participates in the development of data products, analysis software, and documentation, acquires the data for permanent archiving by the NSSDC, and provides the international scientific community with on-line access to the data, and the public with access to images and information about the data and COBE's stunning scientific achievements.

Astronomical Data Center and FITS Support Office - The ADF provides scientific guidance to the Astronomical Data Center (ADC) and the FITS Support Office. The ADC, part of a federation of international data centers that includes the Centre de Donnies astronomiques de Strasbourg (CDS) in France, acquires, verifies, formats, documents, and provides on-line access to files containing astronomical data in computer-readable form, and develops and maintains software tools to

access the data. The FITS Support Office is responsible for documenting the FITS standard and participating in its evolution, advising persons involved in NASA astrophysics missions on how their data can be presented in FITS format, and providing on-line documentation for and limited user support directly to the research community.

Advanced Data Interface Development -The ADF staff in collaboration with the University of Maryland Institute of Advanced Computer Science is using object-oriented data base (OODB) methodology to build a new data-locating service, the Astrophysics Multispectral Archive Search Engine (AMASE). AMASE allows multispectral and multi-mission data in the NASA archives to be searched easily by scientific parameters. AMASE is a metadata base that links fundamental measurements published in astronomical catalogs with the relevant low-level mission data sets and the high-level mission data products in the archives. The scientific attributes searchable in the AMASE prototype include astronomical names, positions, coordinates and classifications. Other parameters such as flux, color, proper motion and redshift will be searchable in later releases.

A complimentary effort undertaken by the ADF which utilizes relational database methodology is the Web Interface for Searching Archival Research Data (WISARD) on the NASA Data Archive and Distribution Service (NDADS). WISARD has been developed in order to improve the accessibility of data archived on NDADS and to facilitate multi-wavelength, multi-mission research using the NDADS archives and related public archives. WISARD supports queries on fields which are in-common between the various NDADS astrophysical catalogs (i.e. target coordinates and date of observation); choice of search epoch; access to the SIMBAD name/coordinate resolver; catalog-specific field searches (e.g. instrument, object class, etc.); search criteria refinements; union and intersection queries on multiple catalogs; default and user-specified display of the query results; and subsequent NDADS and EUVE public archive data requests.

The Viewer/CATS EYE/Impress (VCI) interface is being developed also. It allows users to display, explore, cull, sort, manipulate and reformat data and metadata in catalogs and journal tables to meet the user's specific needs. Catalog information is available from the ADC, but the VCI allows data sets to be downloaded from other data centers in a convenient user friendly manner.

State-of-the-art information technology is being developed to enable users to obtain a better science yield from ADC's and other data center's holdings. The ADF is pioneering work on a new format XML which is starting to be utilized throughout the Space Science community. This format will allow the dynamic manipulation of journal tables and other data sets. Another area the ADF is pursuing concerns agent technology. These agents will enable the data centers to have more efficient data management and distributed computing.

SELECTED RECENT ACHIEVEMENTS

Mission Data Management Planning - The ADF advises Code 600 and external astrophysics projects on the formulation of their Project Data Management Plans (PDMP). These important documents describe the spacecraft-to-investigator flow of scientific data, and address related management and implementation issues. For example, the ADF collaborated with the

Harvard-Smithsonian Center for Astrophysics to develop the SWAS PDMP and provided advice on ground data handling to the Microwave Anisotropy Probe (MAP) team, which will be developed as a MIDEX mission.

Future Mission Planning - The ADF collaborates with the Code 600 Laboratories to develop plans for future space science missions. For example, we are participating in mission concept studies for the Submillimeter Probe of the Evaluation of Cosmic Structures (SPECS), and recently ran a successful workshop on "Submillimeter Space Astronomy in the Next Millennium."

ASCA Processing - The ADF has completed reprocessing all current ASCA flight data to the Revision 2 standard. This provides both archival scientists and proprietary Guest Observers with the highest quality data currently available. A copy of the ADF processed archive is being provided to the ASCA mission partner, the Institute for Space and Astronomical Studies (ISAS) in Japan. This will facilitate research by providing a common set of data to both sides of the Pacific. As is standard policy, all data is being supplied to the HEASARC as it is being processed.

XTE Processing and Distribution - The ADF has processed and distributed 95% of the AO1, AO2 and AO3 XTE data to date (350 Guest Observers). These observations began January 31,1996. Many uncertainties in the processing and data distribution system had to be worked out. The ADF has completed reprocessing all current RXTE flight data to the Revision 1 standard. The ADF XTE team also provided all the data to the instrument teams using the internet and tape distribution. This insured that the hardware teams could verify the correct operation of the suite of observing instruments onboard XTE.

Thin-Foil X-ray Ray Tracing - The ADF created an X-ray ray tracing simulator for use by the ASCA and ASTRO E missions. This package traces X-ray photons through both the ASCA and ASTRO E telescopes and predicts the performance of the optics. This software has been integrated with the ASTRO E XRS simulator to allow the ASTRO E science community to plan optimal science use of this instrument.

Advanced Data Interfaces - Both AMASE and WISARD have achieved usefulness for the user community. This was in evidence by the interest generated by the ADF exhibit of both interfaces at the recent American Astronomical Association meeting in San Antonio. The AMASE prototype can be accessed on the Web at the URL: http://amase.gsfc.nasa.gov/ and WISARD is accessible via the Web at: http://hypatia.gsfc.nasa.gov/wisard/wisard.html

The ADF has produced browser files for most of the NASA UV astronomical data holdings, including the IUE archive. These browsers enable researchers to preview data products and determine their applicability. In the spirit of interoperability, the browser pages are accessible from both the ADF WISARD interface and the Space Telescope MAST facility (http://archive.stsci.edu/mast.html). More recently, the ADF staff has begun to create tools which will facilitate data mining of the IUE archive. Specifically, the temporal behavior of objects observed 10 or more times over the 17 year lifetime of IUE can be investigated. As a first step in the mining process, a browser which displays dynamic spectra of each set of repeated observations was constructed. This facility enables a researcher to decide whether further analysis is warranted. It also provides a set of data which will guide the ADF staff in the development of automated tools which will be capable of attacking even larger data sets.

CODE 632

OVERVIEW

The Space Physics Data Facility (SPDF) develops and operates a range of programs serving data needs of the NASA and international space physics science communities. Central efforts of SPDF are the WWW-based Coordinated Data Analysis Workshop Web (CDAWeb) and the Satellite Situation Center Web (SSCWeb) software development and science-enabling services. These services and other efforts of the SPDF support NASA's Sun-Earth-Connections (SEC) program, the International Solar-Terrestrial Physics (ISTP) program including international elements and the InterAgency Consultative Group (IACG) solar-terrestrial research initiative. Several members of SPDF play key roles in the science and ground systems of the upcoming IMAGE mission, as well as science investigator roles in ISTP, IMP-8 and the upcoming Cluster mission. SPDF and its systems have played key roles in the Space Physics Data System (SPDS) in collaboration with other elements of the SSDOO and the Space Science Directorate laboratories, and are a logical supporting element to the new Space Science Data Service (SSDS) and an expected OSS Sun-Earth-Connections Data System (SECDS).

http://spdf.gsfc.nasa.gov/

CHARTER

SPDF works closely with Code 600 laboratory and flight project personnel in space physics data operations activities. SPDF develops and implements capabilities to serve space physics scientists' needs by supporting the creation and distribution of multi-source, multi-parameter, and multi-project data sets and data bases, "value-added" interdisciplinary data bases, and other products (e.g., CD-ROMs); develops such systems for specific NASA flight projects; and leads the development of nationally accessible advanced data base systems in the areas of solar-terrestrial physics. This includes the development, implementation, and operation of a WWW-based system for viewing and downloading multi-instrument space physics data (CDAWeb). SPDF works closely with flight project personnel in data system planning, utilization, and operation. SPDF designs and implements the SSCWeb software system, that provides mission planning information for scientists involved in the ISTP program supporting NASA and other agency spacecraft science operations planning. SPDF personnel represent the National Space Science Data Center as appropriate in interfacing with data producers to identify and coordinate the acquisition of appropriate space physics data from active missions. SPDF identifies and oversees loading of appropriate data to the active on-line/near-line space physics data archive and development of appropriate user interface and other tools for that environment (e.g. SPyCAT). SPDF develops and integrates state-of-the-art capabilities and systems necessary to carry out its mission.

MAJOR ACTIVITIES

SPDF continues its role of enabling coordinated science in the tradition established by the Coordinated Data Analysis Workshop (CDAW) program. Taking advantage of the new WWW technology, CDAWeb now allows users to display or download simultaneous data from many investigators in order to attack significant physical problems of global scale that may not be otherwise addressable. The concept originated in the solar-terrestrial community within the International Magnetospheric Study (IMS) program to analyze simultaneous data from a variety of sources to understand better the structure and dynamics of the Earth's magnetosphere. The Inter-Agency Consultative Group (IACG) is presently sponsoring a series of science campaigns, all supported in one degree or another by the databases of CDAWeb. CDAWeb is hosting an increasing set of higher-resolution spacecraft products and products from an expanding range of missions beyond ISTP (e.g. FAST and ACE) including new key non-NASA data for ESA's Ulysses missions and the Russian Interball Tail and Aurora spacecraft.

The Satellite Situation Center (SSC) consists of a software system, operational and development facilities, and an operational staff to support a range of science planning and science analysis needs where spacecraft orbital information must be brought into play with magnetic field models and magnetospheric region definitions. The operational SSC and the SPACEWARN (SW) offices support the Inter-Agency Consultative Group (IACG) program and populate on-line files of orbital elements and help carry out commitments to the Committee on Space Research/International Ursigram and World Days Service (COSPAR/IUWDS), and the Consultative Committee for Space Data Systems (CCSDS).

The operational SSC works closely with the ISTP Science Planning and Operations Facility (SPOF) to meet ISTP and IACG needs. SSCWeb supports both listing and graphics with the ability to perform sophisticated queries to identify times of specific spacecraft locations and various spacecraft-spacecraft and spacecraft-ground conjunctions. The system is designed to support easily consistent updating of distributed, customized copies of the underlying data base from files generated at other facilities, for example the SSC's receiving orbit elements and then providing updates on IACG missions to the SPOF or the SPOF updating the SSC with respect to core ISTP missions. The full capability of an enhanced SSC software system and data bases are now publicly accessible as SSCWeb as a joint SPDF/NSSDC effort.

SPDF, in collaboration with NSSDC is making critical data-management related contributions to the Global Geospace Science (GGS), ISTP, and IACG programs. SPDF is defining the correct and most cost-effective use of key data standards, developing software against these standards to support specific program objectives and supporting a master near-line data archive.

One key activity is the support of ISP/GGS-IACG use of the NSSDC-developed and maintained Common Data Format (CDF) as a standard for Key Parameters (KPs). KPs are a time-continuous data product characterizing the physical measurements of each instrument from every investigation and are the key ISTP mechanisms supporting a "global" view of the data collected. SPDF has developed a further set of detailed "CDF

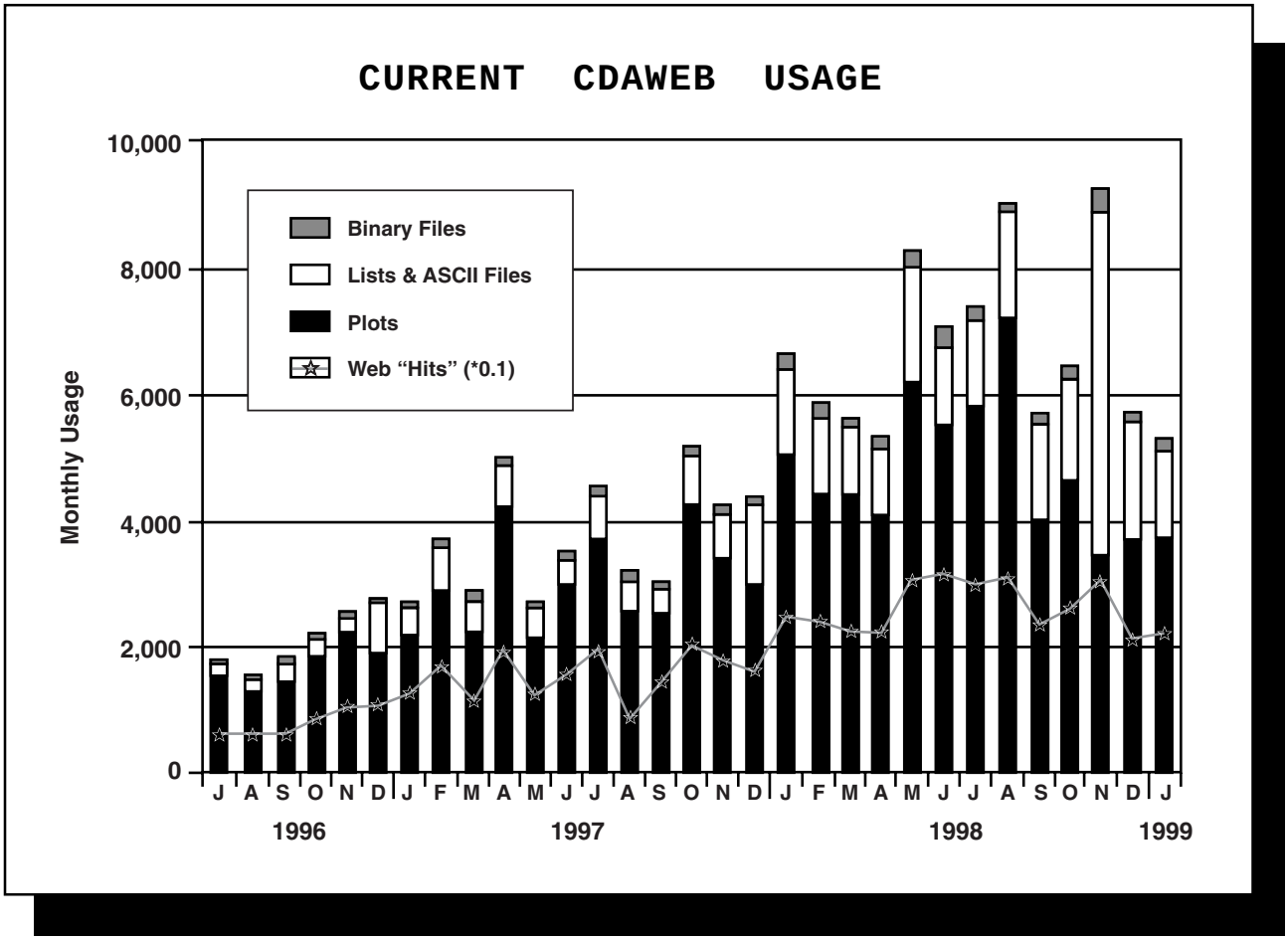
Implementation Guidelines" as a foundation to enable ISTP to realize its desired global and holistic view of its data. These standards now form a baseline for international space physics exchange and have been endorsed by both the Cluster project and the IACG. SPDF is now developing new, Java-based tools to greatly ease the learning and implementation effort for data providers to cast data into ISTP-guidelines compliant CDFs.

A second key SSDOO contribution to ISTP will be the ingestion and hosting of the long-term KP data base in the NSSDC Data Archive and Distribution Service (NDADS). The SPDF effort in this has included development of software subsystems for data ingest and a WWW-based interface to NDADS : the Space Physics Catalog (SPyCAT) . The system continues in operation with data being received from the ISTP Central Data Handling Facility (CDHF) on a daily basis. This very convenient and powerful user interface also supports a wider range of general archival data science users beyond immediate ISTP project limits, including e.g., DE, Hawkeye, ISEE-1, -2,. and -3, Pioneer 10/11, Voyager and SAMPEX. These capabilities taken in conjunction with the format standards, CDAW program, and SSC software form a powerful base to help support IACG science campaigns and declared ISTP "Event Databases."

SPDF partners with NSSDC staff to provide technical oversight and other guidance to specific activities on behalf of NSSDC. These activities include the identification and acquisition of key space physics data; the creation of value-added data sets, such as the OMNI and Coordinated Heliospheric Observations (COHO) data bases; acquisition and dissemination of space physics models; and the furthered accessibility of key archival space physics data sets, for example, in loading them into NDADS and in developing simple and portable basic display software.

Actively involved in enabling coordinated science (IACG and ISTP) and data management, the Space Physics Data Facility is leading the definition of a new program in data-intensive radiation belt modeling. As follow-on to the traditional NSSDC Trapped Radiation Environment Modeling Program (TREMP) that produced the existing NASA trapped radiation models, the SPDF is leading an effort to construct a new generation of trapped radiation models using modern data management technology (e.g., object-oriented database, data format standards, and modern communications tools). The model architecture is designed such that the models will have better performance and accuracy by being updateable, extensible as well as parameterize-able. Combining both empirical and theoretical modeling techniques, the new models will be semi-empirical such that they will be important tools suitable for both scientific and space weather applications.

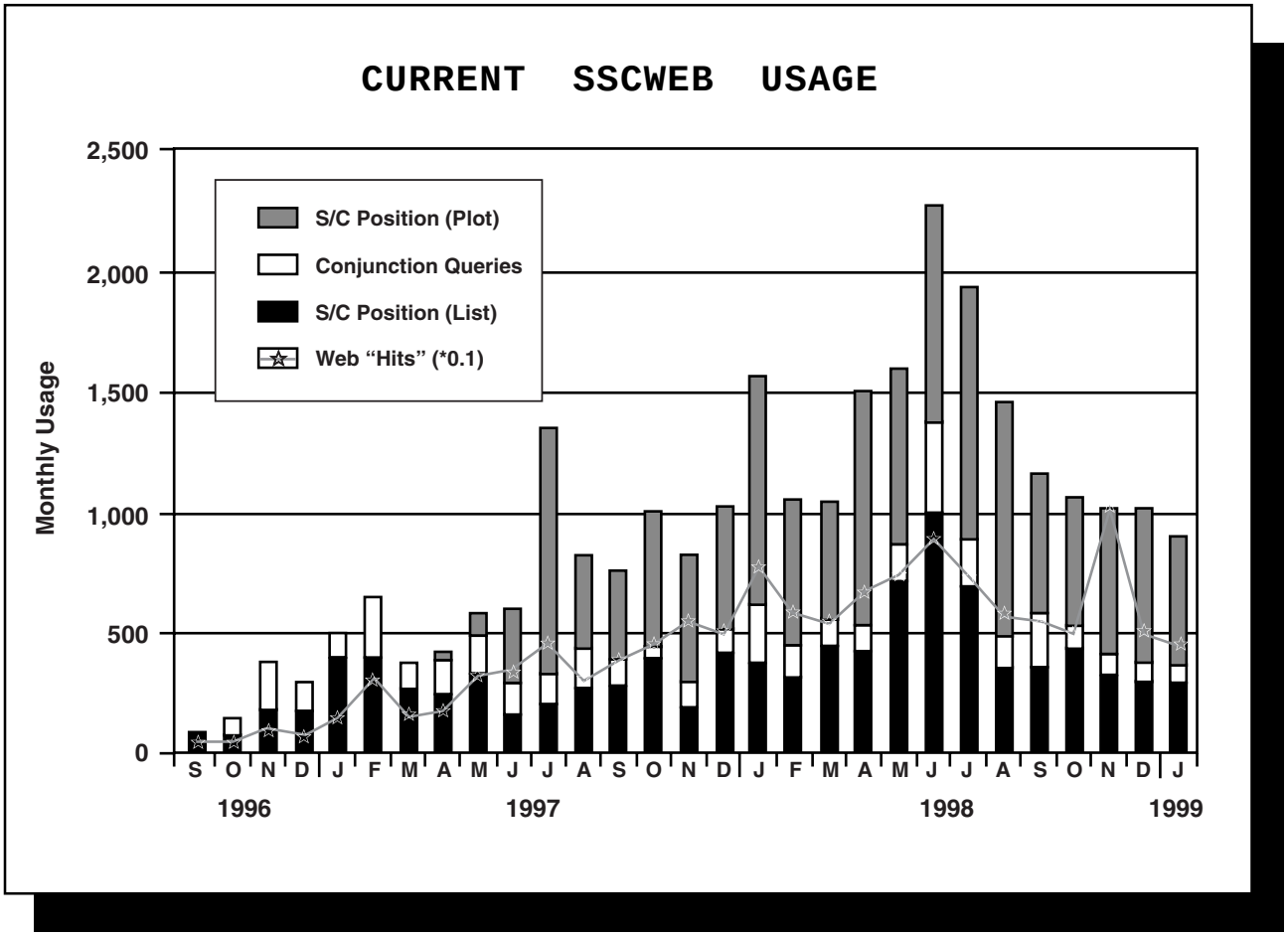
SPDF staff actively define and lead a range of science instrument work (e.g. on IMP-8 and on the upcoming IMAGE mission) as well as various funded Guest Investigator research efforts in e.g. trapped radiation modeling, solar/galactic cosmic ray studies and studies of the earth's bow shock using ISTP and other data. As one example, the bow shock study investigates the dynamic nature of Earth's bow shock to gain a new understanding the bow shock's position, shape, and motion, and the relationship between changes in the solar wind and the response of the bow shock. Studies are performed using the vast



data resources of ISTP concentrating on three satellites: Geotail, IMP 8 and WIND. Using primarily Geotail at the Earth's bow shock with Wind and IMP 8 upstream as monitors, we investigate the source of the multiple bow shock crossings and whether or not the shock is ever still. We look at how the interaction changes based on solar wind nominal conditions such as Mach number, IMF direction (B_y or B_z in particular), and ram pressure. There are also configurations for which two are more spacecraft are nearly simultaneously crossing the bow shock. For these "events" we look for similar features at both crossings to attempt to answer the questions "does the bow shock move as a rigid body and under what conditions?"; and "does the rigid shape match the one predicted by local normals calculated with the model of Peredo et al.

SELECTED RECENT ACHIEVEMENTS

- The combined efforts of SPDF with its partners in the NSSDC and the ISTP SPOF were recognized by Goddard in granting a "National Resource" group achievement award to the "Sun-Earth Connections Coordinated Data Analysis Tools & Services Group" "For new capabilities and ongoing services enabling the best science community use of Sun-Earth Connections data to achieve critical NASA science program objectives." An earlier stage of much



of this work was recognized by NASA by an Agency-level group achievement award in 1997.

The detailed award justification highly successful data systems including the ISTP/GGS-IACG data standards and software; planning and data services in the ISTP SPOF; the CDAWeb data retrieval-browse user service ; applications and libraries supporting advanced local display-analysis; and a Web-based science planning user service (SSCWeb), justifying this work in the context of a National Resource award by the specifics of:

- These kinds of services are essential to meet SEC requirements for easy access to multi-Agency, multi-mission, multi-instrument data, and for coordinated science and science campaign planning.
- These services operate for direct use by the extended science and educational community.
- These services are inherently inclusive of data beyond any immediate project bounds.
- These services are a foundation for key international partnerships (including NASA's role in the InterAgency Consultative Group) and better enable a wide range of joint science that leverages to advance NASA science objectives.

- These Goddard services remain unique to this NASA and international community in their functionality, they continue to grow in content and function to meet user needs, and they continue to grow in popularity and usage.
- To meet requests of NASA international partners, these services are now being replicated at other international facilities.
- Results and products from these services are seen in pervasive use at major SEC-related science meetings.
- These services have a range of mechanisms in direct customer involvement in defining their directions and evolution, including Agency forums, science team meetings and workshop, and open advisory groups.

- Use of the CDAWeb system continues steady growth since its operational start in late May 1996. The number of CDAWeb plots created by users now ranges between 4000 and 6000 or more per month, typically peaking near major space physics meetings such as the AGU or international meetings such as IAGA. A graph of current usage is shown.

- A prototype CDAWeb "mirror" site has been successfully established at the Max Planck Institute in Garching. The site will support international access to Equator-S data and allows easier European access to select ISTP Key Parameters as part of the international ISTP and IACG collaboration. A second prototype mirror site was established at the Rutherford Appleton Laboratories in the UK in time to support the ISTP workshop held there in September 1998 and remains active.

- Major upgrades to CDAWeb's support for auroral imager data (e.g. the Polar UVI, VIS and PIXIE instruments) were made during 1998. These new capabilities now allow the CDAWeb imager data to be acccessed by users with full geographic or magnetic coordinate registration of the images. Movie displays of imager data are also now available, and new prototype Java-based applets are in development for better user ability to "zoom" image features and to adjust color tables to better see features or structure of their specific interest.

- An upgrade to CDAWeb disk capacity was made in the Fall of 1998, to handle the steady growth in CDAWeb data holdings as established data flows continue, and to handle new, higher-resolution data beginning to flow as part of the new ISTP event database effort. The CPU supporting CDAWeb was upgraded in 1997; because server performance is a key factor in the effectiveness of the CDAWeb service, a new CPU upgrade is planned by Spring 1999.

- The SSCWeb capability has been publicly available since September 1996 and now averages 1000 up to 2000 executions of the system per month, as shown in the graphic. SSCWeb now contains all critical functionality of the former non-Web SSC software plus much more functional graphics than were supported by the X-windows interface of the old system. The SSC software system is installed and is being maintained as a baseline capability of the ISTP SPOF. Partial functionality of the software was recently developed for the WWW environment and made available through SSCWeb.

- The "CDF Implementation Guidelines," developed to aid in the effective use of CDF

by ISTP in its KP data base, have been streamlined to encourage submission of higher resolution data by the ISTP PI community. The core set is sufficient to provide the minimum archive product. These guidelines anticipate issues in and lay a solid foundation for more effective scientific understanding and use of KPs across time, instrument, and spacecraft file boundaries.

• An open CDAWeb/SSCWeb user meeting was held during the Spring 1998 AGU and is planned to become an annual event. A variety of important comments were made (and reported e.g. in an article in the NSSDC newsletter). Among the key comments were both strong user endorsements to the value of SPDF's work and intense user interest in seeing more data supported by CDAWeb. SPDF is in fact nearing completion of the initial development of a new set of Java-based software tools to greatly ease the learning and implementation effort for data providers to cast data into ISTP-guidelines compliant CDFs. These tools are designed to operate locally on user machines (with a Java GUI interface). This work is complemented by new ISTP-funding of a Guest Investigator effort to better collect and CDF-convert more key high-resolution data from both the NASA missions and international partner missions of ISTP.

• Substantial upgrades have been made to the SPyCAT interface in 1998.

• All the various systems above (CDAWeb, SSCWeb, SPyCAT, the ISTP ingest pipeline software, CDF etc) were fully configured, tested and certified to NASA as Y2K compliant in 1998.

• The Imager for Magnetopause to Aurora Global Exploration (IMAGE) mission ground system development continues on schedule and within cost under the leadership of a key staff member in SPDF. IMAGE is the first of the new series of the mid-sized explorer projects called Medium-Class Explorers (MIDEX) and is currently scheduled for launch in early 2000.

• The bow shock study effort created a database of the Earth's bow shock crossings and provided web access to it in order to facilitate statistical studies and cross-comparisons. This database stores a list of bow shock crossings as well as information associated with each crossing - solar wind parameters such as Magnetosonic Mach number, plasma beta, IMF Bx, By, Bz, bow shock angles and ram pressure. The database design allows several kinds of plots to be created for specific subsets of the database, the conditions specifying the subset supplied through the WWW-based interface. Plots such as bow shock crossing locations and surface normal directions are currently supported. The database presently holds 950 crossings of the Earth's bow shock flanks observed by the Geotail spacecraft. In addition J. Safrankova and Z. Nemecek supplied two years worth of Magion-4 (Interball-Tail's sub satellite) bow shock crossings approximately 1100 crossings). We plan to add IMP-8 and Wind bow shock crossings in the future.

The programs of SPDF are beginning to form a consistent framework and a solid foundation within which major challenges posed in data management and data handling by key Sun-Earth-Connections programs. The efforts will continue into the new millennium with the IMAGE and Cluster II missions.

NATIONAL SPACE SCIENCE DATA CENTER AND WORLD DATA CENTER-A

CODE 633

OVERVIEW

The National Space Science Data Center (NSSDC) is a multidiscipline archive, supporting astrophysics, solar and space plasma physics, and lunar and planetary sciences. NSSDC acquires data from space-flight projects, discipline data systems, and individual principal investigators. NSSDC manages data both in on-line modes and in off-line stores of tape, film, and other media, and disseminates data worldwide. The center maintains comprehensive information files about NSSDC-held and other data. Finally, NSSDC manages the NASA/Science Office of Standards and Technology (NOST). As an element of the NASA/OSS Space Science Data Service, NSSDC is the permanent archive for most NASA space science mission data and is the active archive for much data in selected discipline areas. As an element of the SSDOO, NSSDC collaborates with other facilities of SSDOO, with the other laboratories of the Space Sciences Directorate, and with the public for accessing NASA archival mission data.

http://nssdc.gsfc.nasa.gov/

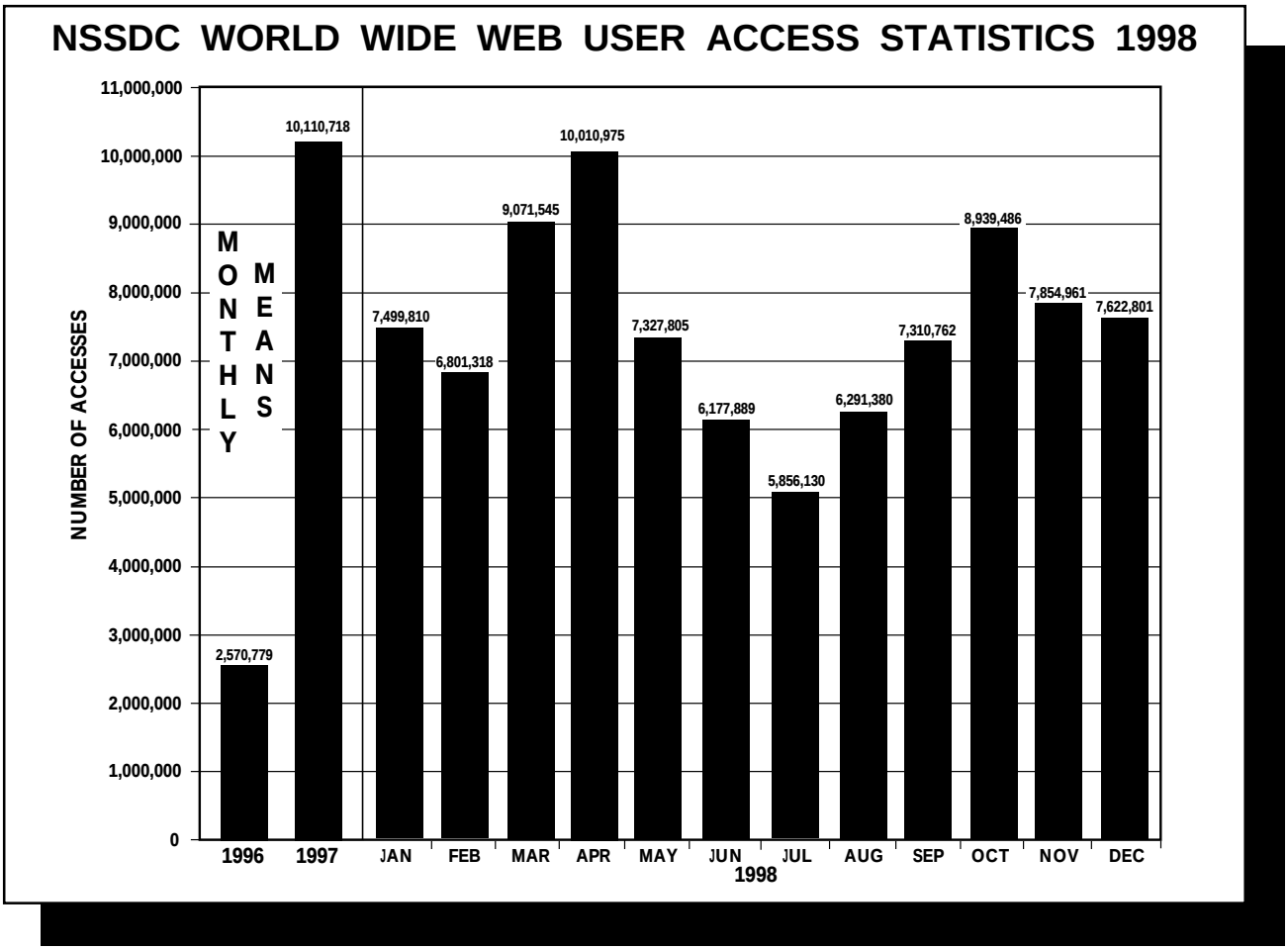
CHARTER

The National Space Science Data Center serves as the permanent long-term archive and distribution center for a broad range of space science satellite data and information. It is responsible for the maintenance and operation of discipline-independent directories, catalogs, data standards, and other information services; access to existing and future NASA space science archives; support as requested of data center node(s) for science discipline data systems; and participation in the development of a nationally accessible science data system.

The NSSDC maintains the necessary in-house expertise to support NASA data management, including related advanced information and storage technologies for distributed and intelligent data systems. The NSSDC develops and integrates state-of-the-art capabilities and systems necessary to carry out its mission and is responsible for maintaining useful products and publications. In recent years NSSDC has been aggressively exploiting World Wide Web technology to make its data and services more readily accessible. NSSDC is responsible for the operation of the World Data Center-A for Rockets and Satellites (WDC-A-R&S), which serves as NASA's agent for the international exchange of space science information and data.

MAJOR ACTIVITIES

NSSDC is responsible for the archiving and dissemination of scientific data from specific astrophysics and space physics missions and other discipline missions as appropriate. NSSDC manages the long-term space science and planetary archive and provides electronic



and on-line data distribution services. It maintains the long-term archive of both computer-readable and non-computer readable data (i.e., film) and preserves valuable information content against physical deterioration of the storage media.

The NSSDC interfaces with astrophysics, planetary, and space physics discipline data systems and with the Space Physics and Astrophysics Data Facilities to ensure timely access to archived data and information. It may provide limited special services and value-added products or generate multidisciplinary data bases for the astrophysics, planetary, and space physics science communities. It produces regular publications promoting and informing the science user community of its archive contents and services. As assigned by NASA Headquarters, it assures the continuing accessibility of distributed NASA archived data files when the entities managing those files cease that activity.

NSSDC maintains expertise in information systems technologies and applies this knowledge to discipline-independent data systems and related services. It promotes data system interoperability.

NSSDC maintains a number of popular information systems. The NSSDC Master Catolog provides a wealth of information on past, present, and future spacecraft, including information on individual

experiments and sensors for space science missions and data sets associated with them. Hyperlinks to further information or to data are provided if available. There is also information on NSSDC's customer community, web access to many of the most popular images NSSDC distributes, and catalog and online ordering capability for several hundred CD-ROMs, etc.

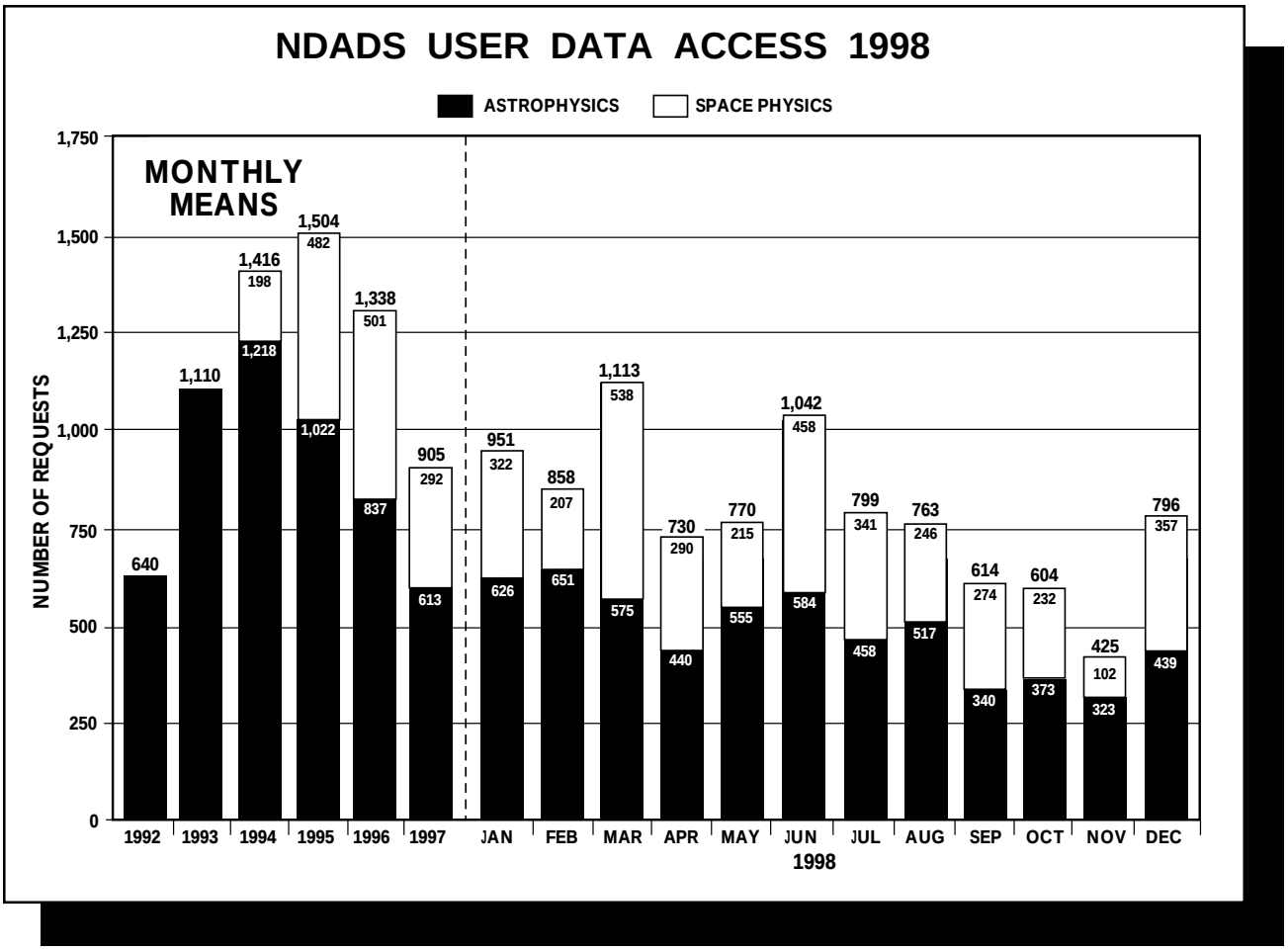
In addition, NSSDC, through its NASA/Science Office of Standards and Technologies (NOST), leads the NASA activity in international standardization efforts for compatibility of distributed on-line scientific data and information files. It also defines, develops, and manages a set of generic services covering a wide range of space and Earth science disciplines. It develops and integrates state-of-the-art capabilities and systems necessary to carry out its mission.

NOST serves the NASA science communities in evolving cost-effective, interoperable data systems by performing a number of functions designed to facilitate the recognition, development, adoption, and use of standards by these communities. The NOST Standards Library collects, updates, and disseminates information about existing and emerging standards and new technologies of relevance to the NASA science community and its related data systems. The development of new standards is supported through participation in the international Consultative Committee for Space Data Systems (CCSDS) Panel 2, the International Astronomical Union's Flexible Image Transport System (FITS) committees, and the NOST's FITS Technical Panel. Standards support is provided through support offices for the CCSDS Standard Formatted Data Unit (SFDU) standards and the International Astronomical Union (IAU) FITS standard and through the convening of the Formats Evolution Process to help the community better understand their standards and evolve more interoperable systems.

The NSSDC Data Archive and Distribution Service (NDADS) Facility improves the capabilities of the NSSDC to collect, manage, and distribute the astrophysics and space physics archive. NDADS is a hardware/software-based solution to maintain a large on-line archive and rapid distribution service. NDADS provides services not only to NASA but also to a worldwide science user community. Located at Goddard Space Flight Center in Building 28, it presently consists of a VMS-based computing cluster that supports a pair of optical disk jukeboxes. Major hardware and OS modifications are anticipated in 1999.

The NDADS system architecture provides a natural isolation between catalog/archive and user interface, facilitating update of the archive without affecting the user interface. NDADS has a current capacity of almost 1.7 terabytes of near-line optical disk storage. One of the most promising features of the architecture is its easy expandability to tens of terabytes.

NSSDC, ADF, and SPDF have developed WWW-based and e-mail based interfaces to the NDADS data holdings. WISARD is astrophysics oriented and SPyCAT supports primarily the time series data sets of space physics. Requests via these interfaces yield data which may be retrieved either via anonymous FTP or default NSI/DECnet copy. It is also possible to arrange to have the data sent directly to the requester's computer. Project data sets currently on line and available from NDADS include those from the Astronomical Data Center (ADC); the Dynamics Explorer (DE) program; High Energy Astrophysical Observatory (HEAO) 1, 2, and 3; Interplanetary Monitoring



Platform 8 (IMP 8); International Sun-Earth Explorer (ISEE 1 & 3); Ulysses; Wind; Geotail; Hawkeye; IRAS; IUE; SKYLAB; ASTRO 1; and VELA 5B data. The figures show measures of access to NSSDC's data and information services. WWW access is now provided to most NSSDC services and the number of accesses per year continues to increase. NSSDC's customers downloaded 1.03 million data files from NDADS, anonymous/ftp, etc. in 1998.

SELECTED RECENT ACHIEVEMENTS

The most important result of NSSDC's 1998 activities is the continuing preservation of growing space science data volumes, ensuring their continuing and future accessibility to the space science, education, and general public communities. NSSDC's archive has now grown to 11.1 TB of space science data, plus an additional 3.3 TB of legacy Earth science data, being managed, with the addition of 1.2 TB to this archive in 1998.

NSSDC continues to distribute large amounts of data by network to the space science community and general public, and by offline mailings to the general public. During 1998, NSSDC's customers downloaded via network 1.03 million data files and received about 4 TB of data on mailed media. Further details of data inflow to, and outflow from, NSSDC are found in NSSDC's Annual Report.

Through its NASA/Science Office of Standards and Technologies (NOST), NSSDC provides international leadership in

providing increasingly effective digital data archiving. During 1998, the ISO/CCSDS sponsored Archive Reference Model was issued after 3 years of NOST leadership of its evolution. In addition, NOST defined and convened the Digital Archive Directions (DADs) workshop to define the next steps in digital archives definition.

NSSDC was active in the evolution of the distributed NASA/OSS data environment. In addtion to participating as a member of the Space Science Data Service (SSDS) Technical Working Group, NSSDC reached agreement with the Multi-Mission Archive at the Space Telescope Science Institute (MAST) active archive for optical/UV data for the MAST to assume data distribution roles and for NSSDC to serve as permanent archive for such data. In keeping with a similar agreement reached with the High Energy Astrophysics Science Archive Research Center at Goddard, NSSDC received the first HEASARC data volumes for permanent archiving. In addition, NSSDC was active in developing, with others of the Sun Earth Connection (SEC) community, recommendations to HQ for implementation of an SEC Data System.

As an alternative approach to the centralized, CDF-based OMNIWeb, COHOWeb and CDAWeb systems providing browse and download functionalities to various magnetospheric and heliospheric data sets, NSSDC used Java (and C) to create ATMOWeb as a new retrieve/browse interface to atmospheric and ionospheric data held at NSSDC as ASCII tables. ATMOWeb promotes Java applet downloading along with data, such that the user's computer, rather than NSSDC's computers, uses its cycles in plotting data.

NSSDC's OMNI data set, holding virtually only IMP 8 data for the 1980's and 1990's started to have many of its 1990's data gaps filled by the addition of time-shifted data from the ISTP/Wind spacecraft. OMNI should eventually be essentially gap-free for the times after the Wind launch in September, 1994.

The tools supporting both NSSDC and external-community use of the Common Data Format were made much more user effective through a conversion from command-line-based to GUI-based (GUI = Graphics User Interface).

At the request of the NASA Chief Information Officer, NSSDC played a central role in the development of a white paper on NASA science data retention. This paper will underlie a new Science Data Retention policy statement, which will, among other things, govern the relation between NASA and the National Archives and Records Administration (NARA) regarding what data come to be permanently archived at NARA. This is an area that had become somewhat confused.

NSSDC brought many datasets to network accessibility for the first time in 1998. Particularly noteworthy was an effort whereby several IBM/binary (1973-1991 data) and VMS/binary (post-1991 data) NSSDC-archived tapes, holding 11-minute resolution energetic particle rate data from the University of Maryland experiment on IMP 8, were read and ASCII records were created containing a subset of general-interest words from the original binary records. These data were then made network-accessible from NDADS. Occasional interactions with the original University of Maryland team occurred during this effort.

Among the items made network accessible from NSSDC during 1998 were: the current Guideline for Developing a Project Data

Management Plan; a page listing and characterizing the 70+ Explorer spacecraft launched by NASA since the late 1950's; an index page guiding users to NSSDC's various WWW-accessible interfaces through which data from various SEC missions are available.

A great deal of effort was expended on ensuring that NSSDC systems would run correctly in the year 2000. NSSDC's general software environment was brought under much improved configuration management for this. Only minor renovations of NSSDC's applications software were needed. One significant problem came up relative to NSSDC's ability to continue creating new WORM optical platters for NDADS in the new millenium, but NSSDC anticipates having no further need for this as the NDADS optical disk jukeboxes, now approaching 10 years old, are expected to be supplemented in 1999 by new systems to which all new-data-writing will be done.

NSSDC's WWW home page received a new columnized look-and-feel. User access to this page and to the many pages in the NSSDC tree of WWW pages continues to grow.

SSDOO PERSONNEL KUDOS

The Space Science Data Operations Office employees below have been recognized for the following awards and honors:

Goddard National Resources Award

Sun-Earth Connections Coordinated Data Analysis Tools & Services Group

Robert E. McGuire - GSFC Code 632
Ramona L. Kessel - GSFC Code 632
Robert M. Candey - GSFC Code 632
Richard J. Burley - GSFC Code 632
Gregory W. Goucher - GSFC Code 633
William H. Mish - GSFC Code 690
Tamara J. Kovalick - RITSS/Code 632
Richard T. Baldwin - RITSS/Code 632
Raghav Parthasarathy - RITSS/Code 633
Frank A. Ferrier - RITSS/Code 633
Mauricio Peredo - RITSS/Code 695
Syau-Yun W. Hsieh - RITSS/Code 694
Scott A. Boardsen - RITSS/Code 632
Muriel A. Taylor - RITSS/Code 632
Sheng-Hsien Chen - RITSS/Code 632
Michael H. Liu - RITSS/Code 633
Laura E. Carriere - RITSS/Code 633
H. Kent Hills - RITSS/Code 632
John F. Cooper - RITSS/Code 632
Daniel B. Berdichevsky - RITSS/Code 690
K. Celest Lindsay - RITSS/Code 633
Barbara E. Rowland - RITSS/Code 633
Chee-Ming Wong - RITSS/Code 633
Phillip M. Williams - QSS/Code 632

Goddard Excellence in Outreach

Sten F. Odenwald

Special Act Award

The following civil servants were recognized for their extensive contributions to the completion of the SSDOO support contract. This contract was awarded to Raytheon on December 1, 1998.

Curtiss Barrett
Robert Candey
Shing Fung
Lisa Kelly
Stephen Kempler
Joseph King
Nancy Laubenthal
Bill Lawson
David Leisawitz
Robert McGuire
Mary Stevens

Peer Awards 1998

Jennifer Ash-Poole
Richard Baldwin
Edwin Bell
Kirk Borne
Christine Cain-Shaffer
Vivek Dwivedi
Harold Felder
Jay Friedlanber
Carrie Gallap
James Gass
Emily Greene
Kelly Gygax
Karen Horrocks
Tami Kovalick
Louis Mayo
Ella Munoz-Gonzales
Carolyn Ng
Sten Odenwald
Sardi Parthasarathy
Robert Patterer
Mauricio Peredo
Edward Pier
Margaret Russell
Barry Sclesinger
David Strope
William Taylor
Julie Weaver
David Williams

Raytheon ITSS Team Award for outstanding contributions to the Government Y2K effort

SSDOO "NDADS Y2K Compliance Team"

Steve Bove
Arthur George
Kent Hills
Colin Klipsch
Tamara Kovalick
Pat McCaslin
Ella Munoz-Gonzalez
Fred Pierce
Barbara Rowland
David Strope
Muriel Taylor

Raytheon ITSS Peer Award for 1998/1999

Dr. Edward Shaya

Continuous Management Improvement (CMI) Award

Software Engineering Process Group (SEPG)
John Garrett, Raytheon ITSS

MISSIONS & RESEARCH & DEVELOPMENT

Spacecraft Missions

IMAGE Mission
James L. Green, CoI
Shing Fung, CoI
Bill Taylor, CoI

IMP8 Mission
Joseph H. King, Project Scientist
Robert McGuire, CoI

Wind and Polar
James L. Green, Deputy Project Scientist

Voyager
Robert McGuire, CoI

US Rosat Data Center
Rich Pizarski, Project Manager

SSDOO Research and Development Activities

The following proposals have been selected by the NASA peer review process and are funded and active.

Spacecraft Mission Studies

Workshop on Submillimeter Space Astronomy in the Next Millennium
David Leisawitz, CoI

Submillimeter Probe of the Evolution of Cosmic Structure (SPECS) - Design Studies
David Leisawitz, CoI

Information Systems R&D

Sun-Earth Connections Campaign Data Coordination
Ramona Kessel, PI

Interoperable Systems for Archival Information Access (ISAIA)
Richard White, CoI
Joseph King, CoI

Application of XML to Documentation and Content-Based Searching of Astonomical Catalogs
Ed Shaya, PI
Jim Gass, CoI
Cynthia Cheung, CoI
Richard White, CoI

Automated Processing of ISIS Topside Ionograms into Electron Density Profiles
Dieter Bilitza, CoI

Satellite Ion/Electron Density/Temperature Data on CD-ROM and WWW
Dieter Bilitza, PI
Natasha Papitashvili, CoI

Science

The Redshift Dependence of the Interaction-Activity Connection among Ultraluminous Starbursting Galaxies
Kirk Borne, PI

AXAF Investigation of the Archtypical ULIRG: Arp 220
Kirk Borne, CoI

Snapshot Survey of Dynamically Close Galaxy Pairs from z=0.1 to z=0.5
Kirk Borne, CoI

Identification of M Supergiant + B star Binaries in the Magellanic Clouds
Derck Massa, PI

FUV Diagnostics of Structure in Hot Star Winds
Derck Massa, CoI

Cosmic Infrared Background Fluctuations from the WIRE Infrared Explorer
Sten Odenwald, CoI

International Solar Terrestrial Physics (ISTP) Guest Investigator Program
Scott Boardsen, CoI

Interaction of Magnetospheric Particles Applied to Classroom Teaching (IMPACT)
John Cooper, CoI

Investigation of Radiation Belt Electron Dynamics and Transport Using Multi-Spacecraft Correlative Measurements from Low to Geosynchronous Altitudes
Lun Tan, CoI

Investigation of Plasma Flow Characteristics in the High-Latitude Cusp Region
Lun Tan, CoI

Galaxy Winds vs. Cooling Flows in Poor Clusters
Richard White, CoI

NASA HST Cycle 8 Education & Public Outreach Program, "Value-Added Educational Tutorials for HST Data"
Kirk Borne, PI

Raytheon ITSS Sabbatical Fellows

Research in Colliding Galaxies
Kirk Borne
Research in Titan's Atmosphere
Lou Mayo

On Going R&D In 1999

The following research activities were awarded through the NASA or NSF peer review process in previous years but are still active in 1999.

Information Systems R&D

Astrophysics Multispectral Archive Search Engine (AMASE)
Cynthia Cheung, PI

Science

Radio Plasma Imaging
Bill Taylor, PI
James Green, CoI

Shock Morphology in Star-Forming Ring Galaxies
Kirk Borne, PI

Snapshot Survey of the Ultraluminous IRAS Galaxy Sample
Kirk Borne, PI

Archival Study of Nuclear Morphology in Interactive Galaxies
Kirk Borne, PI

NIR Snapshot Survey of Ultraluminous IR Galaxies
Kirk Borne, PI

Do Massive Star Clusters Form in Young and Weak Galaxy Interactions?
Kirk Borne, CoI

The Winds of B supergiants
Derck Massa, PI

Determining the Physical Properties of the Main Sequence B Stars
Derck Massa, CoI
Determination of the Distances and Masses of 2 Galactic Cepheids
Derck Massa, CoI

The Winds of Main Sequence B Stars in NGC 6231, Evidence for Shocks in Weak Winds
Derck Massa, CoI

Space Weather: Improved Global Specification of the Topside Ionosphere
Dieter Bilitza, PI

Investigating Cosmic Background Fluctuations in the Infrared Using COBE/DIRBE Data
Sten Odenwald, CoI

Energetic Ion Interactions with the Galilean Satellites
John Cooper, PI

Cooling Gas, Cold Gas, and the Dynamical History of Clusters of Galaxies
Zhengping Huang, CoI

The interaction between cluster central radio sources and cooling flows
Zhengping Huang, CoI

Investigations of a Large, Complete Sample of Galaxy Groups Using the ROSAT, All-Sky Survey
Richard White, CoI

FOS Spectroscopy of NGC 1316: Fornax A
Edward J. Shaya, CoI

Derivation of the Inverse Compton and Extragalactic Components of the Large-Scale Gamma-Ray Emission: Implications for the Possible Existence of a Galactic Gamma-Ray Halo."
Tom Sodroski, PI
Nils Odegard as Co-I

Education and Outreach

Sun-Earth Connection Education Form
James Thieman, CoI

PUBLICATIONS

The SSDOO personnel are considered experts in developing, implementing, and operating data processing systems, science mission planning tools, and massive data archives. There are currently approximately 32 civil servants and over 100 support contractors working in the SSDOO. The following publications list of scientific papers, technical data system articles, brochures, data reference guides, catalogs, and newsletters is descriptive of the type of work performed by SSDOO over the period of a year. Copies of these publications are available upon request.

PUBLICATIONLIST
January 1998 - Present

Scientific Articles
(Journals, Proceedings, & Reports)

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- NOST News
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NSSDC Volume 14, Number 2, June 1998

- IUE Reaches Final Archive: What Lies Ahead
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- SSDOO/NSSDC Participate in 1998 NASA Career Expo
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- NSSDC 1997 Annual Report Available
- NASA Interacts with Science Teachers
- NOST Issues New Draft FITS Standard
- Summer Intern Preview
- NSSDC Sponsors TODTWD Activities
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NSSDC Volume 14, Number 3, September 1998

- Digital Archive Directions Workshop Extremely Successful
- IMP 8 Anniversary
- Additional IMP 8 Particle Data Accessible from NSSDC
- New IMP 8 Data Set Created at NSSDC
- NSSDC Tapes Moved as TSSF Closes
- GSFC Reorganization Brings New Staffers at NSSDC
- ATMOWeb Offers WWW/Java-Based Access to AE Data
- The IRI Continues To Improve AAAS Provides Standards for NASA Curriculum Materials
- New White Paper on NASA Science Data Retention Issued

- NSSDC Assesses Ending Paper Version of Its Newsletter

NSSDC Volume 14, Number 4, December 1998

- New Process for Influencing Formats Evolution and Adoption
- Two Millionth Data File Retrieved from NDADS
- NSSDC Acquires Silverman's Records of Old Auroral Observations
- NSSDC Acquires Data from Many Soviet Missions
- Common Data Format Status and Plans
- SSDOO Year 2000 Compliance Update
- Sun Earth Connection Education Progress at AGU Meeting
- New Data, Education, and Science Grants Won by SSDOO Staffers
- GSFC Selects Raytheon/ITSS for SSDOO/NSSDC Support Contract
- Outsourcing Desktop Initiative Started at NASA

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ACRONYMS

AAS	American Astronomical Society
ACE	Advanced Composition Explorer
ADC	Astronomical Data Center
ADF	Astrophysics Data Facility
ADS	Astrophysics Data System
AMASE	Astrophysics Multispectral Archive Search Engine
AOF	Archive Operations Facility
ARMS	Automated Retrieval Mail System
ASCA	Advanced Satellite for Cosmology, and Astrophysics
ASP	Astronomical Society of the Pacific
AXAF	Advanced Xray Astrophysics Facility
BAAS	Bulletin of the American Astronomical Society
CCSDS	Consultative Committee for Space Data Systems
CDAW	Coordinated Data Analysis Workshop
CDF	Common Data Format
CDHF	Central Data Handling Facility
CD-ROM	Compact Disc-Read Only Memory
CGRO	Compton Gamma Ray Observatory
CMI	Continuous Management Improvement
COBE	Cosmic Background Explorer
COHO	Coordinated Heliospheric Observations
CoI	Co Investigator
COSPAR	Committee on Space Research
CPU	Central Processing Unit
DADS	Digital Archive Directions
DE	Dynamics Explorer
DIRBE	Diffuse Infrared Background Experiment
DLR	Deutsches Forschungs Anstalt für Luft-und Raumfahrt
EDC	Einstein Data Center
EOS	Earth Observing System
ESA	European Space Agency
EXOSAT	European X-Ray Observatory Satellite
FAST	Fast Auroral Snapshot Explorer
FITS	Flexible Image Transport System
FTP	Anonymous File Transfer Protocol
GGS	Global Geospace Science
GRO	Gamma Ray Observatory
GSFC	Goddard Space Flight Center
GUI	Graphics User Interface
HEAO	High Energy Astrophysical Observatory
HEASARC	High Energy Astrophysics Science Archive Research Center
HST	Hubble Space Telescope
IACG	Inter-Agency Consultative Group
IAGA	International Association of Geomagnetism and Aeronomy
IAU	International Astronomical Union
IDN	International Directory Network
IHS	International Heliospheric Study
IMAGE	Imager for Magnetopause-to-Aurora Global Exploration
IMP	Interplanetary Monitoring Platform
IMPACT	Interaction of Magnetospheric Particles Applied to Classroom Teaching
IMS	International Magnetospheric Study
INSPIRE	Interactive NASA Space Physics Ionospheric Radio Experiments
IRAS	Infrared Astronomical Satellite (The Netherlands-NASA-U.K.)
ISAIA	Interoperable Systems for Archival Information Access
ISAS	Institute for Space and Astronomical Studies
ISEE	International Sun-Earth Explorer
ISO	Interoperable Systems Office

ISTP	International Solar-Terrestrial Physics
IUE	International Ultraviolet Explorer (satellite, NASA-U.K.-ESA)
IUWDS	International URSIGRAM and World Days Service
KP	Key Parameter
LHEA	Laboratory for High Energy Astrophysics
MAP	Microwave Anisotropy Probe
MAST	Multi-Mission Archive at the Space Telescope Institute
MD	Master Directory (NASA)
MIDEX	Mid-Sized Explorer Projects
MIT	Massachusetts Institute of Technology
MO&DA	Mission Operation and Data Analysis
NARA	National Archive and Records Administration
NASA	National Aeronautics and Space Administration
NASIRC	NASA-Wide Automated Systems Incident Response Capability
NDADS	NSSDC Data Archive and Distribution Service
NGC	New General Catalogue
NODIS	NSSDC On-Line Data and Information Services
NOST	NASA/Science Office of Standards and Technology
NSF	National Science Foundation
NSSDC	National Space Science Data Center (NASA)
OGIP	Office of Guest Investigators Programs
OODP	Object Oriented Data Base
OSP	Orbiting Satellites Project
PDMP	Project Data Management Plan
PI	Principal Investigator
PROMIS	Polar Regions Outer Magnetosphere International Study
R&D	Research and Development
RITSS	Raytheon Information Technology and Scientific Services
ROSAT	Roentgen Satellite
RPI	Radio Plasma Imaging
RSDP	ROSAT Science Data Processing
RXTE	Rossi X-Ray Timing Explorer
SAMPEX	Solar, Anomalous and Magnetospheric Particle Explorer
SAO	Smithsonian Astrophysical Observatory
SEC	Sun-Earth Connections
SEPG	Software Engineering Management Group
SFDU	Standard Formatted Data Unit
SIMBAD	Set of Identifications, Measurements, and Bibliography for Astronomical Data
SOLTIP	SOlar connection of Transient Interplanetary Processes
SPACEWARN	World Warning Agency for Satellites
SPDF	Space Physics Data Facility
SPDS	Space Physics Data System
SPECS	Submillimeter Probe of the Evaluation of Cosmic Structures
SPOF	Science Planning and Operations Facility
SpyCat	Space Physics Catalog
SSC	Satellite Situation Center
SSDOO	Space Science Data Operations Office
SSDS	Space Science Data Service
STELAR	Study of Electronic Literature for Astronomical Research
STIS	Standards and Technology Information System
SW	SPACEWARN
SWAS	Submillimeter Wave Astronomy Satellite
TRACE	Transition Region and Coronal Explorer
TREMP	Trapped Radiation Environment Modeling Program

UCSD	University of California San Diego
URL	Universal Resource Locator
ULIRG	Ultra Luminous Infra Red Galaxy
VCI	Viewers/CATSEYE/Impress
WDC-A-R&S	World Data Center-A for Rockets and Satellites
WISARD	Web Interface for Searching Archival Data
WORM	Write Once Read Many
XML	Extensible Markup Language