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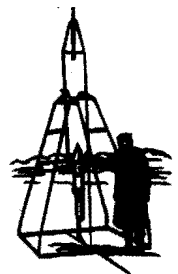
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# 1995 ANNUAL REPORT



Goddard Space Flight Center  
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ANNUAL STATISTICS  
AND HIGHLIGHTS REPORT  
FOR THE  
NATIONAL SPACE  
SCIENCE  
DATA CENTER

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# **1995 Annual Report of the National Space Science Data Center**

## **PREFACE**

The National Space Science Data Center is pleased to issue this 1995 Annual Report describing (1) the 1995 growth and evolution of NSSDC's data archives, access pathways, and other tools and services, and (2) the 1995 access to those data and services by NSSDC's customer communities. This report, revised in format relative to recent years, has been made WWW-accessible in the hope that readers will avail themselves of the opportunity to link to the services reported herein.

The scope of this report is that of the traditional NSSDC as defined by the NSSDC budget. It should be noted that some of the activities thereby supported are the responsibilities of the Astrophysics and Space Physics Data Facilities, organizational peers of the formal NSSDC within Goddard's Space Science Data Operations Office.

I welcome suggestions for user-benefiting improvements to this Annual Report and to NSSDC services.

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## 1. INTRODUCTION

This report characterizes NSSDC's data holdings, metadata holdings, access pathways, and value-added data products, tools, and services at the end of 1995, with a focus on the 1995 activities leading to that end-of-year state. In addition, this report characterizes the nature and amount of 1995 access to NSSDC's data and services by its multi-component customer community.

## 2. HIGHLIGHTS

NSSDC ingested 1.4 TB of data from 30 space science missions in 1995, to bring its total holdings of space science data to 6.6 TB. During 1995, about 0.70 TB of astrophysics and space physics data were made network accessible, doubling in one year the amount of data network-accessible from NSSDC. In addition, NSSDC held at the end of 1995 30 thousand earth science data tapes not yet migrated into the EOSDIS environment. More detailed characterizations of these numbers, by science discipline by mission, as measured in both byte counts and volume (tapes, etc.) counts are found in section 2 of this report.

During 1995, NSSDC significantly increased its World Wide Web pathways to its more important data and services. While the e-mail-based ARMS interface to NSSDC's nearline mass storage system (NDADS) has existed for a few years now, new WWW-based interfaces were created for access to both its astrophysics data (WISARD; <http://hypatia.gsfc.nasa.gov/wisard/wisard.html>) and its space physics data (SPyCAT; <http://nssdc.gsfc.nasa.gov/space/ndads/spycat.html>).

The COHOWeb system (<http://nssdc.gsfc.nasa.gov/cohoweb/cw.html>) was built to provide WWW-based display and retrieval of an initial 100 spacecraft-years of uniformized heliospheric magnetic field and plasma data from many deep-space spacecraft. COHOWeb extended the prior year's OMNIWeb effort which now provides WWW access to the 1963-1995 OMNI data set of near-Earth solar wind and related data.

Additional WWW interfaces were built to provide access to NSSDC's metadata stores, geophysical models, and spacecraft position data. The discipline pages accessible from NSSDC Home Page (<http://nssdc.gsfc.nasa.gov>) provide pathways to the descriptive material about numerous spacecraft and experiments as held in the NSSDC Master Catalog. This extends the prior year's effort which yielded WWW access to the NASA Master Directory.

NSSDC first provided WWW access during 1995 to a great many geophysical models and to pages through which key atmospheric, ionospheric, and geomagnetic and magnetospheric magnetic field models could be executed. That is, users could

specify the model, the time, and the place, and NSSDC software would compute and return values of model parameters. These models are accessible from [http://nssdc.gsfc.nasa.gov/space/model/models\\_home.html](http://nssdc.gsfc.nasa.gov/space/model/models_home.html).

In general, 1995 was a year for winding down the nearly 10-year-old NODIS system through which users logged into a captive account on an NSSDC computer to access key data and services. Most of these data and services are now WWW-accessible.

Readers are encouraged to exercise the multiple options on the hierarchical array of WWW pages starting with NSSDC's home page. There are several more functionalities beyond those called out in the preceding chapters.

### **3. DATA MANAGED AT NSSDC, AND 1995 INFLOW AND OUTFLOW**

There are several ways to characterize the multi-disciplinary NSSDC archive. Byte counts are a common metric for modern archives, and will be reported herein. Numbers and diversity of media volumes managed, and numbers of distinct data sets, are also very important. The last of these, and the diversity of media types, relate to the intellectual heterogeneity and technical heterogeneity of the archive, respectively, and we shall report on these also.

At the end of 1995, the 30-year old National Space Science Data Center had 4451 distinct data sets and accompanying documentation packages being managed. Table 1 indicates the disciplines from which these data sets come, and a breakout as to whether the data sets are digital or non-digital (film, etc.). The table shows that these data sets come from 1327 experiments which have flown on 378 mostly-NASA spacecraft. By data set count, space physics is the dominant discipline, accounting for nearly half NSSDC's data sets. This is reflective of the fact that in its early years, NASA launched a preponderance of multi-experiment space physics missions.

Note from the table that NSSDC manages roughly equal numbers of digital and non-digital (mostly film) data sets, although it should also be noted that NSSDC has been acquiring almost no non-digital data in recent years.

Table 2 is a different characterization of the NSSDC archive, by byte counts and media volume counts. The byte counts are estimates, involving assumptions about the mean numbers of bytes on various media types. Note that most NSSDC-resident astrophysics data are network-accessible, largely because the bulk of NSSDC's astrophysics data have arrived recently and because two high-volume older data sets (IUE and IRAS) have been migrated from offline to "nearline."

Note that only astrophysics data and space physics data are network-accessible from NSSDC. That planetary data is not network-accessible is the result of the emphasis

of the Planetary Data System (through which virtually all planetary data has entered the NSSDC archive for the past several years) on CD-ROM production and dissemination, and because PDS nodes are now making the most important planetary data network-accessible from their nodes. [An exception is NSSDC's WWW-accessible planetary image catalog, at <http://nssdc.gsfc.nasa.gov/imgcat/>, which is largely oriented towards the general public.] NSSDC's Earth science data are gradually being migrated to the EOSDIS data management infrastructure, hence are not good candidates for network-accessibility from NSSDC.

Table 3 better characterizes NSSDC's network-accessible data, by Project and by whether the data are immediately accessible from Magnetic disk (online) or from the robotics-based NDADS system (nearline). Note that the Glossary spells out these and other acronyms. Data held online are typically of relatively small volume and very high interest. Figure 1 shows the growth of the nearline data volume over the past five years, and indicates which projects' data ingest started in which years. It should be noted that the near line archive reached ingest rates in the 80 GB/month range in the second half of 1995.

Figure 2 characterizes the data volumes made network accessible via NDADS during 1995. Most of these data first arrived at NSSDC during this year, while a small amount was promoted to network accessibility from NSSDC's offline archive. Data inflow to NSSDC during 1995 is discussed in more detail subsequently.

Table 4 characterizes the digital media managed at NSSDC, not including back up copies. This table is an expansion of Table 2 in which total numbers of unique digital media volumes were given. It should be noted that most volumes are replicable and have one backup volume. However, for "CD-ROM (Titles)" which are not locally replicable, NSSDC typically holds between 20 and 200 copies of each title. For these, NSSDC must replenish stock through a commercial vendor as request activity drives NSSDC stock down.

Table 5 identifies NSSDC's cumulative non-digital archive, by disciplines by form factor. Note that NSSDC has large volumes of non-digital data for each of the discipline areas it supports. It should be noted, however, that very little new data are arriving at NSSDC in non-digital form in recent years. In particular, in 1995, NSSDC received in non-digital form only: Ulysses/URAP wave channel plots on 386 microfiche cards; 356 IMP-8/LEPEDEA daily spectrograms as color slides; ISEE 2 magnetic fields plots on 137 microfiche cards; and a handful of Magellan and other planetary press release photos.

### 3.a. DATA INFLOW —

Tables 6 and 7 characterize the inflow of digital data to NSSDC during 1995. In particular, Table 6 shows that NSSDC received approximately 1.43 TB of new data in 1995, via a combination of networks and hard media. Table 6 shows data volumes by project, with comparable volumes for the three major discipline areas supported by NSSDC. Table 7 characterizes the inflowing media types by discipline. Several points should be noted. CD-WO media are the dominant input media type overall, and for space physics and planetary science individually. Roughly comparable numbers of 4-mm, 8-mm, and 9-track tapes arrived at NSSDC, with 4-mm tape the most favored and 8-mm tape the least. Planetary inflow was overwhelmingly dominated by Compact Disk (both mass-replicated and write-once), astrophysics by 4-mm and 9-track tape, and space physics by the broadest range of media types.

During 1995, NSSDC received approximately 400 GB of data electronically, in addition to the data arriving on the media reported in Table 7. The electronic inflow was dominated by the ASCA, IUE, and ROSAT missions, with relatively small admixture of such missions as ISTP (mainly WIND and Geotail), IMP-8, Ulysses, Pioneer, and Voyager.

By data set count, which as noted earlier marks the intellectual heterogeneity of NSSDC, increments or totalities of 194 distinct data sets from 122 distinct experiments arrived at NSSDC during 1995. Of these 194 datasets, 130 were new data sets at NSSDC. Also, of the 122 experiments contributing data to NSSDC, first data were received from 20 experiments, largely as flown on the WIND and Ulysses spacecraft.

### 3.b. DATA OUTFLOW —

NSSDC provides user access to its data holdings through multiple electronic interfaces and, in addition, through a user support infrastructure for the mailing of offline digital and non-digital data volumes. Most electronic interfaces are accessible through NSSDC's WWW home page and include: (1) dataset-specific WWW-based interface pages; (2) anonymous/FTP pathways to a range of data files maintained permanently on NSSDC magnetic disk as well as files staged from NSSDC's nearline mass storage environment; (3) WWW-based and other interfaces to that nearline environment for the purpose of selecting data files and having it staged or downloaded; (4) NODIS, the venerable captive-account-based pathway to many NSSDC data sets and services now being phased out by newer pathways.

The dominant dataset-specific WWW-based data access interfaces NSSDC offers relate to the OMNI and uniformized-COHO datasets (through OMNIWeb and COHOWeb, respectively), the Infrared Astronomical Satellite (IRAS), and the



Astronomical Data Center astronomical source catalogs. The OMNI data set is a 30+ year compilation of multi-spacecraft near-earth solar wind magnetic fields and plasma data, while the COHOWeb database is a uniformized set of files of merged magnetic field, plasma, and position data for each of many deep space spacecraft. OMNIWeb and COHOWeb became user-available in early and late 1995 respectively and were averaging 700 and 300 home page accesses per month in late 1995.

1500 astronomical source catalogs and tables are maintained online for easy access through an ADC-specific interface first made available in 1995. During the latter part of 1995, the system was experiencing approximately 5,000 accesses per month.

A later section of this annual report summarizes the broad range of data and services made ANON/FTP-accessible by NSSDC. For the purposes of this section, we note that the main spacecraft data sets held permanently on magnetic disk for ANON-FTP access are COBE data and the Principal Investigator-provided native-formatted COHO files used as input to COHOWeb as previously described. During 1995, 4,451 COBE and 11,093 COHO data files were ANON/FTP-downloaded by users.

Table 8 summarizes the 1995 accesses to NSSDC's nearline mass storage environment through the multiplicity of available interfaces. Note that three measures are offered for each mission supported. A request is the specification of one or multiple "entry ID's" each of which is one file or a group of related files. Both request counts and counts of files are reported. Finally as a measure of the breadth of interest in the data from any given mission, we count on a monthly basis, and report annual means of these monthly counts, the numbers of unique electronic addresses (username @ site) accessing each mission's data.

[The last of these measures must be interpreted with care in the case of Vela 5B, ROSAT, and ASCA, for which the GSFC/HEASARC acts as an intermediary between some users and NSSDC's archive.]

By all measures, IUE data and the IUE user community is the dominant beneficiary of NSSDC's nearline environment. Users of ADC data represented the next most broadly based user community. Other somewhat broadly based communities accessed data from IMP-8, ISTP, DE, ROSAT, and IRAS.

That NSSDC's nearline data environment hosted a totality of 17,970 requests in 1995, for a total 0.27 million data files, demonstrates the value of this NASA-unique multi-disciplinary environment.

By way of trends, Figure 3 shows the growth in both NDADS request counts and files downloaded over the past 5 years.

While the dominant mode of dissemination of data to the astrophysics and space physics research communities is via the internet, NSSDC continues to provide a high level of offline data dissemination. The customer community for this offline data dissemination is to a large extent a general public, including educators and students. Table 9 characterizes this user community of NSSDC's offline data services.

Table 10 gives the counts of requests for offline data sets from various disciplines in 1995, and as integrated over NSSDC's history. (A small fraction of requests which are multi-disciplinary are double counted in this table.) Note particularly the dominance of planetary data over both time scales. This is largely associated with lunar and planetary image data.

Table 11 shows the most recent 5-year history of NSSDC's offline data request activity by media type. Several points are noteworthy. Requests for data on magnetic tape have been declining uniformly and dramatically over this interval. That tapes-disseminated numbers are not declining as fast as tape-request numbers is due to the inclusion of Earth-science-tape out-migration, and long-standing IUE 3-agency tape exchange, in these statistics as requests.

The dominant mode of offline digital data dissemination is now via CD-ROM. The 1992 peak visible in Table 11 is associated with Voyager planetary image CD-ROM's becoming available at that time. It is of interest to note that every working day of 1995, NSSDC mailed about 40 CD-ROMs to 3+ requesters.

Also significant from Table 11 is the fact that, while requests to NSSDC for film data have declined by a factor of 3 over the past 5 years, NSSDC still finished one film request every other working day.

#### **4. ADDITIONAL NSSDC SERVICES**

In addition to its archive of scientific data characterized in the preceding part of this Annual Report, NSSDC offers a number of additional services which are described in this Section. Note that some of the following subsections address specific services (NASA Master Directory and NSSDC's underlying RSIRS information bases, our Standards activities, our value-added data product and interface creation, etc.) while others address multi-service access pathways (WWW pages, ANON/FTP, NODIS).

##### **4.a. The NASA Master Directory**

The NASA Master Directory (NMD) is an open, network-accessible system for brief, overview information about data sets of interest in the space sciences (astrophysics, planetary science, solar physics, space physics, and space life sciences). The NMD

contains information not only about NSSDC space science data set holdings, but also about the important data sets and locations of data set information in the general space science community. A number of the non-NSSDC data set entries contain URL references to important sites on the World-Wide Web where further information may be obtained. When accessing the NMD through its WWW interface (<http://nssdc.gsfc.nasa.gov/nmd/nmd.html>) these URL's are highlighted for immediate hyperlinking to the other information sources. For NSSDC data holdings, the NMD data set information leads directly to the more detailed information on the data sets contained within NSSDC's Relational System for Information Retrieval and Storage (RSIRS - see below).

The WWW interface to the NMD now includes the capability to retrieve entries based on simple text retrieval search techniques. Further improvements are being made to the interface to incorporate some of the capabilities still available in the older windows-like interface (such as email retrieval of the information contents in both an easily-readable format or in the Directory Interchange Format (DIF) which facilitates transfer of the information to other DIF-based directories or rapid modification and update of the information in the NMD. It is expected that nearly all capabilities of the windows-like interface will be incorporated into the WWW access and then the windows interface will be discontinued.

During 1995, the mean monthly number of WWW accesses to the NMD was 784, with 358 queries being launched, which in turn led to the display of 70 actual data set descriptions. Slow growth over the year was experienced.

The number of distinct data sets, or groups of related data sets, described in the NMD, at the end of 1995 was 776. This is less than one year earlier because of the fissioning of the Earth-science- oriented Global Change Master Directory and the space-science-oriented NASA Master Directory.

Although general web search methods can be used to find information about space science data on the web, the results of such searches often yield many extraneous web sites which may not give the needed information. Directories such as the NMD are still useful in the WWW era because of the focus on a specific type of information (space science data sets) which is presented in a consistent format, and because of the NMD charter to be comprehensive.

#### 4.b. Relational System for Information Retrieval and Storage (RSIRS)

RSIRS has been the main source of detailed information about NSSDC data holdings for many years, as well as about all the spacecraft and experiments from which those and other data have come. RSIRS actually consists of a combination of a number of traditional databases describing specific parts of NSSDC data and

information holdings. These parts have been traditionally called the "partitions" of RSIRS, but now these partitions are being brought together into a more unified database containing all NSSDC metadata information.

The Automated Internal Management (AIM) File identifies virtually all launched spacecraft, the experiments carried by many of those spacecraft, and data sets primarily as archived at NSSDC. Table 12 identifies the numbers of spacecraft, experiments, and data sets described in the AIM File, along with the numbers of new entries made in 1995. The database serves as the source of information for many of the NSSDC's WWW information pages. The NSSDC Master Catalog (NMC) and a number of discipline project pages retrieve information from AIM and build WWW pages "on the fly" so that the latest information is presented to the user. Figure 4 shows the rapid growth in WWW-based access to AIM/NMC descriptions from the March 1995 introduction of their WWW access pathway to the end of the year when about 17,000 descriptions were accessed in December.

The AIM database also serves as a useful source of comparative information about spacecraft, experiments, etc. such as launch dates, time spans of data, orbital characteristics, time resolution, data availability, etc. The presence of comparative information in a consistent format within a single database makes the database especially valuable for survey reports.

A similar, but slightly different partition of RSIRS is the ~~NSSDC Supplementary Data File (NSDF)~~ ~~which tracks non-spacecraft data, multi-source spacecraft or other data, models and programs, and other NSSDC-held data sets that do not fit the AIM spacecraft/experiment/data set hierarchy.~~ See Table 13 for NSDF statistics.

The Technical Reference File (TRF) tracks individual published and unpublished papers associated with spaceflight experiments. The NSSDC ID for the experiment is attached to the reference information so lists of papers relevant to a particular experiment can be reported, and/or provided to persons accessing data from a given experiment from NSSDC. TRF also contains references to selected standards relevant to space science data management as well. TRF statistics are given in Table 14.

The Interactive Request and Name Directory (IRAND) tracks people who have interacted with NSSDC over the years. It includes full names, one or more addresses, telephone and email information, and what NSSDC distribution lists they are on. The database contains approximately 50,000 entries and this information is also accessed and made available through the PIMS interface on the NSSDC WWW Home Page. Further IRAND statistics are available as Table 15.

The Interactive Data Archive (IDA) is another RSIRS partition of interest. IDA tracks the inventory of NSSDC's digital data volumes which are stored offline. IDA had 157,683 records at the end of 1995, with 3093 records having been added during 1995.

#### 4.c. NASA/Science Office of Standards and Technology (NOST)

The NASA/Science Office of Standards and Technology (NOST) at the NSSDC exists to serve the NASA science communities in evolving cost effective, interoperable, information systems. The approach taken is to facilitate the use of new technologies, and in particular those technologies based upon, or evolving into, standards. A standard is understood to be a specification which is widely available within the community for which implementations, based upon the standard, are desired or prevalent.

NOST has focused its effort in 1995 toward facilitating the development and use of technologies and standards in the information representation and access domain, including archival information management. The NASA science disciplines continue to face significant challenges in making their digital information readily accessible to a range of users while also preserving it for the long term in the most cost-effective manner. NOST promotes multi-discipline and international/industry based standards solutions to effect maximum longevity and cost-effective support. NOST participates in the international Consultative Committee for Space Data Systems (CCSDS), with input to ISO SC 13, in areas addressing generic data packaging and description, and addressing archival information standards, as described in section 3.1.1. NOST participates in the evolution of the FITS standards through the operation of a NOST FITS technical panel that produces a standards specification for adoption by the International Astronomical Union, as described in section 3.3.2. Finally, NOST evolves and maintains the functionality of the Common Data Format (CDF) for access to data and it provides user support services as described in section 3.1.3.

##### 4.c.1. Consultative Committee for Space Data Systems (CCSDS)

NOST participates in the international CCSDS Panel 2, which is developing technologies based on standards, called CCSDS Recommendations, in support of information interchange within and among the international space agencies. NOST also supports users of these technologies by providing a support office and by providing a data description registration and dissemination service (called a Control Authority Office) in accordance with CCSDS Recommendations. The related activities, services, and accomplishments are described in the remainder of this section.

The CCSDS is a consensus, voluntary organization formed and maintained by representatives of its member agencies. Member agencies include NASA, ESA, CNES, BNSC, DLR, INPE, NASDA, CSA and TsNIIMash. Many other agencies also participate as Observers which gives them full rights except for voting.

NOST leads NASA's participation in CCSDS Panel 2. This panel is addressing the problems of information interchange among the agencies and therefore also within the agencies because these problems do not stop at agency boundaries. The recommended technologies support greater automation in understanding the information obtained from, or derived from, spaced based sensors regardless of the scientific discipline involved. To the extent practical they are based on, or add support to, already widely used standards.

Panel 2 has evolved a concept, known as Standard Formatted Data Units (SFDUs), which can be readily extended by users and also by future Panel 2 Recommendations. The three primary functions are: 1) standards for the identification, linking, and packaging of data and metadata (i.e., descriptions of data), 2) computer interpretable languages for expressing metadata, and 3) establishment of metadata registration and dissemination services to provide recognized, accessible, and permanent archives of data descriptions.

The Recommendation highlights for 1995 were in the areas of metadata registration and dissemination, canonical file name transfers, and archival standards. The Recommendation "Control Authority Data Structures" was approved by all the agencies and specifies the format for the registration, dissemination, and revision of data descriptions between users and the internationally coordinated, and ISO standardized, set of Control Authority Offices. These offices assign unique identifiers to submitted data description objects and return these identifiers to the submitters so the identifiers can be used to link data objects to their data descriptions. In addition, the draft Recommendation known as "Referencing Environment" was approved for formal agency review. It provides a standard way to express directory/filenames for exchange across heterogeneous operating systems and media and is a companion to the CCSDS/ISO-12175 (SFDU) data packaging standard being used by several NASA projects and systems. Finally, NOST lead the establishment of an archival standards work area for CCSDS as requested by ISO. Representatives from NASA disciplines, other Federal agencies, academia, and industry met in the US. to advance the initial work package producing a Reference Model for Archival Information Systems. Their enthusiasm for this effort was outstanding and was matched at the international level. The completed model, expected in May 1998, will establish initial criteria for recognition of a true archival function and should lead to improved archival implementations, provide a basis for further standardization, and provide more cost-effective vendor support.

NOST also assists implementors of selected Recommendations through its SFDU Support Office, and it operates the NSSDC Control Authority Office providing for electronic registration and WEB retrieval of data descriptions.

It has provided support to several projects in 1995 including registering descriptions from ISTP/WIND, SOHO, POLAR, IACG, SAN MARCO, and PIONEER 10/11. It has assigned 22 new registration identifiers for data description objects.

#### 4.c.2. Flexible Image Transport System (FITS) Technical Panel and Support Office

The Flexible Image Transport System (FITS) is the standard format for astronomical data transport, endorsed and supervised by the International Astronomical Union (IAU). NOST participates in the evolution of FITS by commenting on proposed new FITS extensions and conventions and by the development of a formal FITS specification document using the NOST standards accreditation process.

The NOST FITS Technical Panel produced an internationally reviewed "Definition of the Flexible Image Transport System (FITS)", NOST 100-1.1. It was approved by the NOST Executive Board and has been submitted to the IAU as an official specification of FITS. This provides NASA's astrophysical projects with a clear specification of the standard.

The FITS Support Office developed a set of World Wide Web pages which are tied to a Home Page at [http://ssdoo/gsfsc.nasa.gov/astro/fits/fits\\_home.html](http://ssdoo/gsfsc.nasa.gov/astro/fits/fits_home.html). A hypertext version of *FITS Basics and Information* describes and provides links to significant FITS documents, software packages, and network resources. The *Definition of FITS*, the *User's Guide*, FITS Support software to list headers, and the *Basics and Information* file are all accessible from the Home Page. The *Basics and Information* file is continually updated. Information remains available in text form by ftp at <ftp://nssdc.gsfsc.nasa.gov/pub/fits/>.

During the year, over 1250 accesses each were recorded for the Home and Basics Web pages, and an additional 600 copies of *FITS Basics and Information* were retrieved by anonymous ftp. Over 400 electronic retrievals each of the Standard and the *User's Guide* were logged, about half from the FITS Support Office site and half from the NRAO server.

#### 4.c.3. Common Data Format

The NSSDC Common Data Format (CDF) is a self-describing data abstraction for the storage and manipulation of multidimensional data in a discipline-independent fashion. CDF is comprised of three parts, the CDF data files that contain both the actual data values and metadata, the CDF software library that is used to create, access, manage, manipulate, etc. CDF files, and a well-defined Applications

Programming Interface (known as the CDF Interface) that provides transparent access to underlying software and data. CDF provides the essential framework for which generic applications (e.g., visualization, statistical) can easily be created.

The CDF was selected as one of the five runners-up in the 1995 NASA Software of the year Award.

The International Solar Terrestrial Physics (ISTP) Project is NASA's single largest user of CDF. The ISTP Project is using CDF to store its Key Parameter data. In addition, CDF is used heavily by the international community through the IACG projects associated with the ISTP project. This effort provides a consistency among data formats and structures and allows data to be shared transparently among a variety of projects and applications.

A World Wide Web (WWW) page located at <http://nssdc.gsfc.nasa.gov/cdf/> on the internet provides a description of CDF, access to the software distribution, documentation, papers, a list of Frequently Asked Questions, and facilitates interaction with the CDF support group at the NSSDC.

In addition, there have been a number of NSSDC WWW-based interactive applications built on top of the CDF format. Among these are OMNIWeb, COHOWeb, and CDAWeb.

The evolution of the CDF Library features and tools has continued throughout 1995. The CDF staff has been working towards the release of version 2.6 of the CDF software which is expected to be released in the summer of 1996. The primary features consist of sparse records and data compression. In addition the library was ported to a few new operating systems to support the user community.

#### 4.d. NSSDC Online Data and Information Service

After nine years of service, NSSDC's Online Data and Information Service (NODIS) will be phasing out. Since its inception in October 1986, NODIS has earned its reputation as a simple, efficient, and user-friendly gateway to NSSDC's suite of information systems and services. Figure 5 shows the history of NODIS usage over its lifetime.

During its first year of service, NODIS (then known as the NSSDC Account) averaged about 50 users per month. Its services included access to the Space Physics Analysis Network (SPAN) services menu, the Central Online Data Directory (Codd, predecessor to the NASA Master Director[NMD]), the OMNI data set (solar wind field and plasma data) menu, and a few more (seven in all). Since that time NODIS's suite of services has grown to 18 and at its peak in 1994, enjoyed an average



of 2,300 monthly users. Its most popular services have been the NMD, the Astronomical Data Center (ADC), the Planetary Science service, and the NSSDC CD-ROM Catalog.

This past year, NODIS experienced a dramatic decrease in activity due to the ever-growing popularity of the World Wide Web (WWW), whereon all previously accessible NODIS services are now available. Consequently, on March 1, 1996, NODIS will replace its current NODIS interface with a transitional, limited-functionality interface providing LYNX-based access to NSSDC's WWW Home Page from which many other NSSDC data and services are also available. In addition, this transitional interface will provide on-going access to a few traditional NODIS services containing some non-web adaptable functionality.

Access to this transitional NODIS interface will be the same as for the out-going NODIS (TELNET NSSDCA.GSFC.NASA.GOV; USERNAME=NODIS; no password prompt). The transitional NODIS interface itself will likely be removed by mid-1996.

# Glossary

ADC	Astronomical Data Center
AIM	Automated Internal Management
ANON-FTP	Anonymous File Transfer Protocol
ARMS	Automated Retrieval Mail System
ASCA	Advanced Satellite for Cosmology and Astrophysics
BNSC	British National Space Centre (United Kingdom)
CCSDS	Consultative Committee for Space Data Systems
CD-ROM	Compact Disc-Read Only Memory
CD-WO	Compact Disk-Write Once
CDAW	Coordinated Data Analysis Workshop
CDF	Common Data Format
CGRO	Compton Gamma Ray Observatory
CNES	Centre National d'Etudes Spatiales (France)
COBE	Cosmic Background Explorer
COHO	Coordinated Heliospheric Observations
CSA	Canadian Space Agency (Canada)
DE	Dynamics Explorer
DLR	Deutsche Forschungsanstalt für Luft- und Raumfahrt e.V. (Germany)
EOSDIS	Earth Observing System Data and Information System
ESA	European Space Agency
FITS	Flexible Image Transport System
GB	Gigabyte
HEAO	High Energy Astrophysics Observatory
HST	Hubble Space Telescope
HUT	Hopkins Ultraviolet Telescope
IDA	Interactive Data Archive
IMP	Interplanetary Monitoring Platform
INPE	Instituto Nacional de Pesquisas Espaciais (Brazil)
IRAND	Interactive Request and Name Directory
IRAS	Infrared Astronomical Satellite
ISEE	International Sun-Earth Explorer
ISO	International Standards Organization
ISTP	International Solar-Terrestrial Physics
IUE	International Ultraviolet Explorer
LEPEDEA	Low Energy Proton and Electron Differential Electrostatic Analyzer
NASA HQ	National Aeronautics and Space Administration (USA)
NASDA	National Space Development Agency of Japan (Japan)
NDADS	NASA Data Archive and Distribution System
NMC	NSSDC Master Catalog

NMD	NASA Master Directory
NODIS	NSSDC On-Line Data and Information Service
NOST	NASA/Science Office of Standards and Technology
NRAO	National Radio Astronomy Observatory
NSDF	NSSDC Supplementary Data File
NSSDC	National Space Science Data Center
OGLE	Optical Gravitational Lensing Experiment
OMNI	Interplanetary Medium Data
OSO	Orbiting Solar Observatory
PDS	Planetary Data System
PIMS	Personnel Information Management System
ROSAT	ROentgen SATellite (German X-ray research satellite)
RSIRS	Relational Systems for Information Retrieval and Storage
SFDU	Standard Formatted Data Unit
SPyCAT	Space Physics Catalog
TB	Terabyte
TRF	Technical Reference File
TsNIIMash	Central Research Institute of Machine Building (Russian Federation)
UIT	Ultraviolet Imaging Telescope
URAP	Unified Radio And Plasma wave experiment
URL	Universal Resource Locator
WISARD	Web Interface for Search Archival Research Data
WORM	Write-Once, Read-Many
WUPPE	Wisconsin Ultraviolet Photopolarimetry Experiment
W W W	World Wide Web

Table 1

**Counts of NSSDC Data Sets and Data Set Sources  
as of 12/31/95**

<u>Discipline</u>	<u>Digital</u>	<u>Non-Digital</u>	<u>Totals</u>	<u>Exps w. Data</u>	<u>S/C w. Data</u>
Astronomy	194	108	302	124	37
Space/Solar Physics	1,323	1,057	2380	699	149
Planetary	440	727	1167	283	86
Earth	256	159	415	209	106
Other	43	144	187		
Totals	2,256	2,195	4,451	1,327	378

Table 2

**State of the NSSDC Archive  
12/31/95**

	<u>No. of TeraBytes</u>	<u>No. of TeraBytes Network-Accessible</u>	<u>No. of Media (Digital)*</u>
Astro	1.2	1.1	3,308
Space Physics	2.3	0.3	11,876
Planetary	3.1	0	22,368
Earth	3.3	0	30,465**
Total	9.9	1.4	68,017

\* See Table 4 for detail; Not counted is large quantity of data on microfilm, microfiche, ...

\*\* Awaiting transfer to EOSDIS

Table 3

**Data Electronically Accessible from NSSDC  
as of December 31, 1995**

	Total Volume (Gigabytes) as of 12/31/95 -----			Total Volume (Gigabytes) as of 12/31/95 -----	
	Online -----	Nearline -----		Online -----	Nearline -----
Astrophysics			Space Physics		
ADC		6.9	COHO	1.7	
ASCA		337.5	DE		85.1
Astro-1			Hawkeye		13.6
HUT		0.2	IMP 8		19.0
UIT		12.3	ISEE		9.4
WUPPE		2.1	ISTP		6.2
CGRO		1.1	OMNI	0.1	
COBE	0.6		Pioneer		0.6
GINGA		0.8	San Marco		0.1
HEAO-1		12.6	Skylab		7.4
HEAO-2		4.4	Ulysses		2.3
HEAO-3		0.6	YOHKOH		138.2
HST		2.6			
IRAS		84.3	Subtotal	1.8	281.9
IUE		497.5			
NRAO		0.6			
OGLE		0.7			
OSO 8		23.1			
ROSAT		68.4			
VELA 5B		20.9			
Subtotal	0.6	1,076.6			
Grand Totals	2.4	1,358.5			

Table 4

**Counts of Volumes at NSSDC Archive  
on 12/31/95**

	Astro Physics -----	Space Physics -----	Planetary Science -----	Earth Science -----	Total -----
4-mm Tape	370	16	2	0	388
8-mm Tape	88	378	75	0	541
9-Track Tape	2,590	10,318	20,701	30,465	64,074
CD-ROM (Titles)	33	18	525	0	576
CD-WO	4	920	885	0	1,809
12" WORM (Offline)	0	56	0	0	56
12" WORM (NDADS)	203	58	0	0	261
M-O Disk	0	49	0	0	49
Totals	3,306	11,876	22,368	30,465	68,017

Backup volumes not included

Table 5

**Photographic Data Products at NSSDC by Discipline**

Discipline -----	Micro film -----	Micro fiche -----	Film (feet) -----	Film (Frames) -----	Reels -----	Slides -----	Other* -----
Astrophysics	6,020	18,524	100	63,459		89	
Earth Science	1,430		4,200	236,066			1
Planetary Science	3,294	6,345	143,214	390,735	259	5	10
Space Physics	20,188	12,872	4,640	4,379		41,502	28
Communications	183						
Other	162						
Totals	31,277	37,741	152,154	694,639	259	41,496	39



Table 6

**Data Arriving at NSSDC During 1995**

<u>Astrophysics</u>		<u>Planetary</u>		<u>Space Physics</u>	
ADC	0.1 GB	Clementine	50 GB	AE	1 GB
ASCA	273	Galileo	6	DE	70
Astro-1	2	Magellan	410	IMP-8	6
COBE	6	Pioneer Venus	15	ISEE	12
IRAS	6	Viking 1 and 2	18	ISTP	
IUE	218	Voyager 1 and 2	13	Geotail	150
OSO-8	16			Wind	70
ROSAT	21	Subtotal	512	Other	
VELA 5B	10			OHZORA	2
				SAMPEX	3
Subtotal	552			San Marco	0.1
				Ulysses	2
				Voyager	0.1
				YOHKOH	50
				Subtotal	367
Grand Total	1,431				

- 194 Data sets from 122 experiments arrived in 1995
- First data from 20 experiments arrived in 1995

Table 7

**Media Arriving at NSSDC During 1995**

	Astro- Physics -----	Space Physics -----	Planetary Science -----	Total -----
4-mm Tape	294	1	0	295
8-mm Tape	4	119	7	130
9-Track Tape	98	102	1	201
CD-ROM (Titles)	8	12	202	222
CD-WO	4	359	630	993
12" WORM	0	5	0	5
Magneto-Optic Disk	0	20	0	20
Total	408	618	840	1,866

Table 8

**NDADS 1995 Access Stats - Missions with >100  
Requests in 1995**

	<u>Number Requests</u>	<u>Mean Monthly E-addresses Accessing</u>	<u>Number Files</u>
<b>Astrophysics</b>			
IUE	7,173	112	73,136
ADC	1,942	86	20,090
VELA 5B	648	2	37,318
ROSAT	490	13	15,772
IRAS	338	12	8,683
ASCA	150	4	574
Subtotal	10,741		155,573
<b>Space Physics</b>			
IMP-8	2,551	26	32,388
Hawkeye	1,918	4	8,838
DE	1,239	14	13,667
ISTP (3 MOS)	969	23	27,594
ISEE	142	5	518
Subtotal	6,819		83,005
All Others	410		30,788
Grand Totals	17,970		269,366

Table 9

**NSSDC User Community  
[CY 1995]**

<u>Affiliation Category</u>	<u>Total Requests</u>	<u>Percent of Total</u>
Non-US, Excluding Socialist Countries	751	34.51
US Universities/Colleges	177	8.13
US K - 12 Schools	55	2.53
US Private Industry	212	9.74
No Affiliation [General Public]	729	33.50
NASA/GSFC	102	4.69
Other Government Agencies	70	3.22
Miscellaneous	6	0.28
NASA Centers, Excluding GSFC	41	1.88
Former Socialist Countries	33	1.52
Total	2,176	100.00

Table 10

**Number of Requests for Offline Satellite Data  
from NSSDC by Discipline**

<b>Discipline</b> -----	<b>Data Set Requests 1968 - 1995</b> -----	<b>Offline Data Set Requests 1995</b> -----
Astrophysics	6,984	325
Earth Science	7,049	27
Planetary Science	35,338	2,086
Space Physics	7,294	214
Ephemeris	77	6
Other	17	2
<b>Total</b>	<b>56,748</b>	<b>2,660</b>

Table 11

**NSSDC Offline Data Dissemination Statistics  
as of December 31, 1995**

Offline -----	1991 -----	1992 -----	1993 -----	1994 -----	1995 -----
Number of Requests for Tapes	688	483	209	127	67
Number of Tapes Mailed	2,878	2,258	755	2,544	676
Number of Requests for CDs	600	2,277	1,320	874	814
Number of CDs Mailed	3,747	18,373	11,405	10,669	10,469
Number of Film Requests	432	261	175	181	128
Number of Film Volumes Mailed	20,529	8,448	1,544	3,724	894

Table 12

**AIM Partition Statistics for CY 1995**

<u>Subpartition</u>	<u>Number of Records as of 12/31/95</u>	<u>Number Added in 1995</u>
Spacecraft	5,089	102
Experiment	5,471	62
Data Set	5,222	130
Totals	15,782	274

Number of spacecraft with experiments - 1,021  
 Number of experiments with data sets - 1,327

Table 13

**NSD Partition Statistics for CY 1995**

<u>Discipline</u>	<u>Number of Data Sets</u>
Astrophysics	1,031
Space Physics	430
Earth Science	65
Planetary	35
Other	26
Total	1,587



Table 14

**TRF Partition Statistics as of 12/31/95**

Total Number of Records	37,065
Number of Records Inserted	733

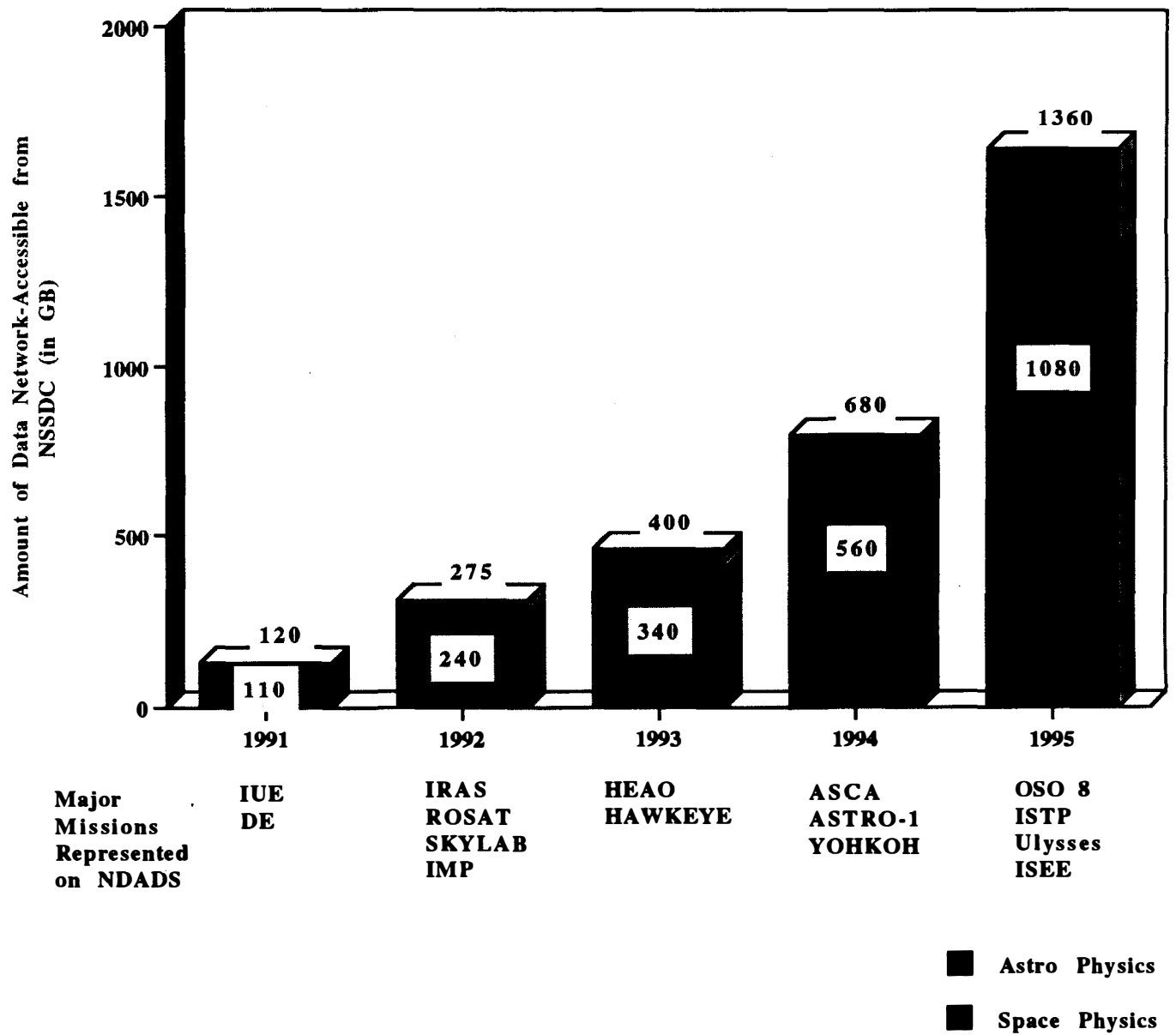
Table 15

**IRAND Partition Statistics as of 12/31/95**

Record Type	Total Records	Records Inserted	Records Updated
Personnel	50,020	1,621	3,103
Request	71,014	2,182	

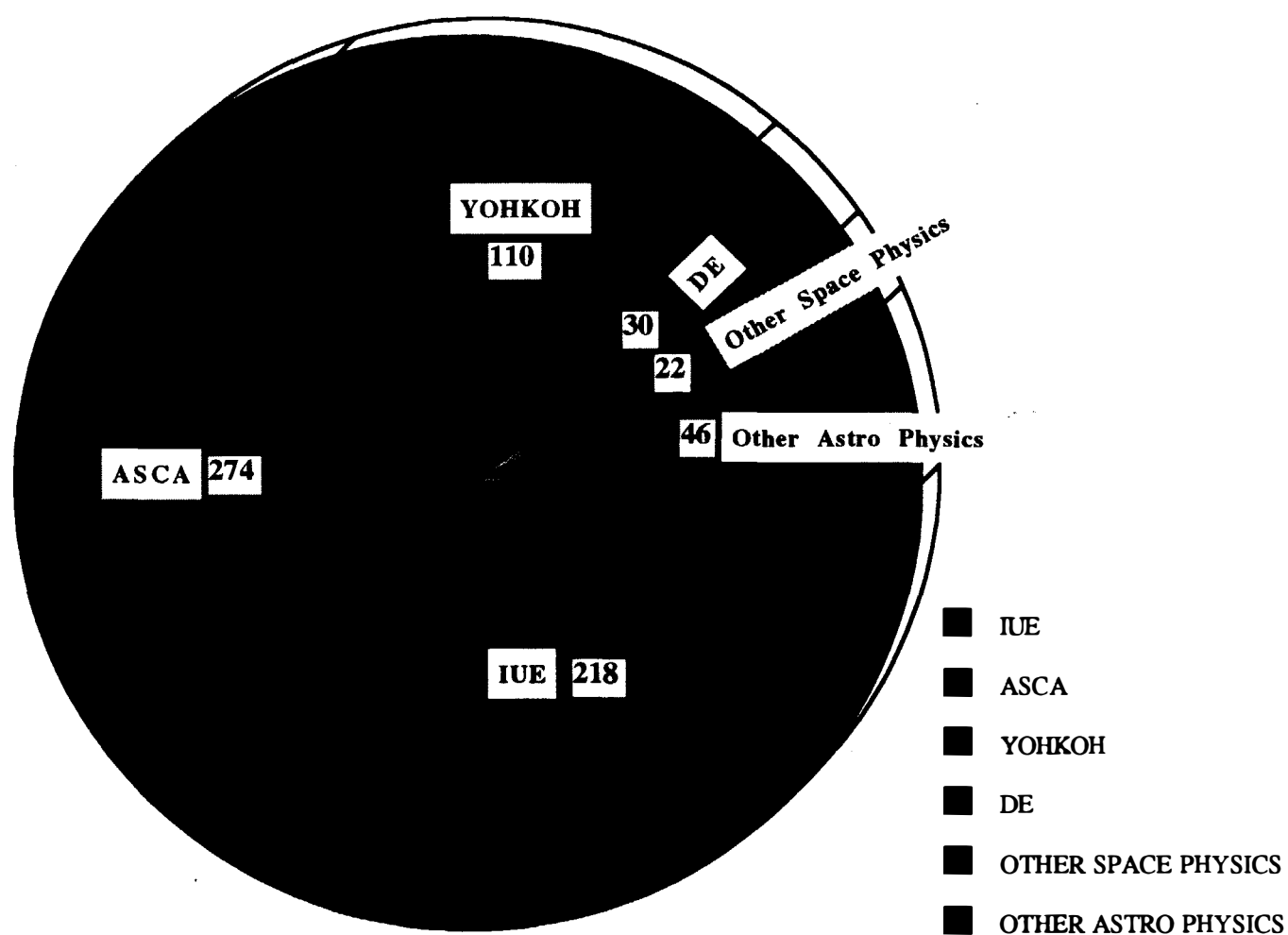
**Figure 1**

**Data Network-Accessible from NSSDC**



**Figure 2**

**1995 Data Ingest to NDADS**



**Total = 700 GB**

**Other Astrophysics: ROSAT, OSO-8, VELA 5B, IRAS, ADC, UIT**

**Other Space Physics: ISEE, IMP-8, ISTP, Ulysses, Pioneer 10 & 11, Mariner 10, San Marco**

**Figure 3**

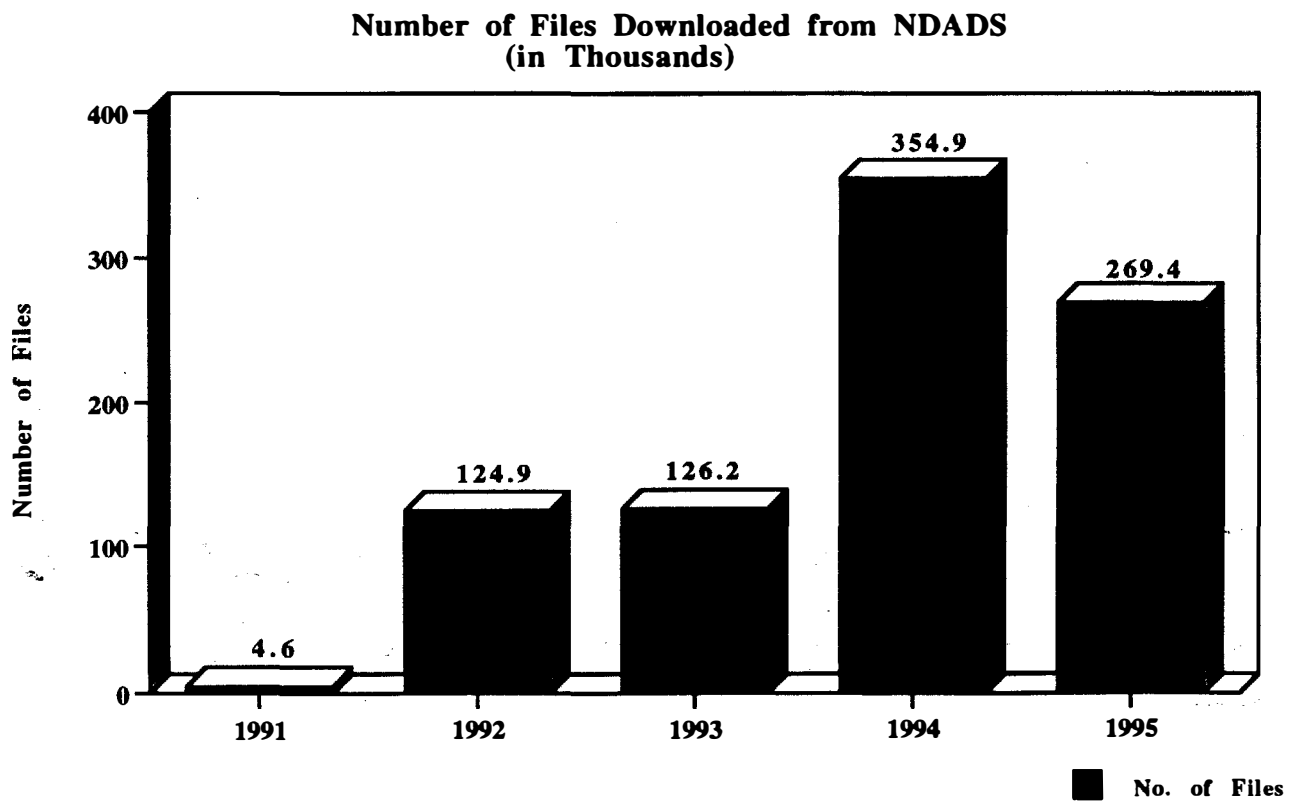
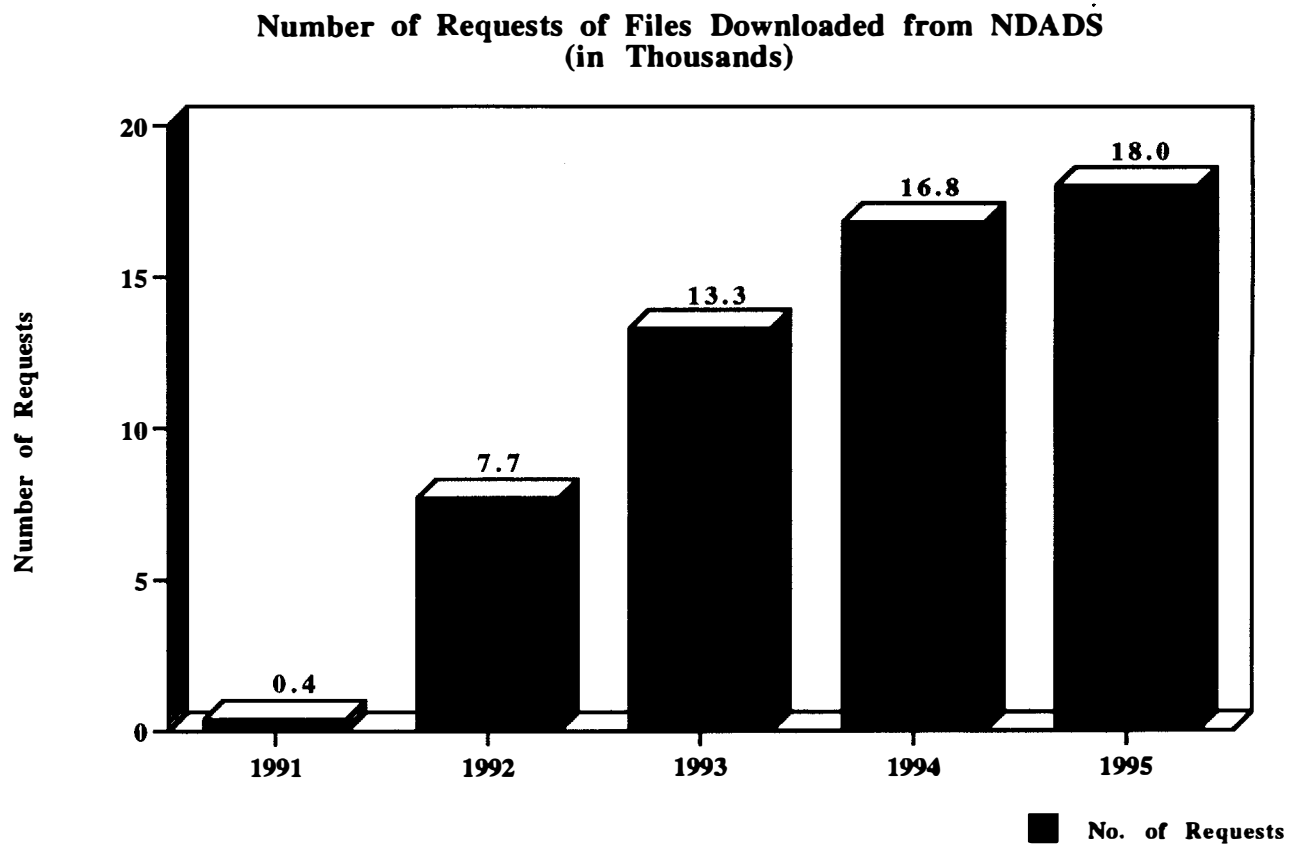


Figure 4

## Accesses to AIM/NMC Descriptions, 1995

