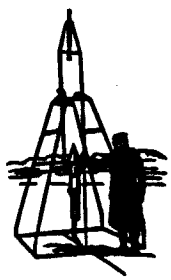
NSSDC/WDC-A-R&S 95-02

1994 ANNUAL REPORT

Goddard Space Flight Center
Greenbelt, Maryland 20771



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ANNUAL REPORT: STATISTICS AND HIGHLIGHTS FOR THE NATIONAL SPACE SCIENCE DATA CENTER

Joseph H. King
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PREFACE

The National Space Science Data Center (NSSDC) is pleased to present this annual report of its 1994 activities and achievements. During 1994 the NSSDC space science data archive grew with the addition of important recent and current data, became more robust as NSSDC virtually completed its migration of space science data from tapes older than ten years to new media and grew more community-accessible as more data were archived on the network-accessible NDADS optical disk mass store systems and as NSSDC continued to exploit World Wide Web (WWW) technology. Easier access to NSSDC data resulted in a continuing growth in NSSDC's data dissemination rate. In addition, NSSDC is pleased to report on its additional activities. These include information system activities, particularly the NASA Master Directory, whereby scientists and program managers learn of data at NSSDC and elsewhere; and standards and technology activities, in particular to those related to the Common Data Format (CDF), the Flexible Image Transport System (FITS), and the Standard Formatted Data Unit (SFDU).

The pages of this annual report are replete with statistics showing growth rates in virtually all NSSDC's metrics. They also present a quantitative characterization, particularly by media type and by discipline, of NSSDC's data archive at the end of 1994.

Some qualitative highlights of NSSDC's year include the following:

- Initial ingestion and dissemination of data from the Advanced Satellite for Cosmology and Astrophysics (ASCA) and SAMPEX missions.
- Continuing ingestion and dissemination of data from such missions as the Cosmic Background Explorer (COBE), the Roentgen Satellite (ROSAT), the International Ultraviolet Explorer (IUE), the Interplanetary Monitoring Platform (IMP 8), Dynamics Explorer (DE), YOHKOH, Magellan, Pioneer, and Voyager.
- Creation of OMNIWeb, whereby hourly solar wind data are made available via the WWW for graphical browsing and networked downloading.
- WWW-dissemination of very large numbers of images of the collision of Comet Shoemaker-Levy 9 with Jupiter, in near real time.
- Preparation and issuance of CD-ROMs of COBE, Magnetic Field Satellite (MAGSAT), and Dynamics Explorer data.
- Improvement in the NSSDC Data Archive and Distribution Service (NDADS) ingest procedures to support nearly a doubling of data made network-accessible, relative to earlier years.
- Enough additional data made NDADS accessible to stimulate a near tripling of the number of data files downloaded from NDADS.
- Separation of the NASA Master Directory (NMD) from the Global Change Master Directory (GCMD) for better support for space scientists, and WWW accessibility of the NMD.
- Publication of at least 37 papers in the refereed space physics literature citing NSSDC as their source of data.

- The Common Data Format software port to Dec/Alpha/OSF, Sun/Solaris, and Macintosh/OS.V7 environments, continued CDF use to underlie much International Solar-Terrestrial Physics (ISTP) data management, and CDF network-accessibility via a CDF WWW page at NSSDC.

- Development of major software modules aimed at the writing/reading of Standard Formatted Data Unit-structured data, bringing SFDU ever closer to fully realizing its potential; also, major advances towards standards for data dictionaries.

- Change in mode of distribution of the NSSDC newsletter from mailing of full paper issues to mailing of synopsized paper versions and WWW access to full articles.

I welcome readers' comments on this report as we continue to make it a more useful characterization of NSSDC's activities. I thank NSSDC staff members, notably Curt Barrett, Winny Davenport, Greg Goucher, Nate James, Rob Kilgore, Lou Mayo, Ralph Post, Pat Ross, Don Sawyer, Jim Thieman, and Syed Towheed for support in its creation.

Joseph H. King
Head, National Space Science Data Center

May 10, 1995

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DATA MANAGEMENT AND DISSEMINATION AT NSSDC

1.0 Data Management and Dissemination at NSSDC

This section is separated into parts addressing the building and management of the archive and the dissemination of data from the archive.

1.1 Building and Managing the Data Archive at NSSDC

During 1994 NSSDC brought many data into its archive, made many newly arriving data and some previously archived data electronically accessible, and migrated some archived data from old to new media. These three activities are separately addressed in the following subsections.

1.1.1 The Data Archive at NSSDC

During 1994 NSSDC added data from 27 distinct NASA missions in the fields of astrophysics, space plasma and solar physics, planetary science, and Earth science. Tables 1-4 show the digital archive at NSSDC grouped by major discipline as of the end of 1994 as well as the data influx during 1994. (See pages 5, 6, 7, and 8.)

Table 5 shows the data received at NSSDC in 1994 in another representation relative to Tables 1-4. (See page 9.) The "Other" column reflects the increased utilization at the NSSDC of the evolving CD (Compact Disk) -Write-Once technology. Analog data include IMP-J, Magellan, and Ulysses images. The overall analog data holdings at NSSDC at the end of 1994 are characterized by discipline in Table 6. (See page 10.)

Total counts of data volumes at NSSDC at the end of 1994 are given in Table 7. (See page 11.) Note that these total counts include both primary and backup copies of data whereas the counts of the previous tables relate to primary copies only.

Yet another discipline-oriented characterization of the NSSDC data archive is Table 8, which shows the total numbers of spaceflight experiments with data at NSSDC. (See page 12.) It is noteworthy that NSSDC held data from 1,157 such experiments, mostly but not totally from NASA missions. More than half of these are space/solar physics, a discipline area in which NASA flew many multi-instrumented spacecraft in its early years.

1.1.2 Bringing Data to Electronic Accessibility

To facilitate data availability to an increasingly networked customer community, NSSDC continued its migration of data to electronic accessibility. NSSDC presently holds a modest amount of data on magnetic disk (on line) and a large and growing amount on its optical disk jukeboxes (near line). NSSDC presently offers four electronic interfaces to various subsets of its archive.

NSSDC is beginning to make its data accessible via the World Wide Web (WWW). This is in addition to NSSDC's more readily WWW-transferable information assets. During 1994 the 1963-1994 hourly solar wind OMNI data set and much Hawkeye data were made WWW-accessible via "OMNIWeb".

Selected additional data sets are held permanently on line for File Transfer Protocol (FTP) access via an ANONYMOUS account. These include COBE data and hourly solar wind data from several heliosphere missions constituting the Coordinated Heliospheric Observations (COHO) data base. (See Figure 6, page 38.)

The NSSDC On-Line Data and Information System (NODIS) account offers data set specific interfaces to OMNI and to various other information options further discussed in section 3. (See Figure 7, page 39.)

Finally, the NSSDC Data Archive and Distribution Service (NDADS) makes many more data available than NODIS or FTP access to the permanently on-line data. NDADS is a pair of jukeboxes holding 12" Write-Once, Read-Many (WORM) optical disks. NDADS has a total capacity of 1.2 TB; actual holdings grew from 395 GB to 663 GB in 1994. Table 9 shows annual amounts of data ingested to NDADS during 1989-1994, separated for astrophysics and space physics missions. (See page 12.)

Table 10 characterizes NSSDC's primary electronically-accessible data holdings at the end of 1994 and also shows the amounts of data ingested to NDADS during 1994, by mission. (See page 13.)

1.1.3 Data Restoration at NSSDC

At the end of 1994 the NSSDC was nearing the end of a key element of future accessibility of data in its

archives, the continued program of migrating data from old 7-track and 9-track tapes to new media pairs (9-track tape and 3480 tape cartridges). Table 11 shows the number of tapes input to the program over its seven-year life and the number handled in 1994, by discipline. (See page 14.) During this period of time a total of 6,050 output pairs was generated from the 35,117 input tapes. Current schedules project that this program will be completed during the second quarter of calendar year 1995 at which time the NSSDC will hold no space science tapes older than ten years. The Data Restoration Project will then be replaced by an ongoing data preservation activity. Newer media types will be used. During these activities the NSSDC has been and will continue to be guided by the community prioritizations of data sets.

1.2 Disseminating Data from NSSDC

NSSDC disseminates many data, both electronically and via off-line mailings of data volumes. This section is separated into subsections addressing these two distinct modes. In most cases of electronic dissemination, there is no NSSDC staff involvement. In the subsections below the NSSDC is able to characterize better its off-line users since more information about off-line requesters is captured into an information base. Such information is impractical to capture where users are accessing data electronically, so the amount of electronic access activity to on-line and near-line files is taken as the measure of their value.

1.2.1 Electronic Data Access

During 1994 NSSDC continued to witness continuous growth in the electronic dissemination of data. The numbers of accesses to the various NODIS data files during 1994 are given in Section 3. (See Figure 8, page 40). Likewise, the numbers of FTP accesses to data held permanently on magnetic disk are given. (See Figure 7, page 39). Finally, the numbers of accesses and, separately, the numbers of files downloaded by NDADS users are given in Table 12, by mission. (See page 14.) For comparison the equivalent numbers for 1993 are also shown in Table 13. (See page 15.) NSSDC continues to be very pleased with the increased use of NDADS and other NSSDC systems.

1.2.2 Off-Line Data Access

During 1994 NSSDC satisfied 3,738 distinct requests for off-line data. Table 14 lists the most frequently requested data sets in order of their request numbers. (See pages 15 and 16.) Note the multi-disciplinary character of the data sets high on this list. The planetary data and many other top ranked data sets were sent out largely on Compact Disk-Read Only Memory (CD-ROM). Table 15 shows the numbers of data requests satisfied by NSSDC in 1994 and over its lifetime. (See page 17.) Planetary requests dominate owing to the popularity of lunar and planetary images. There is a remarkable balance across the other NSSDC-supported disciplines over the years.

Table 16 shows the numbers of media types mailed by NSSDC in 1994. (See page 17.) Note that at 600+ MB/CD-ROM nearly 6.4 TB of data were disseminated on CD-ROM. The numbers of various media type disseminated at NSSDC are shown in Table 17. (See page 18.) Table 18 shows monthly off-line shipping activity levels. (See page 19.) The numbers are dominated by newsletter mailings, but it is noteworthy that on average there were 7.5 daily data shipments from NSSDC. During 1994 approximately 39% of NSSDC requests for off-line data were received by letter or FAX, 33% were received by telephone or other oral communication, and 28% were received electronically.

Table 19 characterizes the NSSDC off-line data request community. (See page 20.) In addition to continuing its support for the NASA and other U.S. and international research communities, NSSDC is supporting access by the "general public" to NASA data. To a significant extent this represents getting CD-ROMs into the U.S. educational community.

PRIMARY DIGITAL DATA VOLUMES AT NSSDC AS OF DECEMBER 31, 1994

DISCIPLINE MISSION	TOTAL VOLUME COUNTS			VOLUMES RECEIVED IN 1994		
	9-TRACK TAPES	OTHER MEDIA	MEDIA TYPE	9-TRACK TAPES	OTHER MEDIA	MEDIA TYPE
ASTROPHYSICS						
ASTRO 1		6	8 mm		6	8 mm
COBE		11	8 mm		10	8 mm
		1	4 mm		1	4 mm
IRAS	283	12	CD		7	CD
		45	8 mm			
IUE	1,892	47	4 mm	102	21	4mm
ROSAT		11	8 mm		11	8mm
		7	OD			
OTHER	6,280	28	4 mm			
		11	8 mm			
		15	CD			
		11	OD			
		10	Floppy			
		27	CD			
TOTALS	8,455	18	OD	102	9	CD
		76	4 mm		22	4 mm
		84	8 mm		27	8 mm

Table 1. Astrophysics Data Volumes Held at NSSDC at the End of 1994 and Received During 1994 by Mission. Counts of backup copies are not included. In virtually all cases "OD" refers to Write-Once, Read-Many (WORM) optical disks. Counts of volumes received at NSSDC during 1994 do not include volumes created at NSSDC

PRIMARY DIGITAL DATA VOLUMES AT NSSDC AS OF DECEMBER 31, 1994

DISCIPLINE MISSION	TOTAL VOLUME COUNTS			VOLUMES RECEIVED IN 1994		
	9-TRACK TAPES	OTHER MEDIA	MEDIA TYPE	9-TRACK TAPES	OTHER MEDIA	MEDIA TYPE
SPACE PHYSICS						
DE 2	32	28	OD	1	14	8 mm
		20	8 mm			
		1	Floppy			
		2	V Tape			
ESRO 4	4			1		
GEOTAIL		561	CD-WO		326	WO-CD
IMP-J	2,943			17		
MAGSAT	228	5	CD		5	CD
SAMPEX		29	OD		29	OD
SMM	52	1	Floppy		19	8 mm
		5	OD			
		19	8 mm			
YOHKOH		1	Floppy		69	8 mm
		123	8 mm			
OTHER	16,994	9	Floppy			
		97	8 mm			
		15	4 mm			
		44	OD			
TOTALS	20,253	106	OD	19	5	CD
		2	Floppy		29	OD
		2	V Tape		103	8 mm
		259	8 mm		326	WO-CD
		15	4 mm			
		561	CD-WO			

Table 2. Space Physics Data Volumes Held at NSSDC at the End of 1994 and Received During 1994 by Mission. Counts of backup copies are not included. In virtually all cases, "OD" refers to Write-Once, Read-Many (WORM) optical disks. Counts of volumes received at NSSDC during 1994 do not include volumes created at NSSDC. (Network refers to numbers of data sets received electronically.)

PRIMARY DIGITAL DATA VOLUMES AT NSSDC AS OF DECEMBER 31, 1994

DISCIPLINE MISSION	TOTAL VOLUME COUNTS			VOLUMES RECEIVED IN 1994		
	9-TRACK TAPES	OTHER MEDIA	MEDIA TYPE	9-TRACK TAPES	OTHER MEDIA	MEDIA TYPE
PLANETARY SCIENCE						
MAGELLAN	16,587	68	8 mm	3,344	45	8 mm
		188	CD		19	CD
		5	Floppy		2	Floppy
		210	CD-WO		210	CD-WO
MARINER 9	53	9	CD-WO		9	CD-WO
MARINER 10	590	15	CD-WO		15	CD-WO
PIONEER 10	395			33		
PIONEER 11	410			17		
PIONEER VENUS 1	522	140	CD	3	140	CD
		2	4 mm			
VIKING 1 ORBITER	494	80	CD		18	CD
VIKING 1 LANDER	226	3	CD-WO		3	CD-WO
VIKING 2 ORBITER	241	61	CD		14	CD
VIKING 2 LANDER	321	3	CD-WO		3	CD-WO
VOYAGER 1	848	12	CD	1	5	CD
VOYAGER 2	568	14	CD	2	1	CD
OTHER	3,035	5	CD			
		3	V Tape			
		4	Floppy			
TOTALS	24,290	501	CD	3,400	197	CD
		2	4 mm		45	8 mm
		68	8 mm		2	Floppy
		9	Floppy		240	CD-WO
		3	V Tape			
		240	CD-WO			

Table 3. Planetary Data Volumes Held at NSSDC at the End of 1994 and Received During 1994 by Mission. Pioneer 10 and 11 and Voyager 1 and 2 provided both space physics and planetary data but are fully accounted for under planetary

PRIMARY DIGITAL DATA VOLUMES AT NSSDC AS OF DECEMBER 31, 1994

DISCIPLINE MISSION	TOTAL VOLUME COUNTS			VOLUMES RECEIVED IN 1994		
	9-TRACK TAPES	OTHER MEDIA	MEDIA TYPE	9-TRACK TAPES	OTHER MEDIA	MEDIA TYPE
EARTH SCIENCE						
ERBS	367	305	OD	4		
Nimbus 7	15,554	7	CD	21	16	3480 Tape
		1	OD		8	Floppy
		42	Floppy			
		2	V Tape			
		16	3480 Tape			
Other	37,855	1	V Tape			
		2	CD			
		307	OD			
TOTALS	53,776	9	CD	25	16	3480 Tape
		613	OD		8	Floppy
		42	Floppy			
		3	V Tape			
		16	3480 Tape			

Table 4. Earth Science Data Volumes Held at NSSDC at the End of 1994 and Received During 1994 by Mission

DATA INGEST 1994

SPACECRAFT	TAPES				MAGNETO-OPTICAL DISKS	CD-ROMs	OTHER	ANALOG
	9-TRACK	8 mm	4 mm	3480				
ASTRO 1		6						
COBE		10	1					
DE 2	1	14						
ERBS	4							
ESRO 4	1							
GALILEO ORB								2
GEOTAIL							326†	
IMP-J	17							357
IRAS						7		
ISEE 1								21
ISEE 2								22
IUE	102		21					
MAGELLAN	3,344	45				19	2* 210†	69
MAGION								4
MAGSAT						5		
MARINER 9							9†	
MARINER 10							15†	
NIMBUS 7	21			16			8*	
PIONEER 10	33							
PIONEER 11	17							
PIONEER VENUS 1	3					140		
ROSAT		11				2		
SAMPEX					29			
SMM		19	1					
SRL 1								27
ULYSSES								1,044
VIKING 1, LANDER							3†	
VIKING 1, ORBITER			2			18		
VIKING 2, LANDER							3†	
VIKING 2, ORBITER						14		
VOYAGER 1	1					5		
VOYAGER 2	2					1		
YOHKOH		69						

* Floppies † Write-Once CD-ROM

Table 5. Data Volumes Received During 1994 Listed by Discipline

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	236,061			1
PLANETARY SCIENCE	3,294	6,345	143,214	390,725	259	5	10
SPACE PHYSICS	20,188	12,735	4,640	4,379		41,146	28
COMMUNICATIONS	183						
OTHER	162						
TOTALS	31,277	37,604	152,154	694,624	259	41,240	39

Table 6. Photographic Data Products at NSSDC Listed by Discipline

VOLUME OF DATA AT NSSDC BY STORAGE MEDIUM

STORAGE MEDIUM	VOLUME AS OF DECEMBER 31, 1994	INCREASE SINCE DECEMBER 31, 1993
DIGITAL MAGNETIC TAPE:		
1/2 in. x 2,400 ft.	90,000	3,546
4 mm	97	22
8 mm	584	174
3480	35,000	16
CD-ROM (TITLES)	582	211
CD-ROM WRITE-ONCE	801	566
OPTICAL DISK:		
OPTIMEM	52	24
SONY (MANAGED)	3	3
MAGNETO	29	29
FLOPPY DISK	88	10
MICROFILM, 100-ft. REELS	39,121	1
MICROFICHE	46,586	1,044
PHOTOGRAPHIC FILM:		
5-in.WIDTH, LINEAR ft.	174,578	0
9.5-in. WIDTH, LINEAR ft.	268,078	0
70-mm WIDTH, LINEAR ft.	590,219	0
35-mm WIDTH, LINEAR ft.	707,852	0
16-mm WIDTH, LINEAR ft.	353,341	0
70-mm WIDTH, EACH	752	0
4x5 in., EACH	21,656	52
5x5 in., EACH	1,181	0
5x7 in., EACH	874	0
5x12 in., EACH	4,045	0
8x10 in., EACH	69,220	37
11x14 in., EACH	52	0
12x15.5 in., EACH	8	0
16x20 in., EACH	95	0
20x24 in., EACH	8,264	0
2.25x2.25 in., EACH	36,069	356

Table 7. Total Counts of Volumes by Type in the NSSDC Archive as of the End of 1994 and Changes Relative to the Previous Year. For round tapes the "increase" represents new tapes submitted less a net diminution associated with NSSDC's Data Restoration Project (See section 1.1.3)

NUMBER OF EXPERIMENTS BY DISCIPLINE/ SUBDISCIPLINE WITH DATA ARCHIVED AT NSSDC THROUGH 1994

DISCIPLINE	EXPERIMENTS WITH DATA	EXPERIMENTS WITH FIRST DATA SET RECEIVED IN 1994
ASTROPHYSICS	115	6
SPACE PHYSICS	637	13
PLANETARY	269	1
EARTH SCIENCES	119	2
LIFE SCIENCES	4	0
OTHER	13	0
TOTALS	1,157	22

Table 8. Experiments with Data by Discipline

NEAR-LINE INGEST 1989 - 1994

YEAR	ASTROPHYSICS	SPACE PHYSICS	TOTAL
1989	0.39 GB	0.00 GB	0.39 GB
1990	41.43 GB	5.60 GB	47.03 GB
1991	71.60 GB	4.35 GB	75.95 GB
1992	128.63 GB	25.36 GB	153.99 GB
1993	95.14 GB	22.84 GB	117.98 GB
1994	206.57 GB	60.59 GB	267.16 GB
TOTALS	543.76 GB	118.74 GB	662.503 GB

Table 9. NDADS Ingest Annual Rates by Discipline

DATA ELECTRONICALLY ACCESSIBLE FROM NSSDC AS OF DECEMBER 31, 1994

	TOTAL VOLUME OF MBYTES		MBYTES MADE ELECTRONICALLY ACCESSIBLE	
MISSION	ON-LINE	NEAR-LINE	ON-LINE	NEAR-LINE
SPACE PHYSICS				
DE				24,566
HAWKEYE		13,577		
IMP 8		12,400		6,257
ISEE 3		1,430	1,445	
SKYLAB		7,350		
YOHKOH		28,590		28,590
ASTROPHYSICS				
ADC		6,180		1,240
ASCA		63,850		63,850
COHO	470		295	
COPERNICUS		5		
GINGA		55,612		
CGRO		1,144		1,144
HEAO 1		12,580		
HEAO 2		4,361		
HEAO 3		604		
HST		2,600		
HUT				
IRAS		83,042		2
ISTP		4,909		1,163
IUE & IUE FA		278,938		89,808
NIMBUS				
NRAO		650		
OGLE		653		
OMNI	36		8	
OSO 8		6,677		6,677
ROSAT		51,280		21,490
STELAR		4,250		
WUPPE		2,105		2,105
UIT		12,266		12,266
VELA 5B		11,197		7,987
TOTALS	506	666,250	1,748	267,163

Table 10. Electronically Accessible Data by Mission

NUMBER OF RESTORED TAPES FROM NSSDC BY DISCIPLINE

DISCIPLINE	RESTORED TAPES 1988 - 1994	RESTORED TAPES 1994
ASTROPHYSICS	2,512	1,569
SPACE SCIENCE (AND SOLAR)	13,442	2,208
PLANETARY SCIENCE (AND LUNAR)	3,212	2,006
EARTH SCIENCE	15,951	884
TOTALS	35,117	6,667

TOTAL OF OUTPUT TAPE PAIRS FOR 1988 - 1994 = 6,050

Table 11. Counts of Restored Tapes

NDADS DATA ACCESS CY 1994

DISCIPLINE	NUMBER OF FILES	REQUESTS
SPACE PHYSICS		
DE	19,629	317
HAWKEYE	26,254	1,062
IMP 8	23,651	882
ISEE 3	2,090	63
SKYLAB	578	27
YOHKOH	31	20
ASTROPHYSICS		
ADC	13,440	1,923
ASCA	555	98
BBXRT	79	12
CGRO_BATSE	290	9
CGRO_EGRET	18	5
COPERNICUS	9	10
GINGA	4	10
HEAO 3	2	1
HST	66	44
HUT	342	7
IUE	74,639	7,943
IRAS	7,725	756
NRAO	38	55
OGLE	24	23
OSO 8	14	2
ROSAT	63,890	2,269
UIT	77	15
VELA 5B	117,840	1,249
WUPPE	3,641	0
TOTALS	354,926	16,802

Table 12. Data Disseminated from the NSSDC in 1994 Through NDADS

NDADS DATA ACCESS CY 1993

DISCIPLINE	NUMBER OF FILES	REQUESTS
SPACE PHYSICS		
DE	3,305	146
HAWKEYE	977	153
IMP 8	4,779	524
ISEE 3	2,996	150
SKYLAB	279	51
ASTROPHYSICS		
ADC	6,680	1,446
COPERNICUS	1,109	5
HEAO 2	19	9
HST	45	7
IUE	55,612	5,800
IRAS	3,511	448
NRAO	203	32
OGLE	13	11
ROSAT	29,677	3,900
STELAR	798	247
VELA 5B	16,244	391
TOTALS	126,247	13,320

Table 13. NDADS Data Access for 1993

DATA MOST FREQUENTLY REQUESTED FROM NSSDC CY 1994

RECORD ID	NAME	COMPLETED REQUESTS
77-076A-10	VOYAGER 2, IMAGING SCIENCE (ISS)	1,103
77-084A-01	VOYAGER 1, IMAGING SCIENCE (ISS)	539
75-075A-01	VIKING 1, ORBITER IMAGING	437
89-033B-01	MAGELLAN, SYNTHETIC APERTURE RADAR	332
75-083A-01	VIKING 2, ORBITER IMAGING	306
GA-16	MISCELLANEOUS ASTRONOMY CATALOGS	200
83-004A-01	IRAS, IR TELESCOPE	160
89-084B-10	GALILEO, SOLID-STATE IMAGING (SSI)	116
78-098A-09	NIMBUS 7, SBUV/TOMS-SOL BK UV/0Z	110
69-043A-01	APOLLO 10, PHOTOS 70 mm +16 mm	38
78-013A-04	HEAO 2, IMAGING PROPORTIONAL CENTER	35
67-008A-01	LUNAR ORBITER 3, LUNAR PHOTOS	30

Table 14. Data Sets Sorted by Off-Line Request Activity (continued on the following page)

DATA MOST FREQUENTLY REQUESTED FROM NSSDC CY 1994 (CONTINUED)

RECORD ID	NAME	COMPLETED REQUESTS
SM-41	OMNITAPE	29
71-063A-01	APOLLO 15A, HANDHELD PHOTOGRAPHY	26
78-103A-02	HEAO 2, HIGH RESOLUTION IMAGER	20
90-049A-02	ROSAT, POS SENSITIVE PROPORTIONAL CENTER	18
72-031A-01	APOLLO 16A, HANDHELD PHOTOGRAPHY	18
90-049A-01	ROSAT, HIGH RESOLUTION IMAGER	18
65-059A-01	APOLLO 11, PHOTOS 70 mm, 35 mm, & 16 mm	17
73-078A-01	IMP-J, TRI-AXIS MAGNETOMETER	17
XD-B3	PLANETARY OBSERVATIONS, COMET	17
XD-B2	PLANETARY OBSERVATIONS, MISCELLANEOUS	16
72-096A-05	APOLLO 17A, HANDHELD PHOTOGRAPHY	15
MN-61	ATMOSPHERIC MODELS	14
79-094A-02	MAGSAT, VECTOR MAGNETOMETER	13
GA-15	ASTRONOMY CATALOGS, COMBINED DATA	11
73-085A-01	MARINER 10, TELEVISION PHOTOGRAPHY	10
71-008A-01	APOLLO 14A, PHOTOGRAPHY	10
69-099A-01	APOLLO 12, PHOTOS 70 mm, 35 mm, & 16 mm	10
GA-11	ASTRONOMIC DATA CATALOGS	9
91-062A-02	YOHKOH, SOFT X-RAY TELESCOPE	8
66-100A-01	LUNAR ORBITER 2, LUNAR PHOTOS	8
73-027A-05	SKYLAB, X-RAY SPECTROMETER TELESCOPE (SO54)	7
MI-91	IONOSPHERIC MODELS	7
67-041A-01	LUNAR ORBITER 4, LUNAR PHOTOS	6
78-051A-13	PVO, ELECTRIC FIELD DETECT (OEFD)	6
78-103A-03	HEAO 2, CRYSTAL X-RAY SPECTROMETER	6
78-103A-05	HEAO 2, SOLID STATE SPECTROMETER (SSS)	6
78-098A-07	NIMBUS 7, ERB-EARTH RADIATION BUDGET	6
78-103A-01	HEAO 2, MONITOR PROPORTIONAL CENTER	6
SL-23	PLANETARY AND TERRESTRIAL AMPS	6
71-051A-04	MARINER 9, TELEVISION PHOTOGRAPHY	5
78-079A-01	ISEE 3, SOLAR WIND PLASMA	5
89-084B-01	GALILEO, NEAR IR MAPPING SPECTROMETER (NIMS)	5
89-089A-02	COBE, DIFFUSE IR BACKGROUND EXPERIMENT	5
67-075A-01	LUNAR ORBITER 5, LUNAR PHOTOS	5
PT-11	TRAPPED RADIATION MODELS	5
91-062A-01	YOHKOH, HARD X-RAY TELESCOPE (HXT)	4
73-019A-01	PIONEER 11, 3-AXIS HELIUM MAGNETOMETER	4
67-112A-01	SURVEYOR 6, TELEVISION	4
89-089A-03	COBE, DIFFERENTIAL MICROWAVE RADIO	4
78-051A-12	PVO, MAGNETOMETER (OMAG)	4
78-102A-01	IUE, ULTRAVIOLET SPECTROGRAPH	4
70-029A-01	APOLLO 13, PHOTOS	4
77-102A-01	ISEE 1, FAST PLASMA AND SOLAR WIND ION	4

Table 14. Data Sets Sorted by Off-Line Request Activity (continued)

NUMBER OF REQUESTS FOR SATELLITE DATA FROM NSSDC BY DISCIPLINE

DISCIPLINE	DATA SET REQUESTS 1968 - 1994	OFF-LINE DATA SET REQUESTS 1994
ASTROPHYSICS	6,659	423
EARTH SCIENCE	7,022	127
PLANETARY SCIENCE	33,242	2,875
SPACE PHYSICS	7,080	91
EPHEMERIS	70	13
OTHER	10	0
TOTALS	54,088	3,529

Table 15. Off-Line Request Counts by Discipline

NSSDC REQUESTS BY OUTPUT MEDIUM CY 1994

MEDIUM	REQUESTS COMPLETED	QUANTITY	AVERAGE QUANTITY PER REQUEST	OUTPUT UNIT
FLOPPY DISKS	370	421	1.138	EACH DISK
CD-ROM	874	10,669	12.207	EACH DISK
BOOKS/BOUND VOLUMES	1,707	2,497	1.463	EACH BINDER
COMPUTER TAPES	93	2,256	24.258	2,400-FOOT TAPE
NEGATIVES (FEET)	1	10	10.000	EACH STRIP
HARD COPY	307	4,201	13.684	EACH PAGE
MOVIE/KINESCOPE FILM	5	5	1.000	EACH ROLL
MICROFILM	7	24	3.429	100-FOOT REEL
COMPUTER PRINTOUT	73	4,367	59.822	EACH PAGE
SLIDES	13	77	5.923	EACH SLIDE
TRANSPARENCIES	23	89	3.870	EACH SHEET
PHOTOGRAPHIC PRINTS	92	3,246	35.283	EACH SHEET
NEGATIVES	40	273	6.825	EACH SHEET
8 mm TAPES	34	288	8.471	EACH TAPE

Table 16. Media Types Mailed in 1994

NSSDC DATA DISSEMINATION STATISTICS AS OF DECEMBER 31, 1994

OFF-LINE STATISTICS	1990	1991	1992	1993	1994
NUMBER OF REQUESTS FOR TAPES	769	668	483	209	127
NUMBER OF TAPES MAILED	3,156	2,878	3,358	755	849
NUMBER OF REQUESTS FOR CD-ROMs	331	600	2,277	1,320	874
NUMBER OF CD-ROMs MAILED	1,073	3,747	18,373	11,405	10,669
NUMBER OF FILM REQUESTS	335	432	261	175	181
NUMBER OF FILM VOLUMES MAILED	14,381	20,529	8,448	1,544	3,724
ON-LINE STATISTICS					
NUMBER OF NODIS SESSIONS	10,029	15,769	24,921	30,861	38,355
NUMBER OF NDADS SESSIONS	0	378	7,725	13,320	16,802

Table 17. Data Disseminated by NSSDC from 1990 Through 1994

SHIPPING ACTIVITY CY 1994

MONTH	DOCUMENT SHIPMENTS	DATA SHIPMENTS	TOTAL
JANUARY	402	123	525
FEBRUARY	455	109	564
MARCH	379	127	506
APRIL	367	181	548
MAY	385	197	582
JUNE	2,031	216	2,247
JULY	420	130	550
AUGUST	367	136	503
SEPTEMBER	1,997	124	2,121
OCTOBER	770	112	882
NOVEMBER	1,687	37	1,817
DECEMBER	2,267	93	2,360
TOTALS	11,527	1,678	13,205

HISTORICAL SUMMARY OF SHIPPING ACTIVITY AT NSSDC (CALENDAR YEAR)

YEAR	1986	1987	1988	1989	1990	1991	1992	1993	1994
SHIPMENTS	22,609	27,230	24,137	24,471	22,641	23,085	64,642*	16,488†	13,205

* Increase because of addition of Solar Terrestrial Energy Program (STEP) newsletter distribution.
† No longer supporting STEP newsletter distribution.

Table 18. Shipping Activity

NSSDC USER COMMUNITY CY 1994

AFFILIATION CATEGORY	TOTAL REQUESTS	PERCENT OF TOTAL
NON-U.S., EXCLUDING SOCIALIST COUNTRIES	910	32.49
U.S. UNIVERSITIES/COLLEGES	389	13.89
U.S. K-12 SCHOOLS	38	1.36
U.S. PRIVATE INDUSTRY	314	11.21
NO AFFILIATION (GENERAL PUBLIC)	742	26.49
NASA/GSFC	132	4.71
OTHER GOVERNMENT AGENCIES	160	5.71
MISCELLANEOUS	9	0.32
NASA CENTERS, EXCLUDING GSFC	80	2.86
FORMER SOCIALIST COUNTRIES	27	0.96
TOTALS	2,801	100.00

Table 19. NSSDC Off-Line User Community

2

INFORMATION MANAGEMENT AT NSSDC

2.0 Information Management

This section of the report describes the various information management technologies avaialable at NSSDC.

2.1 The NASA Master Directory (NMD)

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, life sciences, planetary science, solar physics, and space physics). At the beginning of 1994 the NMD information was contained within the Global Change Master Directory (GCMD) now managed by the Global Change Data Center. During the year a separate data base for NMD was created within the NSSDC so that the directory might be "tuned" to serve better the needs of the space science community. Also, for NSSDC data holdings the NMD data set information will lead directly to the more detailed information on the data sets contained within NSSDC's Relational System for Information Retrieval and Storage (RSIRS - see below). NMD provides as well automated links to other systems that contain the detailed information on the data at other sites.

A World Wide Web (WWW) interface to the NMD was developed during 1994 and is being revised to reflect space science interests. The older windows-like interface to the Master Directory (MD) is still available, however. The NODIS statistics in section 3 reflect on-line accesses to this older interface during 1994. Better integration of the NMD with some of the data bases in RSIRS will be pursued in 1995 as well as a more capable version of the set of WWW pages allowing access to this information. Next year's access statistics should reflect the increased dependence on WWW access to the data information.

2.2 Relational System for Information Retrieval and Storage (RSIRS)

RSIRS has been the main source of detailed information about NSSDC data holdings for many years. The term RSIRS actually consists of a combination of a number of traditional data bases describing specific parts of NSSDC data and information holdings. These parts are now the "partitions" of the RSIRS data base. Brief descriptions of the partitions are as follows.

The Automated Internal Management (AIM) File tracks spacecraft, their on-board experiments, and resulting data sets, primarily those archived at NSSDC. Table 20 shows the numbers of these entities tracked in the AIM file and the additions for 1994. (See page 26.)

The NSSDC Supplementary Data (NSD) File tracks non-spacecraft data, multi-source spacecraft or other data, models and programs, Astronomical Data Center (ADC) source catalogs, and other NSSDC-held data sets that do not fit the AIM spacecraft/experiment/data set hierarchy. Table 21 shows the number of data sets identified in NSD by discipline. (See page 26.)

The Technical Reference File (TRF) tracks individual published and unpublished papers associated with spaceflight experiments through their unique NSSDC IDs. There is also some standards documentation information as well. (See Table 22 on page 27 for the number of information items added in 1994.)

Table 23 shows the Interactive Request Activity and Name Directory (IRAND) statistics for 1994. The IRAND file tracks people and their multiple addresses, their individual requests for data, and which distribution lists they are on. The Personnel Information Management System (PIMS) within NODIS (See page 27.) allows on-line access to the nearly 40,000 names and addresses in this data base.

The Interactive Data Archive (IDA) File tracks NSSDC's inventory of digital data volumes. The Rocket file has a data base of scientific rocket launches. Table 24 shows the IDA and rocket statistics for the year. (See page 27.) The information on rocket launches has not been provided to NSSDC and limited resources prevent active gathering of such information.

2.3 NASA/Science Office of Standards and Technology (NOST)

The NASA/Science Office of Standards and Technology (NOST) at the NSSDC was established

to serve the NASA science communities in evolving cost-effective, interoperable information systems. The goal 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 widely available within the community for which implementations, based upon the standard, are desired or prevalent.

2.3.1 Consultative Committee for Space Data Systems (CCSDS)

NOST leads NASA's participation in the international Consultative Committee for Space Data Systems (CCSDS) Panel 2, which is developing technologies based on the standards called "CCSDS Recommendations" in support of information interchange among the international space agencies. NOST also supports use 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.

Panel 2 has evolved a concept known as Standard Formatted Data Units (SFDUs). The three primary functions for SFDUs are 1) standards for the identification, linking, and packaging of data and metadata; 2) computer-interpretable languages for expressing metadata; and 3) establishment of metadata registration and dissemination services to provide recognized, accessible, and permanent archives. NOST assists implementers of the SFDU concept through its SFDU Support Office, and it has established the NSSDC Control Authority Office Information System (CAOIS) to provide for on-line registration and retrieval of metadata objects. Table 25 indicates some of the activities of the NSSDC Control Authority Office during 1994, such as the assignment of Authority and Description Identifiers (ADIDs), processing of updates to the existing records, etc. (See page 28.)

2.3.2 Flexible Image Transport System (FITS)

The Flexible Image Transport System (FITS) is the standard format for astronomical data transport, endorsed and supervised by the International Astronomical Union (IAU). NOST participated in the evolution of FITS by commenting on proposed new FITS extensions and conventions and by involvement in the work of the overseeing IAU FITS Working Group. NOST supported users of this technology by providing a FITS Support Office; by supporting the development of a formal FITS specification document using the NOST standards accreditation process; and by serving as a source of FITS information, documents, and advice. Figure 1 summarizes the statistics of information distribution by the FITS Support Office during 1994. (See page 28.)

2.3.3 Standards and Technology Information System (STIS)

As a part of the support for standards and technology information dissemination, NOST operated the Standards and Technology Information System (STIS) and a distribution library function during 1994. The STIS is a centralized electronic library that lets users know about available standards and new technologies. The referenced material may have originated from a variety of sources such as books, technical or popular press articles, government or industry reports, and reports created by the NOST staff or NOST technical contributors. NOST encourages individuals within the community who have an interest in a particular standard or new technology area to register as NOST technical contributors. By doing so they agree to provide reports as new information comes to them for incorporation into the STIS under their authorship. Hard copies of the documents are maintained in the standards library, managed by a librarian who responds to standards and new technology requests and prepares information for ingest to the STIS. Table 26 and Figure 2 indicate the 1994 statistics for the holdings and usage of the STIS and the corresponding requests to and documents distributed by the NOST librarian. (See page 29.)

2.3.4 Common Data Format (CDF)

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 be easily created.

Over the years the NSSDC has evolved CDF's functionality, ported CDF to a number of new platforms and operating systems, and witnessed a growth in the CDF user community. Over the past two years the International Solar-Terrestrial Physics (ISTP) Project has been using CDF for its "key parameter" data. During that time ISTP has been the single largest user group.

The year 1994 was very exciting and productive for CDF. Among the more significant CDF developments were the following:

A WWW page was created to describe CDF, facilitate network access to the software distribution and documentation, provide a list of frequently asked questions (FAQs), and facilitate interaction with the CDF support group at the NSSDC. The CDF Home Page has been getting an average of 300 to 400 accesses per month from a combination of government, universities, private organizations, and individual users on an international level. The Uniform Source Location (URL) for the CDF Home Page is http:/nssdc.gsfc.nasa.gov/cdf/cdf_home.html.

Two new major CDF software releases (Versions 2.4 and 2.5) occurred in 1994. In January Version 2.4 was released, which consisted of porting of the software to the DEC Alpha platform running the OSF1 and OpenVMS operating systems and to the Sun running the Solaris operating system; IDL/CDF interface enhancements that allow IDL users to take advantage of a broader range of CDF functionality; a new toolkit program called CDFedit, which allows the user to update, modify, and delete interactively the contents of a CDF file; and more. In December 1994 Version 2.5 was released. CDF 2.5 consisted of a port to the Macintosh computer running Version 7 of the Macintosh operating system. A CDF library and tools are available for both Symantec THINK C and Macintosh Programmer's Workshop (MPW) C and Fortran applications.

During 1994 an average of six user requests per day was serviced. Statistics for on-line access to CDF information are shown as part of the overall statistics for WWW and FTP access in section 3. The NASA-affiliated user community grew substantially, mostly in the area of space science through the ISTP/Inter-Agency Consultative Group (IACG) community. For example, the European Space Agency (ESA) has adopted CDF for the Cluster mission. This community alone consists of hundreds of users internationally. In addition, CDF is used as a part of commercial applications such as International Business Machines' (IBM) Data Explorer visualization package and Research Systems Incorporated's (RSI) Interactive Data Language (IDL) software. Thus, CDF software represents a case of technology transfer from NASA to the U.S. commercial sector.

AIM PARTITION STATISTICS AS OF DECEMBER 31, 1994

SUBPARTITION	NUMBER OF RECORDS AS OF 12/31/94	NUMBER ADDED IN 1994
SPACECRAFT	4,988	115
EXPERIMENTS	5,414	19
DATA SETS	5,097	72
TOTALS	15,449	206

NUMBER OF SPACECRAFT WITH EXPERIMENTS : 1,013 NUMBER OF EXPERIMENTS WITH DATA SETS: 1,294

Table 20. Automated Internal Management (AIM) Spacecraft, Experiment, and Data Set Records

NSD PARTITION STATISTICS BY DISCIPLINE AS OF DECEMBER 31, 1994

DISCIPLINE	NUMBER OF DATA SETS
ASTROPHYSICS	1,029
SPACE PHYSICS	426
EARTH SCIENCE	65
PLANETARY SCIENCE	34
OTHER	18
TOTALS	1,572

Table 21. NSD Supplementary Data (NSD) Data Sets by Discipline

TRF PARTITION STATISTICS AS OF DECEMBER 31, 1994

TOTAL NUMBER OF RECORDS (SCIENCE PAPERS)	36,384
NUMBER OF RECORDS INSERTED DURING 1994	849

Table 22. Technical Reference File (TRF) Statistics

IRAND PARTITION STATISTICS AS OF DECEMBER 31, 1994

RECORD TYPE	TOTAL RECORDS	1994 ACTIVITY	
		RECORDS INSERTED	RECORDS UPDATED
PERSONNEL	48,636	2,177	3,716
REQUEST	68,832	2,739	—

Table 23. Interactive Request Activity and Name Directory (IRAND) Statistics

IDA AND ROCKET STATISTICS AS OF DECEMBER 31, 1994

PARTITION	TOTAL RECORDS	RECORDS INSERTED IN 1994
IDA	148,097	7,742
ROCKET	15,478	0

Table 24. Interactive Data Archive (IDA) and Rocket Statistics

STANDARD FORMATTED DATA UNITS (SFDU) STATISTICS FOR 1994

NSSDC CONTROL AUTHORITY OFFICE	COUNTS
NEW ADIDS ASSIGNED IN PRELIMINARY REGISTRATIONS	33
DATA DESCRIPTION DISSEMINATIONS	10
USER ACCESS TO CAOIS	130
REQUESTS FOR SFDU DOCUMENTS	34
OTHER SFDU REQUESTS	15

Table 25. Standard Formatted Data Units (SFDU) Statistics

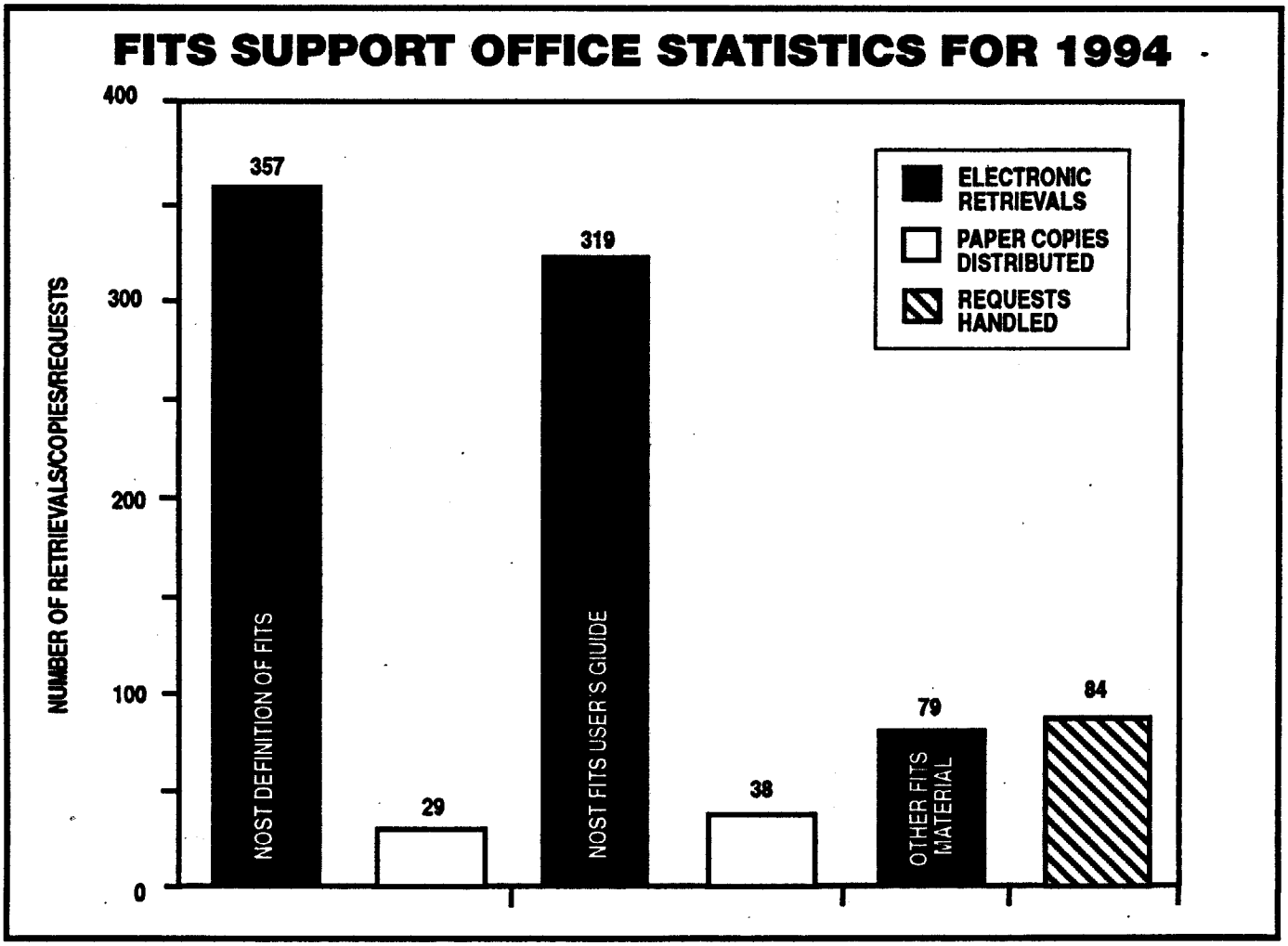

Figure 1. Flexible Image Transport System (FITS) Support Office Statistics

STANDARDS AND TECHNOLOGY INFORMATION SYSTEMS (STIS) STATISTICS FOR 1994

DESCRIPTIONS	NUMBER DISTRIBUTED
ORGANIZATIONS	18
STANDARDS DOCUMENTS	243
OTHER DOCUMENTS	746

Table 26. Standards and Technology Information Systems (STIS) Statistics

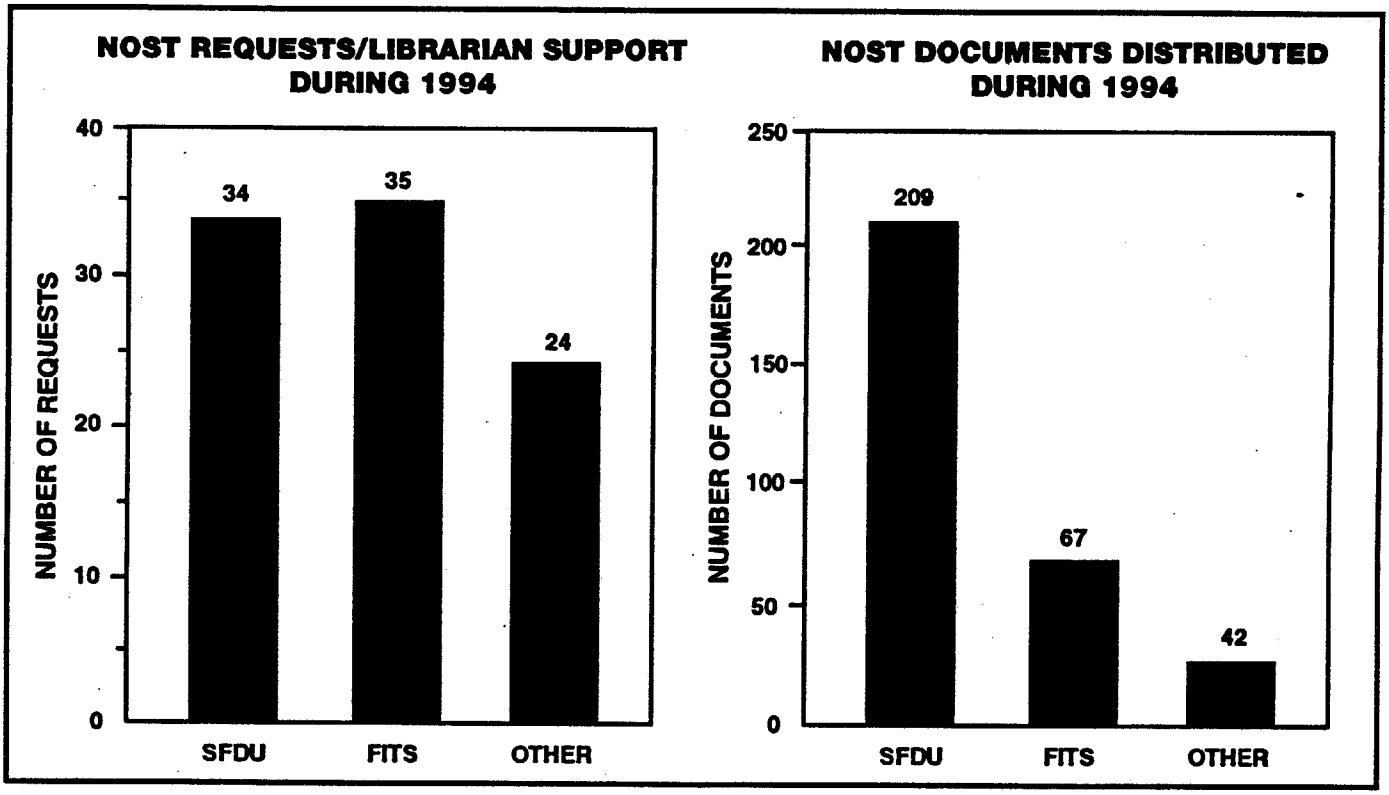

Figure 2. NASA/Science Office of Standards and Technology (NOST) Requests and Distribution

3

ON-LINE ACCESS STATISTICS FOR NSSDC INFORMATION SERVICES

3.0 On-Line Access Statistics for NSSDC Information Services

NSSDC is committed to providing as much data and information as possible to the community in on-line or "near-line" accessibility modes, where near-line involves robotics that quickly allow data to be put into an on-line magnetic disk. Just as the NSSDC On-Line Data and Information Service (NODIS) revolutionized access to NSSDC data and services a few years ago (relative to then current modes of letter and telephone interactions, mailings of data volumes, etc.) so today the World Wide Web (WWW) is stimulating a further step in this revolution by making the electronic interactions far easier.

Figure 3 shows the growth of access to the services offered by NSSDC through the WWW. (See page 35.) Statistics began to be collected during July 1994 when the Shoemaker-Levy comet impact images and information were being disseminated. The number of files transferred decreased for a few months after that event as the interest in the comet decreased and as the services were transferred from one machine to another.

Figure 4 indicates the files transferred for the year for a number of the services offered. (See page 36.) The "About" section defines what can be found in the Web pages and the "Misc" contains a variety of information. "STEP" is the area providing information on the Solar-Terrestrial Energy Program. "CDF" is the Common Data Format Web area. (See section 2.3.4.) The "ADC" pages describe the Astronomical Data Center and provide access to many astronomical catalogs as well as information about them. "NMD" provides access to the WWW interface to the NASA Master Directory as described in section 2.1. "Hawkeye" is an area devoted to information and data from the Hawkeye spacecraft. The "OMNIWeb" pages provide data retrieval and graphical browsing capabilities for near-Earth solar wind magnetic field and plasma data as well as geomagnetic and solar activity indices. "SPACEWARN" contains information about satellite launches in accordance with NSSDC responsibilities as World Data Center-A for Rockets and Satellites (WDC-A-R&S). "Other" is information services for the various services and disciplines as indicated.

Several of the services, such as the Comet Shoemaker-Levy picture area during the times of the comet impacts, were so popular that they had to be separately charted in Figure 5 with a corresponding increase in the scale. (See page 37.) This includes three separate areas of imagery from low-resolution "thumbnail" images to high resolution images of many subjects. The planetary sciences area had a great deal of interest, especially in conjunction with the comet impact.

File Transfer Protocol (FTP) access to NSSDC data and services remains a very heavily-used mode for obtaining files. NSSDC maintains some of its most often requested data and information in directories accessible over Internet through user accounts. Figure 6 shows the number of accesses to NSSDC data and information files available through FTP. (See page 38.) In addition to the versions of the data and information also offered through the WWW and defined above there are the ACTIVE data base satellite ephemeris data providing on-line orbital element files for active scientific spacecraft; Artificial Sky Map (ASM) documents and data; Cosmic Background Explorer (COBE) data products and related documentation; Coordinated Heliospheric Observations (COHO) deep space solar wind data products and related information; Flexible Image Transport System (FITS) information; downloadable graphics software (GRAPHICS_SOFT); Master Directory documentation and information (GSFCPID and MD_DOC); copies of NASA Research Announcements issued by NASA Headquarters (HQ_NRAS); information on solar-terrestrial models (MODELS); information about various Union of Radio Science International discipline groups (MULTIDIS); NASA Climate Data System (NCDS) information; general operations information (OPERATIONS); Standard Formatted Data Unit (SFDU) information; a variety of downloadable software for CDF usage on various platforms (SOFTWARE); general space physics information (SPACE_PHYSICS) as well as information about the Space Physics Data System (SPDS); general instructions for CD-ROMs (SYSTEM); and, finally, downloadable SFDU and CDF software tools and information (TOOLS).

Many data and information requests are still filled through the older NODIS interface, which leads to many interconnected information systems. Requests for off-line data have also been more efficiently handled through the automation of requests. Through NODIS users can access many types of data and information with an emphasis on space science data. One can also consult a 40,000-name data base, immediately receive data from selected projects, browse bulletin boards and newsletters, get references on standards, etc. Figure 7 indicates the number of accesses per month to various categories of NODIS services. (See page 39.) Since many users access the system multiple times, the figure also indicates the number of unique users who accessed the system per month. Figure 8 breaks down the NODIS access into the activity for individual services within NODIS. (See page 40.)

Services available via NODIS in 1994 included NASA Master Directory (NMD) information; access to the 40,000-name data base called the Personnel Information Management System (PIMS); the Interplanetary Medium data base (OMNI); the NSSDC Data Request Service (REQ); access to ionospheric models information (MODELS); the general access to NSSDC information (NSSDC); the Astronomical Data Center catalogs and information (ADC); the Solar-Terrestrial Energy Program (STEP) bulletin board and general information; the Standards and Technology Information System (STIS); the planetary science information area (PLNT); the catalog of NSSDC-distributed data on CD-ROMs (CD-ROM); the access to the anonymous directories for ftp information through NODIS (ANON); the Control Authority On-Line Information System (CAOIS); the Master Catalog of detailed information about data held at NSSDC (See section 2.1.); the Flexible Image Transport System (FITS) information area; the Space Physics Data System gateway; the Coordinated Heliospheric Observations (COHO) access; the Coordinated Data Analysis Workshop (CDAW) information; and the Satellite Situation Center (SSC) service.

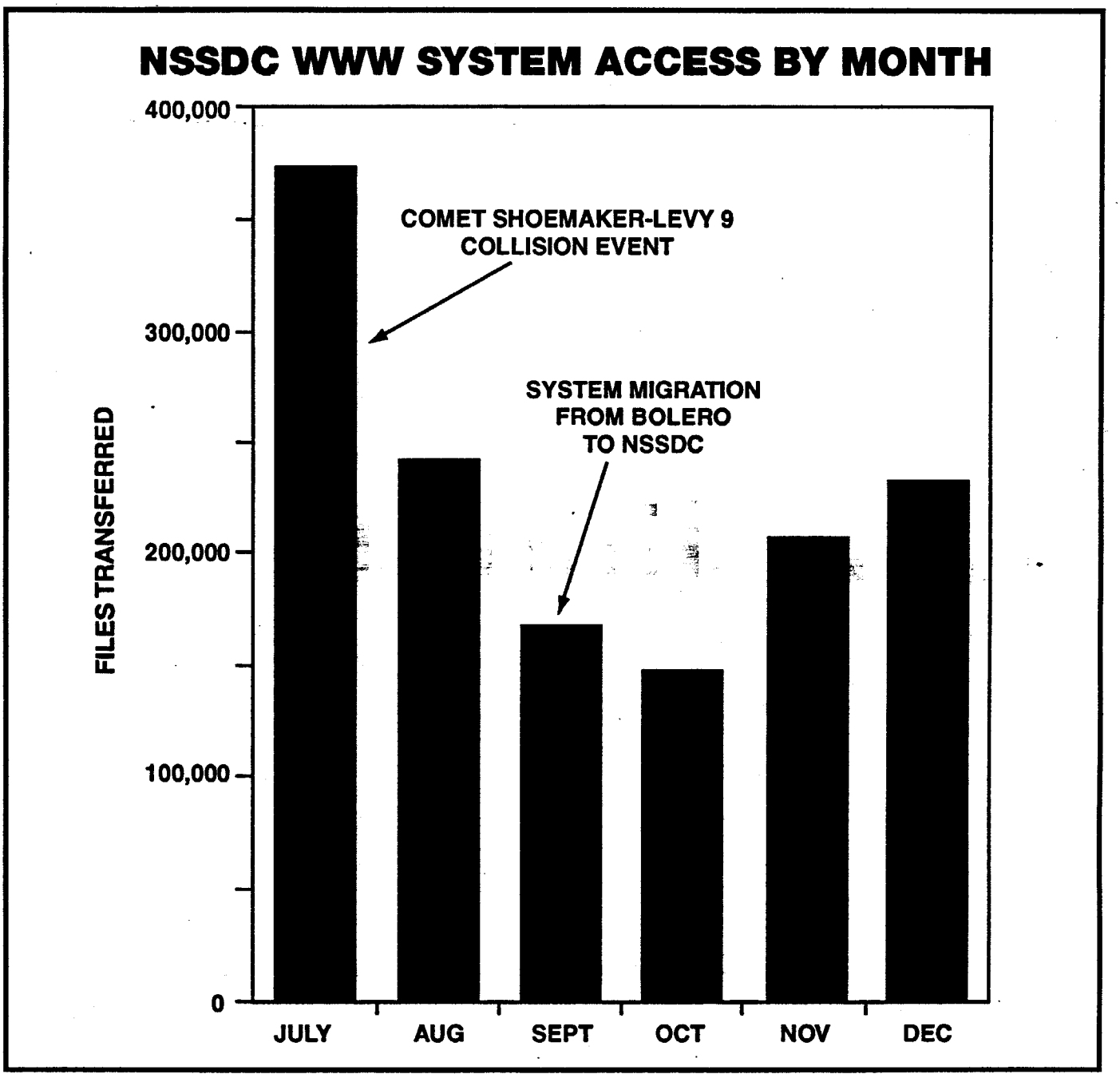

Figure 3. World Wide Web Monthly Access

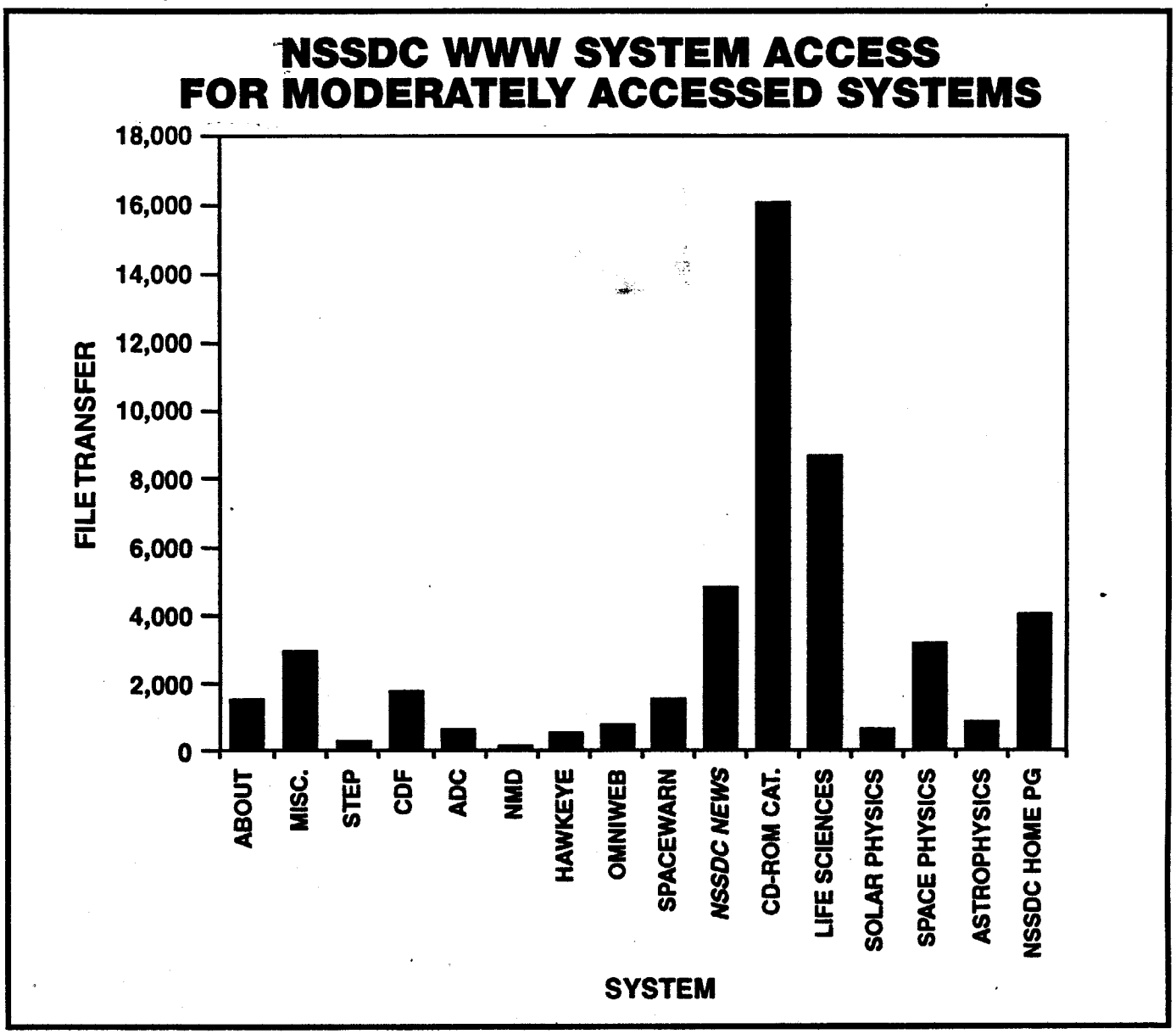

Figure 4. World Wide Web File Transfer for Moderately Accessed Systems

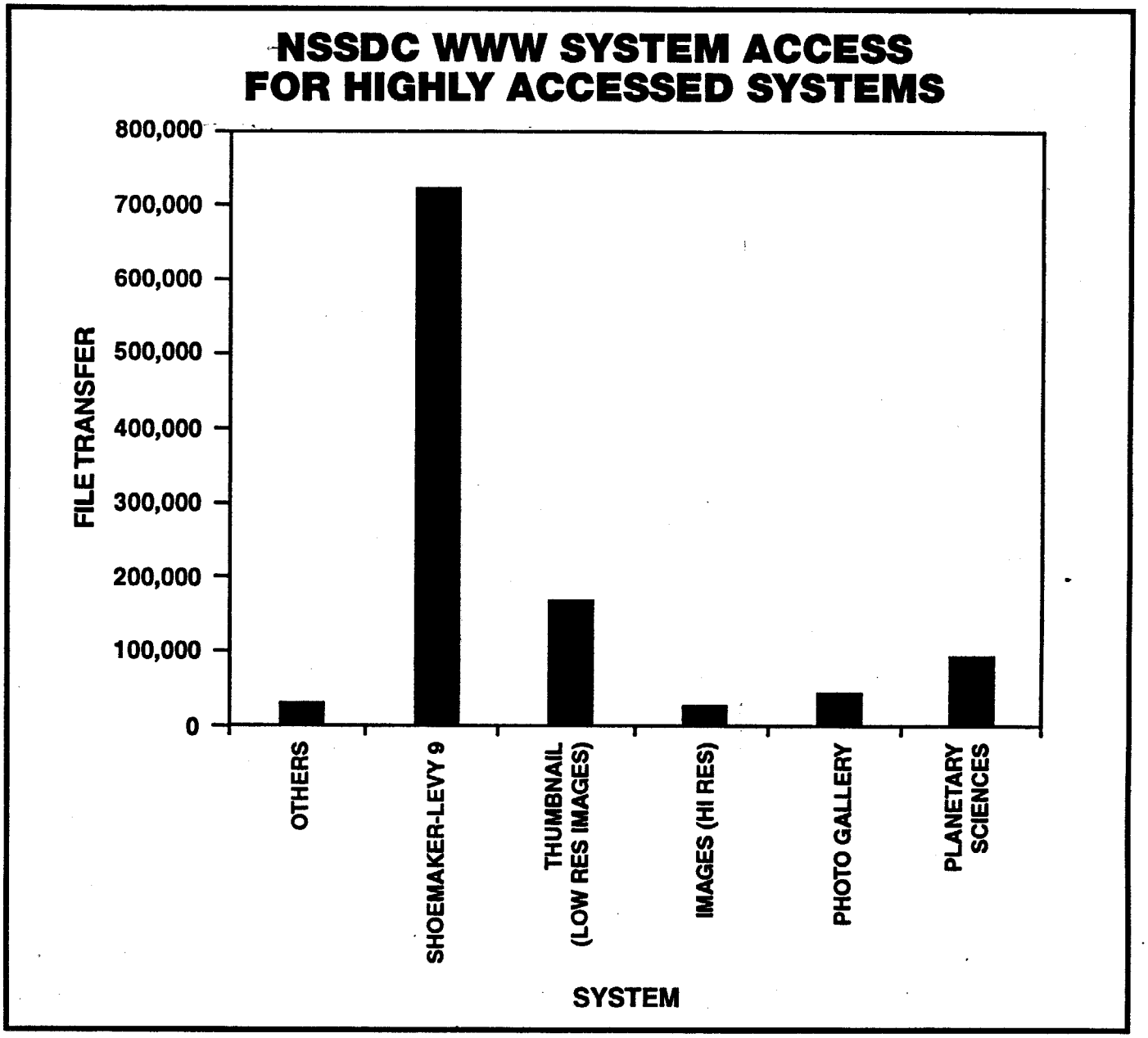

Figure 5. World Wide Web File Transfer for Highly Accessed Systems

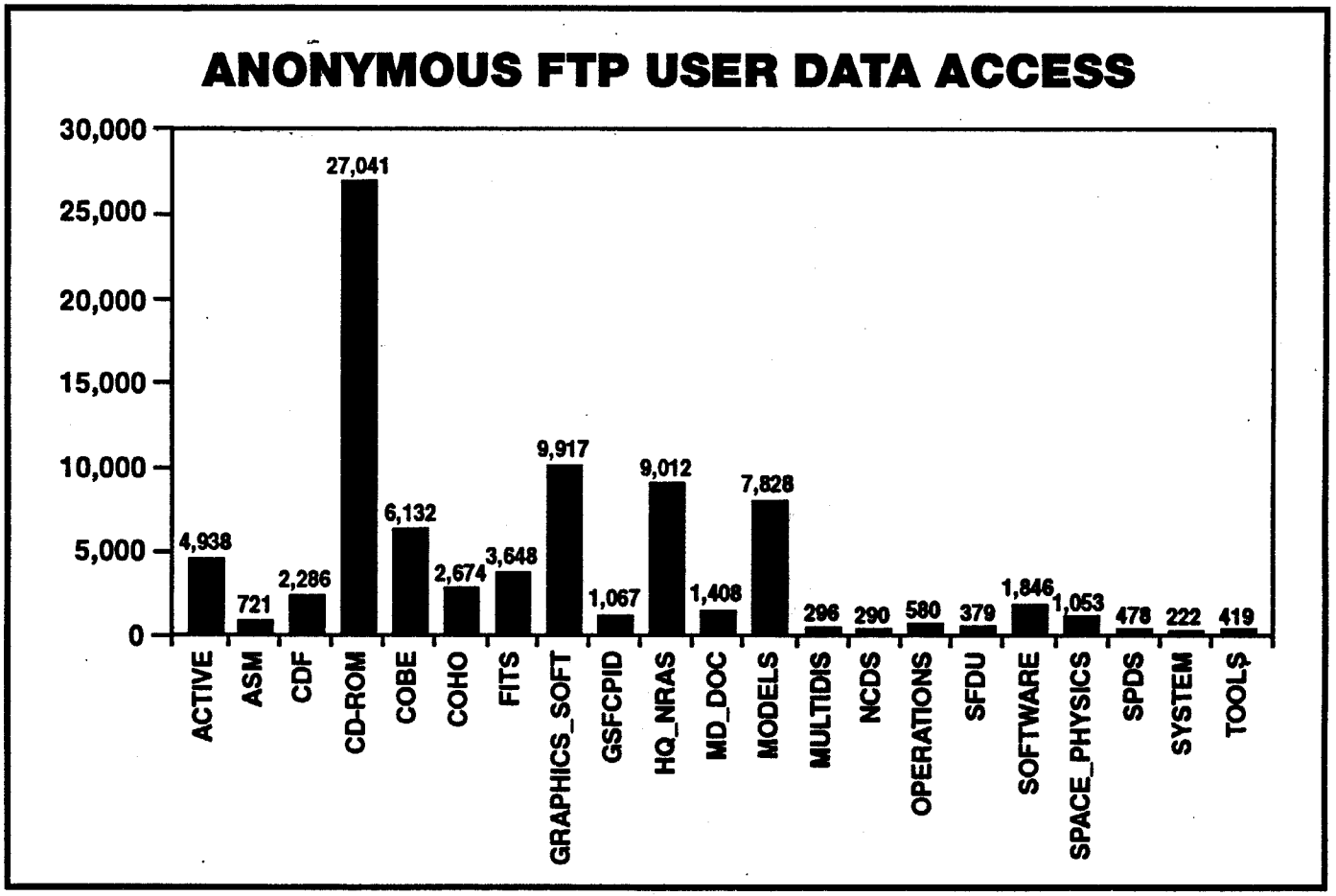

Figure 6. ANONYMOUS Statistics

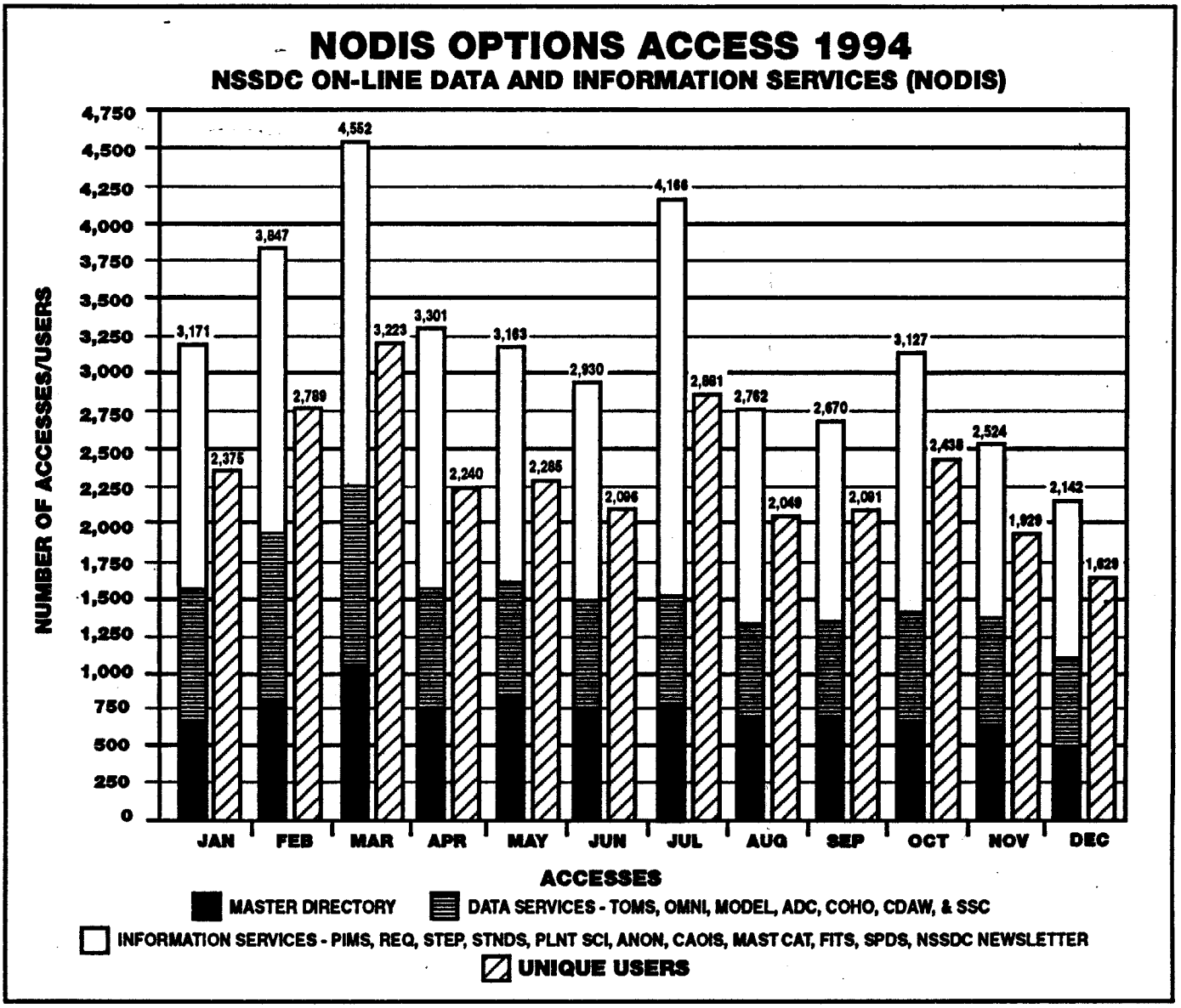

Figure 7. NODIS Options Access Activity

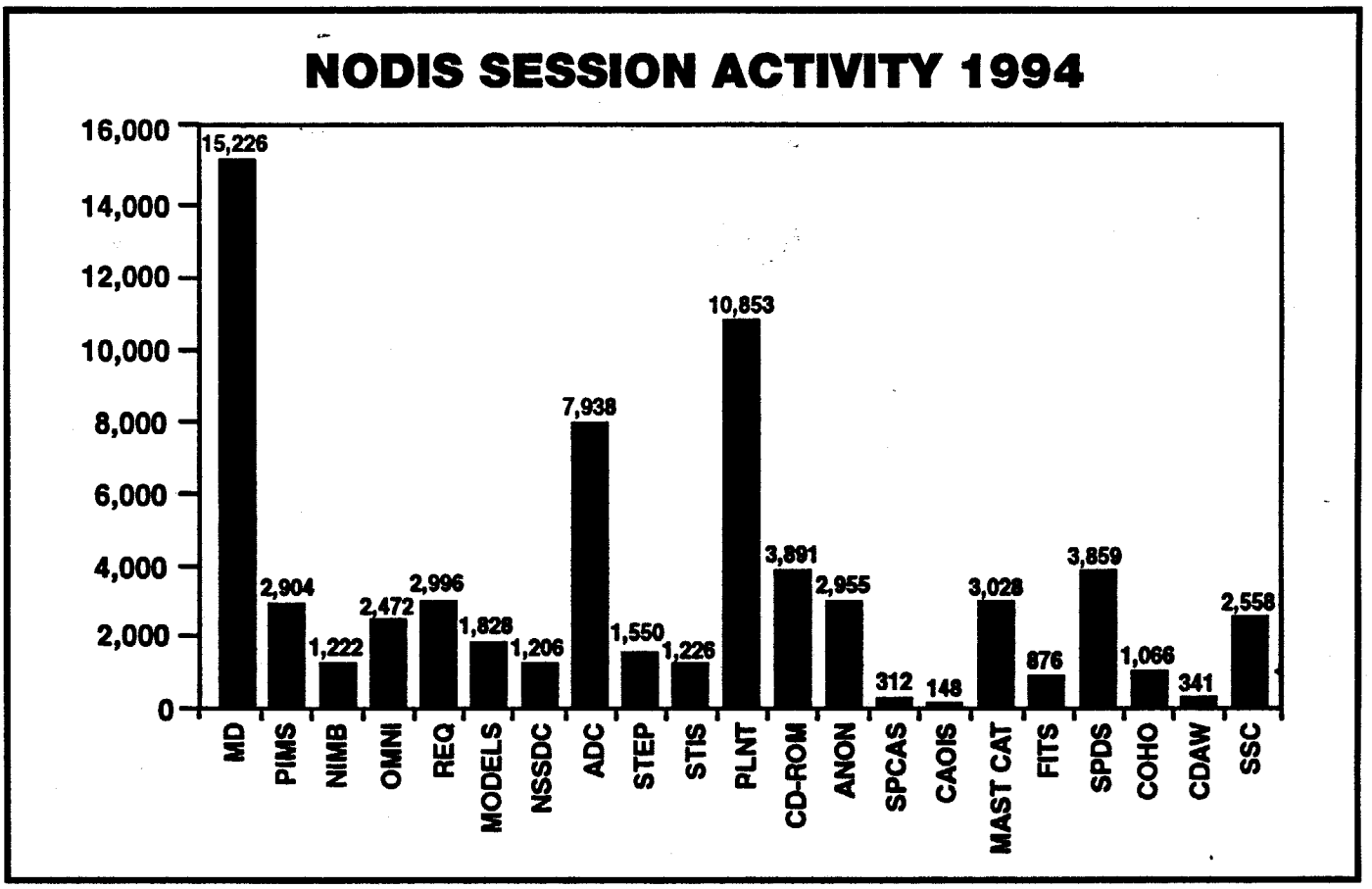

Figure 8. NODIS Access Activity by Individual Services

4

ACRONYMS AND ABBREVIATIONS LIST

ADC	Astronomical Data Center
ADID	Authority and Description Identifier
AIM	Automated Internal Management File
ASM	Artificial Sky Map
ASCA	Advanced Satellite for Cosmology and Astrophysics
BATSE	Burst And Transient Spectrometer Experiment
BBXRT	Astro 1 Broad Band X-Ray Telescope
CAOIS	Control Authority Office Information System
CCSDS	Consultative Committee for Space Data Systems
CD	Compact Disk
CDAW	Coordinated Data Analysis Workshop
CDF	Common Data Format
CDHF	Central Data Handling Facility
CD-ROM	Compact Disk-Read Only Memory
CGRO	Compton Gamma-Ray Observatory
COBE	Cosmic Background Explorer
COHO	Coordinated Heliospheric Observations
DE	Dynamics Explorer
EGRET	Energetic Gamma-Ray Experiment Telescope
ERB	Earth Radiation Budget
ERBS	Earth Radiation Budget Satellite
ESA	European Space Agency
ESRO	European Space Research Organization
FITS	Flexible Image Transport System
FTP	Anonymous File Transfer Protocol
GCMD	Global Change Master Directory
GSFC	Goddard Space Flight Center
HEAO	High Energy Astrophysics Observatory
HST	Hubble Space Telescope
HUT	Hopkins Ultraviolet Telescope
IAU	International Astronomical Union
IACG	Inter-Agency Consultative Group
IBM	International Business Machines
IDA	Interactive Data Archive
IDL	Interactive Data Language
IDN	International Directory Network
IMP	Interplanetary Monitoring Platform
IR	Infrared
IRAND	Interactive Request Activity and Name Directory
IRAS	Infrared Astronomical Satellite (The Netherlands-NASA-U.K.)
ISEE	International Sun-Earth Explorer
ISTP	International Solar-Terrestrial Physics
IUE	International Ultraviolet Explorer (satellite, NASA-U.K.-ESA)

MAGSAT	Magnetic Field Satellite
MD	Master Directory (NASA)
MPW	Macintosh Programmer's Workshop
NASA	National Aeronautics and Space Administration
NCDS	NASA's Climate Data System
NDADS	NSSDC Data Archive and Distribution Service
NMD	NASA Master Directory
NODIS	NSSDC On-Line Data and Information Services
NOST	NASA/Science Office of Standards and Technology
NRAO	National Radio Astronomy Observatory
NSDF	NSSDC Supplemental Data File
NSSDC	National Space Science Data Center (NASA)
OD	Optical Disk
OGLE	Optical Gravitational Lensing Experiment
OMNI	Interplanetary Medium Data
OSO	Orbiting Solar Observatory
PIMS	Personnel Information Management System
PVO	Pioneer Venus Orbiter
REQ	NSSDC Data Request Service
ROSAT	Roentgen Satellite (German X-ray research satellite)
RSI	Research Systems Incorporated
RSIRS	Relational System for Information Retrieval and Storage
SFDU	Standard Formatted Data Unit
SMM	Solar Maximun Mission
SPACEWARN	World Warning Agency for Satellites
SPDS	Space Physics Data System
SRL	Space Radar Laboratory
SSC	Satellite Situation Center
SSDOO	Space Science Data Operations Office
STELAR	Study of Electronic Literature for Astronomical Research
STEP	Solar-Terrestrial Energy Program
STIS	Standards and Technology Information System
TOMS	Total Ozone Mapping Spectrometer
TRF	Technical Reference File
UIT	Ultraviolet Imaging Telescope
U.K.	United Kingdom
URL	Uniform Resource Locator
USGS	United States Geological Survey
V Tape	Video Tape
WDC-A-R&S	World Data Center-A for Rockets and Satellites
WORM	Write-Once, Read-Many
WUPPE	Wisconsin Ultraviolet Photopolarimetry Experiment
WWW	World Wide Web