Space Physics Cosmic & Heliospheric Data Evaluation Panel Report

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1. SUMMARY OF RECOMMENDATIONS

The Cosmic and Heliospheric (C&H) Data Evaluation Panel (DEP) was charged with the task of identifying and prioritizing important C&H data sets. It was requested to provide C&H community input to the Space Physics Division (SPD) for a program of revitalizing data holdings. As detailed below, the panel has identified substantial areas of concern and generally assigned highest C&H priority to Voyager, Pioneer, Helios, IMP-8 and ISEE-3 data in that order.

The following set of recommendations should be viewed as only partial. To date, the panel has found a wide range of data of long-term archival value but will not claim to have been able to conduct a “comprehensive” review. It is our conclusion that significantly more community-held data should be restored and subsequently preserved, although there is clearly an inconsistency between this need and the NASA funding available for this purpose at this time.

We expect an ongoing effort over the next few years to update, extend and complete this analysis under the auspices of the Space Physics Data System (SPDS) C&H Discipline Coordination Team (DCT). The evaluation work should eventually encompass a very broad range of C&H data sources (Shuttle, balloon, ground, historical flight missions) as well as relevant models and software.

Recommendations of the C&H DEP to date are:

1) The most important C&H missions are Voyagers 1 and 2, Pioneers 10 and 11, Helios 1 and 2, IMP-8 and ISEE-3 (ICE). Preservation of data from these missions is the highest archival priority in the C&H discipline. Data from older missions and other data sources have the potential for substantial value but are generally of lesser priority than data from these primary missions.

2) Restoration and/or archiving activities for Voyagers 1 and 2 and for Pioneer 10 and 11 are important but should possibly be project-funded at this time.

3) Several specific Helios-related recommendations are:

   - Funding to the University of Iowa to assure archive of an appropriate subset of Helios 1 and 2 plasma wave data, coordinated with archiving of other priority magnetospheric plasma wave data, should be a high priority data restoration effort.

   - The panel strongly advocates the generation and acquisition of reduced Helios plasma and field data from the primary magneto-optical disks that have been created by the non-NASA PI.

- NSSDC should complete validation and archiving of the high-resolution NASA fluxgate magnetometer data that have been now submitted.

- Data beyond what is already archived from other Helios instruments (e.g. the cosmic ray instruments) should be a high priority for archival acquisition.

4) Archival submission of all key IMP-8 data and select IMP-7 data is critically important. Although IMP-8 is operating and currently funded for operations / data reduction, it is so minimally funded that it should be considered as effectively unfunded by the project for further data archiving (in the same way data activities for Helios 1/2 and ISEE-3 must be viewed).

5) Other satellite, balloon and ground-based data, such as the ONR-604 cosmic ray isotope experiment on DoD's CRRES satellite and the Chicago/Bartol LEE series of balloon experiments for galactic electrons, area of significant value for C&H studies. Provisions for timely and complete archiving should be considered. Data from other data sources (older missions, neutron monitors, cross-sections) should be considered where an appropriate proposal justifying the specific value of restoration can be produced.

6) It is an urgent requirement that current missions such as SAMPEX and Ulysses and new missions such as Wind and ACE assign appropriate priority to planning for effective and timely data archiving.

7) As the C&H field has unique needs for long-term access to telemetry-resolution (highest time and/or raw pulse height) data for some classes of data, the panel advocates feasibility studies and testbed activities to define cost/benefit-effective archiving approaches for such data.

2. CHARTER OF THE COSMIC AND HELIOSPHERIC (C&H) DATA EVALUATION PANEL

One of the many problems of concern to the Space Physics Division (SPD) is the issue of data archiving, in particular whether extant and still valuable older data has been appropriately archived and whether there are data in the present archives that are no longer worth keeping. The problem is complicated in that a significant amount of valuable data, both in the field and in archives such as NSSDC, are in real danger of being lost if resources are not expended soon to "restore" and properly archive such data.

In 1992, the Information Systems Branch at NASA Headquarters began what was termed the "Data Management Initiative" to assist the various science discipline divisions in the identification and restoration of the most valuable NASA data or data of NASA science interest which were in danger of loss. Because SPD has the formal NASA science division responsibility of assuring appropriate management of data, SPD created a series of Data Evaluation Panels in each of its four major sub-disciplines to supply peer review and advice in identifying and prioritizing data sets for restoration work.

The definition, general scope and direction of the SPD Data Evaluation Panels (DEPs), as extended to the specific issues initially confronting the DEP for C&H data are as follow:

(1) The broad charter of the (possibly multi-year) effort was to:

(a) identify important community-held data sets not now archived,

(b) prioritize the assignment of resources to archive such data according to their overall science value

(c) assist the NSSDC in identifying its most important older data sets (so that NSSDC can focus its resources on data of greatest future value), and

(d) advise SPD on the importance and form of additional appropriate data actions that might be part of a "revitalization" effort (e.g., reformatting, extended documentation, value-added processing) for space physics.

(2) In response to a "Dear Colleague" letter originally sent by SPD in 1991 soliciting interest in data restoration and to various informal interactions, there were already four funded restoration efforts (one in C&H) in progress in the community and a list of other ideas for efforts submitted. Perhaps five of these were of reasonable concreteness in C&H at the time of formation of this panel. SPD requested some validation that the initial funding choices were reasonable and a sense of priorities among these and other activities on the existing list that might be applied to further efforts.

NSSDC has also requested guidance in prioritizing its internal data restoration, in particular for the larger data sets (say >20 or >50 tape data sets) in question. However the NSSDC archives hold much less C&H data than e.g. magnetospheric data, so the list of data sets to be initially considered by the C&H DEP is actually fairly short.

(3) SPD originally desired to have all of the panels finish with the first phase of their evaluations by the time of the Space Physics Data System (SPDS) workshop at Rice in June 1993. For a variety of reasons, this did not prove possible for the C&H DEP. An interim C&H report was issued in time for the first full meeting of the new Space Physics Data System (SPDS) Discipline Coordination Team (DCT) in September 1994.

3. ANALYSIS AND DETAILED RECOMMENDATIONS

The following sections are a summary of the issues raised thus far in data panel discussions and the analysis performed to date, with draft recommendations for data restoration activities where appropriate. It should be realized that at this time, the analysis of the full C&H data picture is not yet complete, and significant concerns remain to be addressed.

3.1 General Areas and Issues

Under the heading of general concerns, the panel was concerned with the scope of its activities in general and particularly those activities relevant to the work now underway by the SPDS C&H Discipline Coordination Team (DCT). As discussed in succeeding sections, the panel also felt it important to discuss and define a high-level framework as to how it is prioritizing its work (by mission or data source) on the basis of both intrinsic importance and our current understanding of missions still reasonably well-supported by project-specific funding.

3.1.1 Communities Who Have Interests in C&H Data

- The primary customer community with which this panel is concerned is the NASA science research community. The essence of the science community's concern, beyond issues of balance of funding for data archive/access versus direct research support that fall outside the DEP charter, is data that can be used to support further science. It was a recommendation of the Rice SPDS workshop that restoration and archival funding should be focused on data of greatest likely scientific utility. The DEP accepts that recommendation with the additional observation that the correct use and interpretation of previously unrecognized features in data in the form of physical quantities may not be possible without archive/access to lower-level data products.

- The DEP also recognizes that the customer community for C&H data, both present and future, extends to mission/spacecraft/instrument design and engineering elements of NASA and other US government agency programs. Of particular interest is a continued evolution in understanding of the space radiation environment, including its statistical characterization for risk-factor analysis and hazard prediction (energetic particle events) for both electronic systems and humans in space for extended periods. Some relevant long-term data sets are now at risk and not yet archived (e.g. Helios 1/2, IMP-8). It would be irresponsible to allow the final/total loss of otherwise irreplaceable data even though immediate funding for programs to use that data are presently inadequate. Other key data in some sense “orphaned” include high-energy measurements from CRRES/ONR-604. Design and engineering studies also imply importance for various kinds of laboratory measurements (e.g. cross-sections).

3.1.2 Qualifications on Scope of the Evaluation Effort

- The DEP will not address any issues of online/off-line storage and cost tradeoffs for C&H in SPDS; that issue belongs to the SPDS DCT.

- The panel has not generally concerned itself extensively with more recently launched missions (e.g. SAMPEX, Ulysses, Wind) nor with upcoming missions (e.g. ISTP generally, ACE), although the data from these missions will be of very substantial long-term importance. Some recent information on SAMPEX and Ulysses archiving to date is included for reference.

  It is the hope of this panel, and it should be the direct concern of both SPDS and the NASA Space Physics Division at Headquarters, that adequate provision is being made NOW to assure that data from these missions do not need to become the concern of a future data evaluation/data restoration effort.

3.1.3 Currently Important Missions

The panel discussed the importance and general status of each of the following spacecraft. While the order in which these missions are listed reflects a rough sense of their uniqueness or overall importance, it should be understood that these missions form in reality a coherent set because many C&H studies are typically dependent on a combination of data from multiple sources. This list excludes the most recently launched missions (e.g. Ulysses and Wind), although their data will clearly be equally important to the missions below in the long-term.

- It appears Voyager may be well enough funded that it might be able to handle an appropriate level of archiving within its own budget, although a detailed analysis of any project budget is well beyond the scope of this panel's activities. There is uncertainty however as to full extent of the Voyager data plan, with archiving progress made to date and with future Voyager MO&DA funding. The panel feels strongly a full range of Voyager data sets is extremely important. SPD and the Voyager project must monitor the situation and take the necessary steps to assure all these data are properly archived and soon.

- Pioneer 10/11 is nearing the end of a fairly massive archiving effort. Members of the DEP believe this effort may leave Pioneer in pretty good shape, although at some later point a review of what's really been accomplished will be appropriate (but is not presently an action item).

- There was a general sense that Helios 1/2 were very important spacecraft whose data have not been appropriately archived. Helios was selected as first focus for more detailed DEP review.

- IMP-8 is the next most important spacecraft. Some IMP-8 data restoration and archiving was funded under the Explorer data restoration effort of several years back. The DEP nonetheless notes that despite this limited funding and the fact that IMP-8 remains a funded project, IMP-8 investigator funding has been so limited for so many years that full and appropriate archiving of these data will probably require additional and possibly significant resources.

For some experiments, IMP-7 and even IMP-6 constitute closely-related data sources whose inclusion with IMP-8 could extend the time basis of these measurements back at least from late 1973 to early 1971. Capture of the older IMP data may however now be difficult and will need detailed analysis case-by-case to justify costs.

- ISEE-3/ICE is the next most important spacecraft to C&H. A major issue for ISEE-3 / ICE is that only certain time periods were the focus of the Explorer data restoration effort a few years back. Not all data sets identified in the plan nor necessarily all ISEE-3/ICE data important for archiving are yet collected.

Note that definitive ephemeris is essential for all above missions.

- Older spacecraft generally fall below these initial priorities.

  As resources allow and/or data sets are identified by the community to be at risk/inadequately archived, further review of their status may be appropriate after the higher priority spacecraft have been addressed. General criteria that would apply are the uniqueness/complementarity of the data and quality/information content relative to data produced from the missions above, and other special values.

The panel also notes:

- CRRES measurements are generally important but in substantial measure fall into magnetospheric physics (including trapped radiation). Data of specific C&H importance however are those from the University of Chicago High Energy Heavy Ion Experiment (ONR-604), and are important to capture into the NASA archives. The C&H panels should otherwise work cooperatively with the magnetospheric panel to assure other appropriate CRRES data are not lost.

- ISEE 1/2 are viewed as important spacecraft but should be of primary concern to the Magnetospheric Panel.

- PVO/PV1 is viewed as an important spacecraft, probably in pretty good shape with respect to archiving, but primarily a PDS concern. There is some remaining uncertainly however about the adequacy of arrangements for the PVO cruise data sets.

- There is a current effort to capture Mariner-10 magnetic field data into NSSDC, initially 42 second averages and later high resolution (25 samples/sec) data. These Mariner-10 data are certainly appropriate to the archive and logically at risk due to the age of the data but might not be high priority for special funding at this time.

- Older missions key to establishing the long-term solar cycle dependence of galactic cosmic rays and solar fields/plasmas in the inner and outer heliosphere (e.g. some of the earlier IMP and OGO measurements, Pioneer 6/7, Mariner 4) and various NOAA spacecraft/instruments (e.g. GOES) may need attention. A key element in assessing proposals for such data would be an ongoing scientific effort to maintain continuous cross-calibration among older and newer instruments to form an extended baseline.

The panel further noted that several key data sources of C&H importance (possibly on a par with some of the spacecraft data cited above) include:

- Neutron monitor data and other long-term ground-based cosmic ray data (e.g. ionization chambers, 1936-1975; muon monitors, extensive air shower arrays);

- Solar monitoring data both ground and space-based including visible and X-ray imaging, flare reports, radioheliographic measurements of solar radio bursts such as made at Culgoora and other key sites, coronagraph data including that from the NRL experiment on P-78). These data should be addressed by the solar evaluation panel but may be appropriate for later C&H review;

- Laboratory measurements of nuclear and atomic properties;

- Select instruments on recent or other non-NASA spacecraft (e.g. the Shuttle deployed and retrieved LDEF); and

- Special-purpose multi-mission, multi-spacecraft data sets e.g. aimed at studies of the Heliospheric Current Sheet (HCS) tilt and radial/latitudinal gradients in the galactic cosmic rays.

Data of C&H importance but whose long-term archival value is not well established include:

- Various balloon and rocket measurements flown over the years.

- Select spacecraft measurements directed at e.g. galactic cosmic ray ultra-heavy ions (e.g. HEAO-3).

The underlying issue in the data above is whether the nature of the data (e.g. limited time duration and/or overall statistics) and intensive initial analysis covering the full data set imply at best limited residual value for new science. Counter-views would include (a) analyses are in many cases only partial and (b) for completed but unique measurements, preservation of the data for cross-check analyses later has some intrinsic value.

3.1.4 Summary General Recommendations

- Missions of generally primary C&H archiving importance are Voyager 1/2, Pioneer 10/11, Helios 1/2, IMP-8 and ISEE-3 (ICE). Data from older missions and other data sources have the potential for substantial value but are generally of lesser priority than data from these primary missions.

- Recommendations are not made presently for restoration and/or archiving activities separate from project funding for Voyager 1/2 or Pioneer 10/11. IMP-8 although currently funded for operations, is operating at such minimal funding levels it may be considered effectively unfunded with respect to new data archiving along with Helios 1/2 and ISEE-3.

3.2 Community-Held Data Sets

The panel has tried to deal with two different problems, the first an already identified list of data restoration/preservation "proposals" extant as of April 1992 and the second, working from the list of missions and data sources above, an analysis by mission of whether adequate data are now archived. This work is not completed in this report, although enough is done to define a reasonable set of priorities. Sections below address only data sources thought at this time to be important and at least at some risk of loss without additional direction and/or funding.

3.2.1 Proposals Identified in the April 1992 Restoration Summary

As one preliminary to formation of the various space physics data evaluation panels, a summary list of "proposals" submitted to NASA for space physics data restoration, both unsolicited and in response to a "Dear Colleague" letter sent by SPD in 1991, was assembled and supplied to these committees. The proposals were roughly categorized by sub-discipline and grouped preliminary as "prime" and "secondary", based mainly on whether the initial information submitted seemed of sufficient detail / specificity that it could be understood and the proposal seemed properly relevant to a "restoration" effort. Key sections of the full report are included in Appendix A.

In the initial categorization of proposals, six (cf. H1, H9-H13 in Appendix A) were identified as higher-priority and appropriate at this stage for further consideration. Three more (H25-H27) were also thought relevant but intrinsically of lower priority. Several of the above may have become less relevant since their original submission, as subsequent project/PI efforts have been made to better capture the data. In the early part of 1995 and somewhat in response to the ongoing deliberations of this group, three additional proposals (N1-N3 for numbering convenience) have been submitted.

A summary of these various "proposals" (titles and investigators) is:

Higher-Priority/Initial		
H1	Compression and restoring ISEE-3 cosmic ray data	Meyer
H9	Restoring Cosmic Ray Record (IMPs from 1962 and OGOs)	Simpson
H10a	Archive Low Energy Particle Fluxes from Voyager-1	Krimigis
H10b	Restore and Archive Low Energy Particle Fluxes from IMP-8	Krimigis
H11	Archive Plasma Wave Data from Voyager	Gurnett
H12a	Archive Hi-resolution SW plasma data from Helios 1/2	Rosenbauer
H12b	Archive Hi-resolution magnetic field data from Helios`	Ness
H13	Archive Voyager and Mariner-4 SW plasma data	Lazarus

Lover-Priority/Initial		
H25a	(Archive) Cosmic Ray Data from IMP 7/8	Garrard
H25b	(Archive) Cosmic Ray Data from ISEE-3	Garrard
H25c	(Archive) Cosmic Ray Data from Voyager 1/2	Garrard
H25d	(Archive) Cosmic Ray Data from HEAO (3)	Garrard
H26	Archive Voyager Cruise Data	(multiple)
H27	Archive ISEE(-3) remaining data	(multiple)

New (1995)		
N1	Helios, IMP-6, S3-A Plasma Wave Spectrum Analyzer Data	Kurth
N2	Archiving the CRRES ONR-604 Experiment Data Set	Garcia-Munoz
N3	Restoration/archiving of electron spectra from LEE and ISEE-3	Meyer

As discussions progressed, the committee did not actually try to work its way down these proposals in this specific organization but rather approached the issue by way of (a) prioritization by mission (section 3.1.3 above) and (b) discussion/consideration of specific areas of concern.

3.2.2 Detailed Analysis of Key Data Restoration Sources

3.2.2.1 Data from Voyager 1/2

All Voyager cruise mode experiments, except one, on Voyager 1 and 2 remain fully operable, the Voyager 1 Plasma Science (PLS) experiment being partially operable. Remaining RTG power resources and limits on deep space tracking should provide another twenty years of life for both spacecraft. The downlink telemetry rate is 160-600 bps dependent on spacecraft operation mode.

Archiving arrangements for the Voyager experiments have been formalized only for planetary data through long-standing agreements for data submission to the Planetary Data System, which now holds much of the key parameter encounter data. The status of Voyager cruise data archiving has been in a state of limbo for some time now. Some data from some instruments will indeed be coming into NSSDC from PDS in PDS format. The archiving of data from other instruments is awaiting further negotiations with PIs. The panel noted specific concerns with the fate of Voyager magnetometer and spectral wave data.

Summary of Key Voyager 1/2 Cruise Data Sets at NSSDC through May 1995

		Time Intervals (MM/YY or YYYY)	
PI / Instrument	Data Sets	V-1	V-2
Nav. Team / JPL S/C Ephemeris	Supplementary Experimenter Data Records (SEDR) *Data Contact: Voyager Data Management Group, JPL*	No data	No data
N. F. Ness Bartol Res. Inst. Magnetometer	1-Hr. Interplanetary Archive *Data Contact: L. F. Burlaga, NASA GSFC*	09/77 - 12/89	08/77 - 08/89
J. W. Belcher, MIT Plasma Science Experiment (PLS)	1-Hr. Averaged Solar Wind Plasma Data *Data Contact: J. W. Belcher, MIT*	09/77 - 11/80	08/77 - 12/85
	1-Hr. Averaged. Interplanetary Data - Interim *Data Contact: J. W. Belcher, MIT*	N/A	08/77 - 12/90
	1-Hr. Averaged Archive - submitted to NSSDC by WWW *Data Contact: J. W. Belcher, MIT*	09/77 - 12/80	08/77 - 06/95
S. T. Krimigis JHU/APL Low Energy Charged Particle Expt. (LECP)	15-min. Averaged Low-Energy Flux Near Jupiter *Data Contact: S. T. Krimigis, JHU/APL*	09/77 - 12/79	06/79 - 07/79
	24-Hr. Average Interplanetary Data *Data Contact: R. B. Decker, JHU/APL*	09/77 - 12/93	09/77 - 12/93
E. C. Stone, CIT Cosmic Ray (CRS)	6-Hr Interplanetary Cosmic Ray Data *Data Contact: N. Lal, NASA GSFC*	09/77 - 2/95	09/77 - 2/95
D. A. Gurnett,U.Iowa Plasma Wave Expt. (PWS)	1-Hr. Averaged & High Res. Data - submitted via PDS *Contact: W. S. Kurth, Univ. of Iowa*	09/77 - 01/95	08/77 - 01/95
A. L. Broadfoot, Univ. of Arizona UVS Spectrometer	Solar Lyman-Alpha Backscattering Heliospheric Data *Data Contact: A. L. Broadfoot, Univ. of Arizona*	No Data	No Data

Status for select specific Voyager instruments:

PWS: It now appears that archiving of the high-resolution (and hourly-averaged) PWS data from Voyager will occur through PDS and will be in PDS format and will be in PDS format, available both in CD-ROM and on-line from the PDS PPI node. The hourly cruise data are on-line (WWW) at the P.I. site and under review by PDS; the high resolution data have been submitted to PDS via WWW but are not generally accessible yet.

LECP: Negotiations are in progress for what LECP cruise data will be archived at NSSDC, other than the daily average data set. An early cruise-mode data set (pre-Jupiter) was archived but has subsequently been re-calibrated a number of times. The daily average data are on-line at NSSDC.

PLS: Reprocessed hourly average data sets are on-line (WWW) at MIT and have been submitted to PDS and NSSDC. It may be desirable to archive higher-resolution data and/or to create an archive of PLS spectra, but there have been no negotiations with the instrument team and an optimal strategy needs further detailed analysis.

MAG: The on-line data NSSDC now has are hourly averaged and have the same limitations as cited above for the PLS hourly-averaged data. The data set has been recently updated to 1989 but could be kept substantially more current for best utility. The instrument team maintains an internal archive of higher resolution data but has no plan presently known for submission of this data to NSSDC.

3.2.2.2 Data from Pioneer 10/11

The Pioneer 10 and 11 spacecraft are both operational with power sharing plans for cycling of instruments to conserve power loads with respect to the declining power outputs from the spacecraft RTG's. Both spacecraft are expected to return useful science data from one or more instruments at least through 1995, and Pioneer 10 may last longer. Due to minimal power consumption Van Allen's Geiger Mueller Telescope (GTT) experiment will likely be the last instrument to take data on either spacecraft. Data return is currently at 16 bps with 8-15 hours per day of tracking for Pioneer 10 and 5-9 hours per day for Pioneer 11. Pioneer 10 trackings are forecast to be 6-12 hours per day in 1997. This corresponds to about 2 MB of ground telemetry data per month per spacecraft.

Data archiving at NSSDC is proceeding in accordance with documented goals and assumptions agreements worked out in 1989 between the Pioneer Project, the experimenters, and NSSDC. This agreement called for submission of complete archive data products from launch onward with data encapsulation and documentation in Standard Formatted Data Unit (SFDU) format. Most experiments have submitted data to NSSDC within 2-3 years of data acquisition. Complete Pioneer 11 data submittal by the Ultraviolet Photometer experiment is still pending. Estimated data submission rates for 1995-1997 are about 0.8 MB/month for each spacecraft. Selected key parameter data from many of the already archived data sets have been promoted on-line in the Coordinated Heliospheric Observations (COHO) data base at NSSDC.

The Planetary Data System (PDS) has taken responsibility for promotion of NSSDC-held data to CD-ROM's for Pioneer 11's Saturn encounter. PDS has obtained copies of Saturn encounter data sets on tape from NSSDC, and may obtain other data directly from experimenters.

Summary of Key Pioneer 10/11 Cruise Data Sets at NSSDC through May 1995

		Time Intervals	
PI / Instrument	Data Sets	P10	P11
A. Barnes NASA ARC Plasma Analyzer (PA)	High Resolution (4 min.) Summary Data, SFDU *Data Contact: P. Gazis, NASA ARC*	04/72 - 12/94	04/73 - 07/92
	1-Hr. Averaged Interplanetary Data, SFDU *Data Contact: P. Gazis, NASA ARC*	04/72 - 12/94	04/73 - 07/92
W. Fillius UC- San Diego Trapped Radiation Detector (TRD)	24-Hr. Inhomog. Compress. Interplanetary Summary *Data Contact: W. Fillius, UC-SD*	03/72 - 12/88	04/73 - 12/88
	30-Min. Interplanetary Data, SFDU *Data Contact: W. Fillius, UC-SD*	03/72 - 12/93	04/73 - 8/91
D. L. Judge Univ. of S. Calif. UV Photometer (UVP)	EUV EDR Photo Emission Data *Data Contact: P. Gangopadhyay, USC*	03/72 - 12/93	04/73 - 05/93
	24-Hr. Averaged EUV Interplanetary Archive, SFDU *Data Contact: P. Gangopadhyay, USC*	03/72 - 12/91	No data
D. L. Lozier NASA ARC S/C Ephemeris	24-Hr. Spacecraft Ephemeris Data, SFDU *Data Contact: D. L. Lozier, NASA ARC*	03/72 - 01/90	04/73 - 01/90
F. B. McDonald Univ. of Maryland Cosmic Ray Telescope (CRT)	6-Hr. Averaged Interplanetary Data *Data Contact: N. Lal, NASA GSFC*	03/72 - 12/91	04/73 - 12/91
	6-Hr. Averaged Interplanetary Data, SFDU *Data Contact: N. Lal, NASA GSFC*	03/72 - 12/91	04/73 - 12/91
J. A. Simpson Univ. of Chicago Charged Particle Instrument (CPI)	15-min. Cumulative Pulse Height Event Data *Data Contact: E. M. Murphy, Univ. of Chicago*	03/72 - 12/93	04/73 - 12/93
	5-Min. Averaged Count Rate Summary Data *Data Contact: E. M. Murphy, Univ. of Chicago*	03/72 - 12/93	04/73 - 12/93
	15-Min. Averaged Interplanetary Data, SFDU *Data Contact: E. M. Murphy, Univ. of Chicago*	03/72 - 12/92	04/73 - 11/92
E. J. Smith NASA JPL Helium Vector Magnetometer (HVM)	1-Min. , 1-Hr., & 24-Hr. Averaged Interplanetary Data *Data Contact: J. Wolf, NASA JPL*	03/72 - 11/75	04/73 - 12/86
	15-Min. Averaged Interplanetary Data, SFDU *Data Contact: J. Wolf, NASA JPL*	03/72 - 11/75	04/73 - 12/92
J. A. Van Allen Univ. of Iowa Geiger-Mueller-Tube Telescope (GTT)	1-Hr. Averaged Interplanetry Averages *Data Contact: B. A. Randall, Univ. of Iowa*	03/72 - 01/95	04/73 - 01/95
	24-Hr. Corrected Interplanetary Count Rates *Data Contact: B. A. Randall, Univ. of Iowa*	03/72 - 01/95	04/73 - 01/95
	15-Min. Averaged Interplanetary Data, SFDU *Data Contact: B. A. Randall, Univ. of Iowa*	03/72 - 12/94	04/73 - 12/94
J. D. Anderson NASA JPL Celestial Mechanics	Intermediate Data Records (IDR) *Data Contact: J. E. Hierath, NASA JPL*	12/81 - 12/85	05/82 - 05/83
	Archival Tracking Data Files (ATDF) *Data Contact: J. E. Hierath, NASA JPL*	06/78 - 04/94	06/78 - 05/94

3.2.2.3 Data from Helios 1/2

Based on our general sense of urgency among important C&H missions as explained above, more specific work on the instruments and data of the Helios 1 and Helios 2 spacecraft was undertaken. For this analysis, the instruments/data were divided into 5 general categories.

- Plasma

  One plasma (densities, spectra) instrument (German) was flown on each Helios. The PI at time of flight was H. Rosenbauer at Max-Planck Lindau; the scientist now most involved with this data is Reiner Schwenn.

  All data from this experiment have now been copied by the experimenters to magneto-optical (erasable optical) disks (19 disks of about 600 MBytes each for total 12 GBytes), including 1-d plasma parameters at as good as 40 sec resolution and 3 million spectra, magnetic field data from the Neubauer fluxgate magnetometer averaged to 40 second resolution, relevant orbital information and all raw telemetry data. These data continue to be held by the Investigator team. The raw data are fully documented but that level of documentation is in German. New hourly averages have been and/or are being produced and will be sent to the WDC in the near future.” The team has no current plans to submit the high-resolution data to NASA/NSSDC but intends to continue supporting use of the data.

  Presently, it appears that both the Helios plasma data and the Helios IMF data are being well maintained. A very important next step, upon which the Lindau team is working, is to get the most recent hourly averages out to the space science community at large, and to get the basic plasma parameters (the 'condensed version' referred to above) online.” Higher resolution data would be valuable if more widely accessible; the data are nonetheless German and not NASA data.

- Plasma Waves

  One plasma wave instrument (NASA) consisting of multiple subsystems was flown on each Helios. PI is D. Gurnett at University of Iowa, with Roger Anderson now playing a major role in the handling of this data.

  Microfilm plots that were submitted to NSSDC are felt to be of little use, so there’s a substantial issue to capture these data digitally. One of numerous specific science problems to which these data could be relevant would be study/confirmation of an apparent heliocentric radial inverse dependence of wave intensities inside 1 AU.

  The Iowa group is currently trying to archive (by digitizing and formatting) wideband plasma wave data from various Earth-orbiting missions such as DE, IMP, ISEE, Hawkeye, Spacelab PDP, Injun V, etc. This activity is entirely separate from any Helios activity since Helios has no wideband data. Iowa does, however, have Helios spectrum analyzer data from the Gurnett investigation in-house; this data has been copied from 7-track digital tape to 4mm DAT. However, the group used a Univac 418 for the original data analysis for Helios. Hence, all of their software is in Univac 418-compatible Fortran and the read routines expect a 7-track format.

A high-priority activity might be an effort to port the original analysis code to the Sun/Unix environment so as to be able to read 4mm DAT (and perhaps produce a CDROM versions of this data plots). Without this software, a potential user would have to figure out the tape format and reproduce all of the original effort in designing the analysis software. However, if Iowa did this work once, then any user could gain almost instant access to the data in a usable form.

- Magnetometer

Three magnetometers were flown on each Helios, a search-coil and fluxgate (German) with H. Neubauer as PI and a fluxgate (NASA) with N. Ness PI (F. Mariani of Italy and A. Roberts at GSFC also currently involved with this data):

Six-second magnetic field data from the NASA magnetometers on Helios 1 (1974-1980) and Helios 2 (1976-1980) have recently been submitted via 4-mm DAT tape to NSSDC. NSSDC is archiving this data and plans to move it to the NDADS near-line system.

Hourly average data in COHO database and new NSSDC helio-CD-ROM is from the Neubauer fluxgate on Helios. Interactions with Schwenn (see above) indicate they have already produced erasable optical disks with 40.5 sec resolution Neubauer fluxgate data, although these data are not planned to be publicly archived in the near future.

In context of the plasma data discussion, concern was expressed that data from all magnetometers are important. The DEP has reached no conclusion at this time whether 40 second averages from the Neubauer instrument (the data are nonetheless German and not NASA data) and 6-second data from the NASA instrument would then be sufficient for any foreseen studies. In any event, the most critical action is to simply obtain the hourly average data.

- Energetic Particles

Three energetic particle instruments were flown on each Helios: one (German) with E. Keppler PI (electrons and protons 20-80 keV to about 1 MeV), one (German) with H. Kunow PI but major association of the data with G. Wibberenz (ions >1 MeV/nuc, electrons >0.3 MeV) and one NASA with J. Trainor PI but major association of the data with F. McDonald (ions >3 MeV/nuc, electrons 2-8 MeV and solar X-rays).

These instruments are complementary in energy ranges and species covered in many ways, so all three are actually important. Coverage on the German experiments was better than the NASA experiment (due primarily to the decision to operate the Helios spacecraft in what was originally a forbidden" data mode much of the time). These data are not presently well archived at NSSDC at either high-resolution or fully-reduced comprehensive data products even for the two German experiments. Low resolution, hourly average data products have been archived at NSSDC from all three experiments.

Energetic particle/cosmic ray data in particular are a complex C&H problem because some studies require careful and customized attention to calibrations and background corrections used in reducing combined rate and pulse-height data to physical fluxes. The software for such reduction is PI-specific generally and usually quite complex. Instrument documentation is also complex, consisting of some combination of the instrument / telemetry documentation including calibrations with the reduction and analysis codes themselves (with both in-line and external documentation but often not complete nor carefully reviewed nor kept consistent with the actual software). See discussions relating to this topic in other sections of this report. Even the good higher-level products have not been generated/archived at this time by many of the PIs.

Nonetheless, these data are intrinsically important and a unique resource for heliospheric studies. Those of the panel in this field could certainly never advocate allowing such data (including primary pulse-heights) to be lost. A better understanding of possible approaches to handling data and better understanding of real state of this data at PI sites is required. The NASA low-level" data are believed to be in no immediate danger of direct loss but face a very serious challenge in a forced migration of key software and the database from an IBM/MVS system to a new operating system platform and a new data/media physical base with no existing project as a source of funds.

- Orbit/Attitude

Hourly position in heliographic (RTN) coordinates is included in several field/plasma data sets at NSSDC (including online COHO data). Spacecraft were nominally spinning normal to the ecliptic, so attitude is nearly fixed. NSSDC may not have the full extent of the so-called SEDRs", but the experimenters (e.g. Schwenn) do and have included them in their data products as appropriate/necessary in at least several cases. So the community appears to be in good shape here.

Summary of Key Helios 1/2 Cruise Data Sets at NSSDC through May 1995

		Time Intrvls (MM/YY)	
PI / Instrum.	Data Sets	Helios 1	Helios 2
F. M. Neubauer Univ. of Koln, Ger. Fluxgate Magnetomtr.	8-Second Average Interplanetary Magnetic Field Vector Data *Data Contact: F. M. Neubauer, Univ. of Koln, Ger.*	12/74 - 04/76	01/76 - 04/76
	1-Hour Average Interplanetary Magnetic Field Vector Data *Data Contact: F. M. Neubauer, Univ. of Koln, Ger.*	12/74 - 06/79	01/76 - 06/79
	1-Hour Merged Interplanetary Magnetic Field & Plasma Data *Data Contact: J. W. Freeman, Rice Univ.*	12/74 - 12/80	01/76 - 03/80
N. F. Ness Bartol Research Inst. Fluxgate Magnetomtr	1-Hour Average Interplanetary Magnetic Field Vector Data *Data Contact: L. F. Burlaga*	12/74 - 12/77	01/76 - 12/77
	6-Second Average Interplanetary magnetic field data *Data Contact: F. Mariani, Italy*	12/74 - 11/80	01/76 - 03/80
F. M. Neubauer Univ. of Koln, Ger. Search Coil Magntmtr	8-Sec. Average Spectral Density, 8 Chan, 6.8 - 1470 Hz Dta *Data Contact: F. M. Neubauer, Univ. of Koln, Ger.*	12/74 - 09/75	01/76 - 11/76
D. A. Gurnett Univ. of Iowa SW Plasma Wave	Survey Plots, 20 Hz - 200 Khz in 16 Channels (Microfilm) *Data Contact: D. A. Gurnett, Univ. of Iowa*	12/74 - 12/77	01/76 - 03/80
D. A. Gurnett Univ. of Iowa Fine Frequency Coarse Res. Spectra	Survey Plots, 14.2 Hz - 207 Khz in 21 channels, and 1 - 210 Hz in 1 broadband channel (Microfilm) *Data Contact: D. A. Gurnett, Univ. of Iowa*	12/74 - 12/77	01/76 - 12/77
D. A. Gurnett Univ. of Iowa 26.5KHz - 3MHz Radio Wave	10-Minute Average Summary Data *Data Contact: D. A. Gurnett, Univ. of Iowa*	12/74 - 04/76	02/76 - 10/77
H. W. Kunow Univ. of Kiel, Ger. Cosmic Ray Part.	1-Hour Averaged Interplanetary Count Rate Data *Data Contact: H. W. Kunow, Univ. of Kiel*	12/74 - 12/83	01/76 - 03/80
J. H. Trainor NASA GSFC Galactic/Solar Cosmic Rays	1-Hour Averaged Interplanetary Proton Flux data *Data Contact: F. B. McDonald, Univ. of Maryland*	12/74 - 02/84	01/76 - 03/80
H. R. Rosenbauer MPIA, Lindau, Ger. Plasma Detectors	1-Hour Averaged Interplanetary Solar Wind Plasma Data *Data Contact: H. R. Rosenbauer, MPIA, Lindau, Ger.*	12/74 - 12/80	01/76 - 03/80
	1-Hour Merged Average Interplan. Field & Plasma Data *Data Contact: J. W. Freeman, Rice Univ.*	12/74 - 12/80	01/76 - 03/80
E. Keppler MPIA, Lindau, Ger. Energetic Elec/Protn	1-Hour Averaged Interplanetary Electron-Proton Data *Data Contact: E. Keppler, MPIA, Lindau, Ger.*	12/74 - 12/80	01/76 - 03/80
C. Leinert MPI-Heidelberg, Ger. Zodiacal Light	Reduced Data *Data Contact: C. Leinert,* MPI-Heidelberg, Ger.	12/74 - 02/85	01/76 - 03/80
	Zodiacal Light Data on Tape *Data Contact: C. Leinert*, MPI-Heidelberg, Ger.	12/74 - 02/85	01/76 - 12/79
H. Fechtig MPI-Heidelberg, Ger. Micrometeroid	Micrometeroid Impact Data on Tape *Data Contact: E. Gruen, MPI-Heidelberg, Ger.*	12/74 - 01/80	N/A

3.2.2.4 IMP-7/8

IMP-8 continues to operate as a uniquely long-lived 1 AU solar wind field and plasma monitor, a baseline for low and high energy particle observations in the heliosphere and a spacecraft giving an additional data point in resolving the time/spatial structures that are one target of the ISTP/IACG international suite of missions.

A summary of the instruments and their current archiving status, with at least some notes, is possible based on recent IMP-8 project reporting. An IMP-8 Archiving Plan was prepared in 1989 but only partially funded. Other relevant points:

- The IMP-8 spacecraft remains alive (launched in October 1973!) and generally healthy, although a very slow degradation in power output from the solar panels continues. The battery has long ago died, but IMP-8 to date has survived all Earth shadows. IMP-7 data were acquired from Oct 1972 through Sept 1978, when the spacecraft was commanded off for budgetary reasons. IMP-7 data are compromised by the failure of the magnetometer 6 months after launch.

- Current IMP-8 acquisition is 60-70%, all direct (no on-board data storage), with primary (VHF 137 MHz) telemetry acquisition from stations at Wallops and Redu, secondary but important coverage from Hawaii and the University of Tasmania, very limited coverage from Santiago. Data to date is always handled as analog tapes that are then shipped to GSFC for digitization etc. and eventual (CCT) shipment to the investigators. Test implementation of a low-cost ground acquisition site at McMurdo with data return to GSFC via the Internet is now underway, which if successful could boost IMP-8 coverage to the range of 90%.

- IMP-8 has 10 Principal Investigator teams project-funded for MO&DA. All teams continue to provide data to NSSDC, with some range of lags (1-3 years, typically) and with some range of submission frequency and regularity. NSSDC does not archive IMP telemetry data or "level 0" in most cases but does archive magnetic field and plasma parameters at the highest resolution at which they are continuously generated by the PIs.

- Several IMP-8 instruments (magnetometer and MIT plasma instruments) are supplying ISTP “Key Parameters” (KPs). IMP-8 magnetometer data is reduced to KPs in the CDHF more or less as if it were a “core” ISTP spacecraft instrument; IMP-8 plasma data is electronically pulled to MIT where KPs are generated and returned to the CDHF in a mode that is then more like that of ISTP ground-based and other ISTP-supporting spacecraft (GOES, LANL). Recently this same process has been extended to handling data from the University of Chicago experiment (although no KPs are returned at this time) to support analysis of data from the Ulysses pole passes in 1994 and 1995.

Operational IMP-8 instruments and their current operational status are:

FIELDS:	
Magnetic Fields (Lepping)	Normal
DC Electric Fields (Aggson)	Intermittent Since 12/76; Not Supported
AC Elec. & Mag. Fields (Gurnett)	Wide Band Mode Lost; Not Supported
PARTICLES:	
Cosmic Ray (McGuire)	LED (4-22 MeV/nuc) Anti Problem; VLET, MED and most LED modes OK
Cosmic Ray (Simpson)	Normal
Energetic Particles (Williams)	Normal
Charged Particles (Krimigis)	Normal
Electron Isotopes (Stone)	Partial Failure 1992
Ion & Electron (Ipavich)	ULET Inop 12/15/78; El'static Analyzer OK
PLASMA:	
Low Energy Particles (Frank)	Normal (For Magnetotail)
Plasma (Gosling)	Mag'tail Mode Lost 1985; Solar Wind parms now derived from electrons
Plasma (Lazarus)	Self Calibrations Interrupted

Summary of Key IMP-8 Data Sets at NSSDC through May 1995 (part 1)

PI/Instrument	Data Set Description	Time Intervals (MM/YY)
N. F. Ness Bartol Res. Inst.	15-Second Magnetic Field Vectors *Data Contact: R. P. Lepping, NASA GSFC*	10/73 - 07/91
Magnetometer	1-Minute Magnetic Field Vectors *Data Contact: R. P. Lepping, NASA GSFC*	07/91 - 12/93
	1-Hour Averaged Magnetic Field Vectors *Data Contact: J. H. King, NASA GSFC*	10/73 - 06/94
H. S. Bridge MIT	1-Minute Maxwellian Fits *Data Contact: A. J. Lazarus, MIT*	10/73 - 01/95
Solar Plasma	1-Hour Averaged Interplan. Plasma Data *Data Contact: A. J. Lazarus, MIT*	11/73 - 01/94
S. J. Bame LANL .	2-Minute Solar Wind Moment Data *Data Contact: J. T. Gosling, LANL*	11/73 - 12/92
Solar Plasma Electro. Analyz	1-Hour Averaged Solar Wind Data *Data Contact: S. J. Bame, LANL*	01/75 - 12/78
	1-Hour Averaged Solar Wind Data *Data Contact: J. T. Gosling, LANL*	01/79 - 12/92
L. A. Frank Univ. of Iowa	24-Hour Color E-T Spectrograms *Data Contact: L. A. Frank, Univ. of Iowa*	11/73 - 12/92
LEPEDEA	Plasma Distribution Functions, Magnetotail *Data Contact: C. Y. Huang, Univ. of Iowa*	01/78 - 12/82

Summary of Key IMP-8 Data Sets at NSSDC through May 1995 (part 2)

PI/Instrument	Data Set Description	Time Intervals (MM/YY)
D. J. Williams APL/JHU Electron & Proton Expt.	20-Second Merged Hi-Res Counting Rates *Data Contact: J. L. Gunther, APL/JHU*	10/73 - 09/90
S. T. Krimigis APL/JHU . Charged Particle Meas. Expt	20-Second Merged Hi-ResCounting Rates *Data Contact: J. L. Gunther, APL/JHU*	10/73 - 09/90
	1-Hour Averaged Proton Flux Data *Data Contact: T. P. Armstrong, U. Kansas*	01/74 - 12/90
G. Gloeckler Univ. of Maryland Solar Ions & Electron Expt.	10-Minute Averaged Summary Data *Data Contact: F. Ipavich, Univ. of Md.*	10/73 - 04/95
R. E. McGuire NASA GSFC Cosmic Ray Expt.	1-Hour Averaged Proton Flux Data *Data Contact: R. E. McGuire, NASA GSFC*	08/75 - 07/90
	Full-Telemetry-Resolution Rates and Pulse-Heights *Data Contact: R. E. McGuire, NASA GSFC*	9/73-8/94 (in-progress)
J. A. Simpson Univ. of Chicago Cosmic Ray Nucl. Comp. Expt.	5-Min. Rate & 15-Min. PHA Data *Data Contact: E. M. Murphy, Univ. Chicago*	10/73 - 06/94
E. C. Stone, CIT Elect., Prot., & Ion Isotope Expt.	1-Hour Averaged Counting Rates *Data Contact: R. A. Mewaldt*	10/73 - 12/90
D. A. Gurnett Univ. of Iowa Electr. Wave & Radio Expt.	24-Hour E & B Survey Plots - Microfilm *Data Contact: J. L. Green, NASA GSFC*	10/73 - 12/81
T. L. Aggson NASA GSFC Ambient Electric Field Expt.	40-Second DC E-field & RMS Noise- Plots *Data Contact: T.L. Aggson, NASA GSFC*	12/73 - 10/74
	High Resolution E-field Events - Plots *Data Contact: T.L. Aggson, NASA GSFC*	12/73 - 10/74

The IMP-8 magnetometer team has done a particularly outstanding job in their archiving efforts. Also noteworthy is the effort spear-headed at APL (but led in large measure by Pat Briggs of the Citadel and Tom Armstrong at University of Kansas) to create a merged 20-second database of fields and (low energy) particles and the ongoing efforts of the MIT plasma team. However as noted above, IMP-8 archiving under project auspices has been very difficult within the limited budget. The existing budget barely supports continuing data reduction, let alone science analysis or special reduction/archiving costs. Various instruments over the years have also encountered problems when they were forced to migrate software and/or databases to accommodate the retirement of old technologies.

3.2.2.5 ISEE-3/ICE

The ISEE (International Sun-Earth Explorer) program was an international cooperative program between NASA and ESA to study the interaction of the solar wind with the earth's magnetosphere. The program used three spacecraft, a mother/daughter pair (ISEE 1 & 2) and a heliocentric spacecraft (ISEE 3, later re-named ICE). ISEE 3 initially was kept at the Lagrangian point between the earth and the sun, 0.01 AU from the earth. ISEE 3 was moved from this orbit and made transits through the earth's geomagnetic tail from September 1982 until December 22, 1983, when it made a very close swing-by of the moon and began its cometary mission (and new name ICE for International Cometary Explorer) to the comet Giacobini-Zinner (G-Z). ICE flew through the plasma tail of G-Z on September 11, 1985. It remains in a heliospheric orbit at approximately 1 AU. Some support is currently being provided for ICE operations through the Ulysses project.

ISEE-3 data archived at NSSDC consist of ISEE 3 pool data sets (which contain a few selected parameters at low time resolution from most instruments) and of specific data sets submitted individually by the ISEE PIs. The pool data sets are useful for obtaining rough surveys of the observations encountered, but are not to be considered definitive data. Due to the lack of a central ESA data center, many of the ESA PIs archived their data at NSSDC, to fulfill the archiving requirements of the NASA/ESA MOU.

An ISEE/ICE archiving plan was prepared in 1989. It defined a set of specific time intervals on which better PI data submissions would be focused, namely:

10/77-2/80	Prime operations phase from ISEE 1/2 launch
10/82-12/83	Deep tail phase of ISEE-3 operations
9/85	Giacobini-Zinner encounter, ICE (ISEE-3) only
3/86-6/86	PROMIS campaign, ISEE1/2 only

A table follows on ISEE-3/ICE data sets submitted to NSSDC. Only the principal (usually the longest time span) data sets are included. The panel has been notified by the MEH experiment co-investigator, P. Evenson of Bartol Research Institute, of an effort continuing to analyze the MEH high energy electron data in correlation with a long series of balloon measurements by the LEE (Low Energy Electron) experiment of P. Meyer and P. Evenson (see description below).

Summary of Key ISEE-3/ICE Data Sets at NSSDC through May 1995 (part 1)

PI/Instrument	Data Set Description	Time Intervals (MM/YY)
S. J. Bame (J. T. Gosling) LANL Solar Wind Plasma Expt.	24-Sec./168-Sec. SW & G-Z Data *Data Contact: J. T. Gosling, LANL*	08/78 - 09/85
	168-Second SW Electron Moments *Data Contact: J. T. Gosling, LANL*	02/80 - 06/92
	1-Hour SW Electron Moments - NSSDC *Data Contact: H. K. Hills, NSSDC*	02/80 - 06/92
	1-Min. Plasma & B-field in Tail *Data Contact: J. L. Philips*	12/82 - 12/83
K. W. Ogilvie NASA GSFC Solar Wind Ion Comp. Expt.	1-Hour Averaged He Ions - n, V, T *Data Contact: K.W. Ogilvie, NASA GSFC*	08/78 - 12/83
G. Gloeckler Univ. of Md. Low Energy Cosmic Rays	512-Second Rates - H, He, Z>2 Ions *Data Contact: D. Hovestadt, MPIE, Ger.*	01/80 - 12/81
	?? Count Rate Summary Data *Data Contact: F. Ipavich, Univ. of Md.*	08/78 - 12/83
	15-Min. Averaged Rates - Data Pool *Data Contact: D. Hovestadt, MPIE, Ger.*	08/78 - 02/87
K. A. Anderson UC- Berkeley Interpl. & Solar Electron Expt./X- & Gamma-Ray Burst Expt.	8-Hour Electron Summary Plots - mflm *Data Contact: K. A. Anderson, UCB*	08/78 - 11/79
	32-Second Weekly Summary - Lists & Plots on Microfiche *Data Contact: K. A. Anderson, UCB*	08/78 - 02/87
	Entire X- & Gamma-Ray Data Set *Data Contact: K. Bromund, UCB*	08/78 - 02/87
	X- & Gamma-Ray Event Data *Data Contact: K. Bromund, UCB*	08/78 - 02/87
E. J. Smith NASA JPL . Magnetic Fields Expt	1-Min., 1-Hr., 1-Day Averaged B-field *Data Contact: J. Wolf, NASA JPL*	08/78 - 12/90
	64-Sec. Averaged B-field - Data Pool *Data Contact: E. J. Smith, NASA JPL*	08/78 - 02/87
T. T. Von Rosenvinge NASA GSFC Med. Energy Cosmic Rays	15-Min. & 2-Hr. Cosmic Ray Fluxes *Data Contact: T. T. Von Rosenvinge*	08/78 - 02/87
P. A. Evenson Bartol Res. Inst. Cosmic Ray Electr. & Nuclei Expt.	Cosmic Ray Nuclei & Elect. - Data Pool *Data Contact: P. Meyer, U. of Chicago*	08/78 - 02/87
	Cosmic Ray Nuclei & Electr. Rate Plots *Data Contact: P. A. Evenson, B.R.I.*	08/78 - 12/85
	Cosmic Ray Nuclei & Electr.-Raw Data *Data Contact: L. Krawczyk, U. Chicago*	Proprietary (600 tapes)

Summary of Key ISEE-3/ICE Data Sets at NSSDC through May 1995 (part 2)

PI/Instrument	Data Set Description	Time Intervals (MM/YY)
E. C. Stone, CIT High Energy Cosmic Ray Expt.	1-Hour Averaged Flux - H, He, Z>2 *Data Contact: R. A. Mewaldt, CIT*	12/78 - 01/82
	15-min. Averaged Flux - H, He, Z>2 *Data Contact: R. A. Mewaldt, CIT*	08/78 - 12/78
	HIST Crush & Library Tapes *Data Contact: T. L. Garrard, CIT*	Proprietary (270 tapes)
M. Wiedenbeck NASA JPL High Energy Cosmic Ray Expt.	Cosmic Ray Element & Isotope Tables - On-Line at NSSDC *Data Contact: M. Wiedenbeck, NASA JPL*	08/78 - 04/81
R. J. Hynds Imperial College, UK Energetic Protons	Energetic Protons - Data Pool *Data Contact: R. J. Hynds, Imperial Coll.*	08/78 - 10/86
	256-Sec. OmniDir & Sectored Fluxes *Data Contact: R. J. Hynds, Imperial Coll.*	08/78 - 12/78
	32-Sec. Sect. & Avg. Fluxes (G-Z Enctr.) *Data Contact: R. J. Hynds, Imperial Coll.*	09/85 - 09/92
E. W. Greenstadt TRW Plasma Waves	Plasma Wave - Data Pool Plots & Tapes *Data Contact: E. W. Greenstadt, TRW*	08/78 - 01/87
J. L. Steinberg Paris Observatory Radio Mapping	90-Min. & 24-Hr. Survey Plots -Mfiche *Data Contact: R. G. Stone, NASA GSFC*	08/78 - 02/87
	Radio Mapping Plts & Tape - Data Pool *Data Contact: J. L. Steinberg, Paris Obs.*	08/78 - 02/87
B. J. Teegarden NASA GSFC Gamma Ray Burst Expt.	Gamma Ray Burst Spectrum Data *Data Contact: J. P. Norris, NRL*	11/78 - 12/80

3.2.2.6 Other Data Sources

A variety of experiments and data fall outside our original rough ranking either as individual C&H instruments on missions not primarily of C&H science interest or ground-based data (including in both cases and as above, non-NASA experiments producing data of potential NASA SPDS C&H scientific interest.

- There was extensive discussion on the importance of long-term neutron monitor and other ground-based data bases (international in scope), both their preservation and (for note only, by definition above outside the scope of this panel's concerns) online access. The general sense was that these data may be under-appreciated by NASA but form a very important basis for significant very high energy solar and galactic cosmic ray studies.

  US data sets have been typically funded by NSF, but there is no specific archiving plan for them. The Air Force Phillips Lab informally collects and archives high-time resolution neutron monitor data for GLEs. The official archive for hourly cosmic ray data is WDC-C2, which has a project in collaboration with NGDC which is generally to put all historical data on CD-

ROM in common format. The situation with respect to higher-time resolution data is unclear but appropriate efforts to maintain such databases should probably be encouraged.

- Various kinds of cross-section measurements were noted as of extreme importance to the interpretation of galactic cosmic ray data.

- The University of Chicago has submitted a proposal to archive CRRES/ONR-604 “C2E” level-1 data on CD-ROM along with higher level data containing calculated fluxes and comprehensive user documentation including source codes. This experiment in particular as noted is clearly of C&H concern; other CRRES instruments are important but may be more relevant to other space physics disciplines. CRRES data may be a more general issue to NASA and SPDS, given the potential shutdown of the Air Force Geophysics Laboratory which was the primary sponsor of the CRRES mission.

- A question was raised from the community about neutrino data. There is a preliminary sense, in the absence of proven solar neutrinos, that perhaps those data sets are more relevant to astrophysics (and maybe NSF concerns) than NASA at this time. There was also a general note about ground-array (very high energy) data, which is Space Physics/C&H relevant but also crosses into astrophysics area. Utility of this data versus effort to collect and make usefully available needs more careful consideration. Prioritization of such an effort would probably depend on the details of what might be proposed and at what cost.

- Other sources include data from manned space missions (US and Russian) and sub-orbital balloon and rocket experiments. In the current review, such data have not yet been assigned priority for special attention. A proposal has been submitted by P. Meyer (University of Chicago) for restoration and analysis of Low Energy Electron (LEE) balloon experiment data at 200 MeV to several GeV from flights from 1968 through the present. There is a general sense of the panel that these kinds of measurement are most likely to have archival value when tied together into a longer database.

- For reference, the following information is available on SAMPEX:

  The SAMPEX spacecraft was launched in July 1992 to monitor energetic cosmic rays and high energy electrons in the inner magnetosphere. Emphasis was on the anomalous component of the cosmic rays in the C-N-O group with lower than usual ionization states. The energetic electron detectors enable surveillance of the impact of the electrons on stratospheric ozone and other gases.

  Currently NSSDC has Level-1 data (i.e., Level-0 + ephemeris) on rewritable optical disks with a data volume of about 50 MB/day (implying 12 days/disk), from July 92 to the present (18 GB/year). Data are in Tennis format written by a VAX; a Tennis library of routines have been procured, but satisfactory "read" codes remain to be written or procured so that when Level-1 ceases to be a

Project office responsibility, NSSDC may assume the distribution responsibility satisfactorily. L-1 archival arose at the final phase of the PDMP.

SAMPEX has further agreed to supply to the NSSDC Level-2 data to NSSDC and is planned to be converted by the Project into the ISTP-standard CDF format with SFDU detached labels. Estimated volume of data, expected to begin in a few months are:

30-s Flux averages:	1.7 MB/day	615 MB/year
30-s Rate averages:	4.0 MB/day	1.5 GB/year
Polar cap averaged fluxes/rates	98/500 KB/day	2.5/13.0 MB/year

- For reference, the following information is a current Ulysses summary:

  The Ulysses spacecraft completed the first overflight of the south polar region of the Sun in 1994 and is continuing on towards an overflight of the north solar pole in 1995, to complete the goals of the prime mission as defined prior to launch. NASA and ESA have formally agreed to extend the mission for a second solar orbit through the year 2001 when Ulysses will have completed another pair of polar passes. A formal PDMP, called the Science Data Management Plan, was updated by the Ulysses Project this past year and sets general goals for archiving of data at NSSDC by all Ulysses investigators, including those based in Europe. At the Ulysses Science Working Team meeting in November 1994, most investigators agreed to submit previously proprietary data, to NSSDC as initial archival products.

  Currently NSSDC holds hardcopy plots from URAP and digital data through various end dates 1991-1994 for most of the onboard experiments including solar wind plasma, magnetic field, energetic particles, dust and gamma rays. Many Ulysses data sets are being submitted and updated through the Ulysses Data System (UDS), an otherwise proprietary network managed by ESTEC for ESA and NASA Ulysses investigator teams. NSSDC also receives monthly CD-ROM's from the Ulysses Project in the same EDR format as provided to the Ulysses investigators, the understanding being that NSSDC will hold these CD-ROM's as proprietary data, except that NSSDC may distribute the SEDR ephemeris data files after extraction from the CD-ROM's. Including the CD-ROM's, NSSDC expects to receive about 680 MB per month of digital data from Ulysses, and 70 MB per month of this would be available for open distribution during 1995-1997.

Summary of Ulysses Interplanetary Cruise Data Sets at NSSDC through May 1995 (Part I)

PI / Experiment	Data Set Descriptions	Time Intervals (MM/YY)
A. Balogh Imperial College Magnetic Fields	1-Hour Averaged Magnetic Field Vectors & Magnitudes *Data Contact: A. Balogh, Imperial College - London, UK*	10/90 - 02/92
	1-Min. Averaged Magnetic Field Vectors & Magnitudes *Data Contact: J. Wolf, NASA JPL*	10/90 - 02/92
J. L. Phillips LANL Solar Wind Plasma (SWOOPS) Expt.	4-8 Min. Hi-res & 1-Hr Averaged SW Ion V_{RTN}, T_p, N_p, N *Data Contact: B. E. Goldstein, NASA JPL*	11/90 -12/93
	2-11 Min. Hi-res SW Electron T_e, T_c, T_h, N_e, N_c, N_h *Data Contact: J. L. Phillips, LANL*	11/90 -12/92
R. G. Stone NASA GSFC Unified Radio and Plasma Wave Expt. (URAP)	3-Hr. Summary Plots: Freq.-vs.-Time Spectrograms, E & B Time Series and Spectra *Data Contact: R. J. MacDowall, NASA GSFC*	11/90 - 09/94
	24-Hour Summary Plot Files - Postscript Format *Data Contact: R. J. MacDowall, NASA GSFC*	10/90 - 03/94
	144-Sec. Avg. Radio Astronomy Receiver Intensities *Data Contact: R. J. MacDowall, NASA GSFC*	10/90 - 03/94
	10-Min. Avg. & Peak Field Intensity Spectra - PFR (E-field), RAR (E-field),and WFA (E & B field) *Data Contact: R. J. MacDowall, NASA GSFC*	10/90 - 03/94
Ulysses Project NASA JPL SEDR & EDR Data	1-Mon. Supplementary Expt. Data Records (SEDR) *Data Contact: J. Johnson, NASA JPL*	11/90 - 10/91 12/93 - 02/95
	1-Mon. Experiment Data Records (EDR) & Other Proprietary Data Files on Ulysses Project CD-ROM's *Data Contact: J. Johnson, NASA JPL*	11/90 - 10/91 12/93 - 02/95
E. Grün MPI-Heidelberg,Ger. Dust Expt.	Dust Particle Event Listing *Data Contact: E.Grun, MPI-Heidelberg, Ger.*	10/90 - 12/92
K. C. Hurley UC - Berkeley Solar X-Ray & GRB	0.5-Second Omnidirectional Integrated Counting Rates *Data Contact: R. Williams, UC - Berkeley*	10/90 - 09/94

Summary of Ulysses Interplanetary Cruise Data Sets at NSSDC through May 1995 (Part II)

PI / Experiment	Data Set	Time Intervals (MM/YY)
L. J. Lanzerotti AT&T	Atlas of Ion and Electron Flux Anisotropies- Plot Books *Data Contact: E. C. Roelof, APL/JHU*	11/90 - 09/94
Low Energy Ion & Electron Expt. (HISCALE)	1-Hr. Spin-Averaged Counting Rates - Univ. of Kansas *Data Contact: T. P. Armstrong, Univ. of Kansas*	11/90 -12/93
	1-Hr. Sectored & Spin-Averaged Counting Rates -UDS *Data Contact: J. Tappin, Univ. of Birmingham, UK*	11/90 -12/93
J. Geiss Univ. of Bern, Switz. Solar Wind Ion Comp. Spectromtr. (SWICS)	3.5-Hour Averaged Interplanetary SW Ion Comp. Data *Data Contact: R. v. Steiger, Univ. of Bern*	12/90 -12/93
J. A. Simpson Univ. of Chicago	10-Min. Avg. Sectored & Omnidir. Fluxes & Rates from the Low Energy Telescope (LET) *Data Contact: T. R. Sanderson, ESTEC/ESA*	12/90 - 12/93
Cosmic Ray & Solar Particle Expt. (COSPIN)	10-Min. Avg. Omnidir. Counting Rates from the High Energy Telescope (HET) *Data Contact: R. B. McKibben, Univ. of Chicago*	10/90 - 12/93
	10-Min. Avg. Sectored & Omnidir. Fluxes from the Kiel Electron Telescope (KET) *Data Contact: B. Heber, Univ. of Kiel, Ger.*	10/90 - 12/93
	10-Min. Avg. Sectored & Omnidir. Fluxes from the Anisotropy Telescopes (AT) *Data Contact: K. Steines, Imperial College-London, UK*	01/91 - 12/93
	10-Min. Avg. Sectored & Omnidir. Fluxes from the High Flux Telescope (HFT) *Data Contact: J. D. Anglin, Herzberg Inst., Canada*	10/90 - 06/94
E. Keppler MPIA-Lindau, Ger. Energetic Part. Composition Expt. (EPAC)	10-Min. Avg. Sectored & Omnidir. Electr. & Prot. Fluxes *Data Contact: M. Bruns, MPIA-Lindau, Ger.*	10/90 - 12/94
Interstellar Neutral Gas Expt. (GAS)	No data at NSSDC from this experiment.	---
M. K. Bird Univ. of Bonn, Ger. Solar Coronal Expt. (SCE)	No data at NSSDC from this experiment.	---
B. Bertotti Univ. of Pavia, Italy Grav. Wave Expt. (GWE)	No data at NSSDC from this experiment.	---

3.2.3 Summary Community Recommendations/Priorities

- Helios:
  - Funding to the University of Iowa to assure archive of an appropriate subset of Helios 1 and 2 plasma wave data, coordinated with archiving of other priority magnetospheric plasma wave data, should be a high priority data restoration effort
  - SPDS should strongly advocate the generation and acquisition into NSSDC of reduced Helios plasma and field data from the primary Schwenn magneto-optical disks that have now been produced. At some time in the near future, space physics data restoration/NSSDC should pursue capture of the primary Schwenn magneto-optical data archive.
  - NSSDC should complete archival ingest of the remainder of high-resolution Helios magnetic field data from the NASA instrument
  - SPDS should pursue the earliest possible acquisition more complete energetic particle data.
- SPDS should strongly advocate and consider supplemental funding if necessary to assure full and correct archival submission of all IMP-8 data.

3.3 NSSDC-Held Data Sets

The panel was supplied a very long list of currently NSSDC-held data sets of possible C&H scientific interest, much from older missions. Since NSSDC has been and will probably continue to be a primary C&H data archive site (and for overall SPDS information services, deep archival storage, bulk data dissemination and select near-line/online archival data access), the NSSDC holdings are of great importance. It has been noted to SPDS as a whole and the C&H DEP that NSSDC is generally concerned about the expenditure of resources to restore or preserve data that may be actually of very little remaining scientific importance.

3.3.1 Select Recommendations on Larger NSSDC-Held Data Sets

As is a general problem with the space physics holdings in NSSDC, there are many small data sets from older missions that a panel such as this simply lacks resources to analyze in depth. Clear recommendations to discard data sets were unlikely (relatively little data has no potential science value) and the effort for NSSDC to hold such data sets is relatively small at the per data set level. As a compromise then, the panel attempted to review the NSSDC holdings only for larger (>50 tape) C&H data sets. This review yielded only a very few conclusions, the first two of which are now irrelevant because NSSDC has already restored the data in question.

- The Pioneer 10/11 EUV EDRs held by NSSDC are more complete than the selected new data to be submitted from Pioneer and thus should be saved.
- C&H viewed Pioneer 10 and Helios Asteroid Astronomy as out of C&H scope PDS is interested in this science but has no known active work in progress.
- We believe PDS plans to handle or already has well in hand all relevant ephemeris, field and plasma data (including interplanetary portions) from PVO. NSSDC probably would best work directly with PDS to coordinate any deletion (or continuation) of duplication of overlapping archival holdings.

3.4 Full Telemetry Resolution vs Higher-Level Data Products

A topic of specific concern to C&H is how to handle “full telemetry resolution” (FTR) data. By this term (which we will try to use consistently throughout this section), we refer to an instrument data product from which no critical information from the original telemetry stream has been lost or processed away. Information in an FTR data set may be (and preferably has been) time-tagged, edited to remove bad data, and even reformatted to e.g. expand compressed telemetry words to full lengths and/or standardize the format in some way for easier future use. In the case of an energetic particle instrument e.g., an FTR data set would probably include all the individual pulse height events and full time resolution rates instead of e.g. only the "fluxes" computed from those events and normalizing rates at some(even fairly high resolution) time scale. Such data sets might also be termed Level-0 or Level-1 (depending on the processing actually performed), telemetry or full resolution.

The heart of the FTR question is the inherent contradiction among several factors:

- There is a concern throughout the space physics community and certainly in the C&H DEP that potentially uniquely valuable and irreproducible data should not be discarded. We might call this a concern of “stewardship” on behalf of the NASA science community. But it is also stewardship on behalf of a wide range of other NASA and US government interests, as one example space engineering concerned with the long-term space radiation environment.

- Much of this uniquely valuable and irreproducible data is also and inherently what might be termed

  “low frequency of use” (and likely to remain so)

  because it is also usually

  “very difficult (resource-intensive) to actually use.”

  FTR data are typically unusable without specialized software and expertise. To fully capture current or past FTR data requires substantial effort for each such data set in full documentation (including source codes) and may require appropriate format and software conversions/re-engineering with some ongoing program of software maintenance. Attention to archiving issues early in the life of a project/instrument system will of course substantially reduce these costs, but this has not been a typical nor funded practice for most existing C&H instrument systems and FTR data sets.

- At the same time, there is a concern by the community to focus resources on data of current or greatest interest and utility to the science community, which almost by nature tend to be reduced data that have been processed to the level of physical quantities rather than low level data sets. The low level data however may be essential to confirm discoveries seen in the reduced or higher-level data.

- Resources are and will probably remain very limited, with fairly direct tradeoffs to be made between funding analysis of space physics data and funding of efforts to restore, archive and maintain specific data and/or enhance the utility of such data to a level where they may be "correctly and independent used" by a non-PI investigator.

After extended discussion, there was consensus by the panel that FTR data for C&H missions is at least sometimes appropriate and necessary to archive. The missions involved are so unique at this point and their data likely to be subject to repeated analysis and re-analysis over time that no other strategy may suffice. There is ongoing concern whether the investment of substantial Division resources in archiving most such data is really sensible in the current fiscal environment, but deliberately allowing such unique data to disappear seems irresponsible also. Elements of an appropriate approach to archival handling of FTR data may often make best sense as "shelf" storage of long-lived media (highly standard, very durable without specific maintenance assuming storage under appropriate conditions - in current technology, CD-WO/CDR would be an example), along with a full electronic copy of all existing documentation (source codes, guides and descriptive materials, some even from "scanned" hardcopy pages, and appropriate high-level overviews).

The committee notes that the cost of the necessary hardware is dropping rapidly and there is already a precedent in the NSSDC's handling of "Level -0" ISTP data for shelf storage of telemetry CD-WO media against a future need. Since a key limiting factor in all these kinds of restoration activities is the availability of time on the part of the original PI and knowledgeable data experts from the original team, effective inducements to participate in this kind of program are not just direct salary funding but (a) the assurance valuable data will be retained, (b) a minimized "up-front" workload on the involved experts and (c) emplacement of CD-WO capability at each site that would remain after the restoration proper had been completed. An infrastructure of distributed capability in the community to create such standard media could also likely to be of long-term programmatic value as a standardized method for media-based data exchange.

There will remain a clear preference to get the highest level (most usable form) that still contains the full instrument information. SPDS should probably look for archiving proposals for FTR data that also include derived products more likely to be easily useful and of broadest interest. But details of whether higher-level data come before or after lower-level data has to be an implementation issue handled in the mode of "what makes sense."

Documentation to make the data nominally independently and correctly usable (but admittedly not easily usable) will be an ongoing issue. Expectation is to look for source codes, electronic and/or scanned documents, appropriate overviews and "test data" that could be used to validate the operation of the supplied source codes when recompiled/revamped by a new user. Review of the resulting data package is an area that will need careful attention. To fully validate the completeness/usability of such a package probably requires penetrating and testing what is supplied. Archive administrators probably cannot by themselves commit to doing more than a fairly cursory overview at best, but SPDS/C&H may be reluctant to commit resources to PDS-style peer reviews of data sets.

Restoration proposals including FTR data should probably contain a "white paper" summary of exactly what would be intended to be supplied with data at this level to check plausibility and that could form a kind of checklist for some TBD combination of SPDS/NSSDC review. There is however an element of risk that data will be archived that will prove ultimately unusable due to omission of key ancillary information that is unavoidable in this approach.

A fresh perspective that the panel suggests is to look at such older archived FTR data as a combined resource with the expertise of the original PI or team members for some extended period past their analysis funding. So data in the archive could be held for use by the team itself and by more general users but with the assumption those users might have to involve the PI to make any kind of efficient use of this data. This approach would retain the idea of “correctly usable” data that has usually been called out as an NSSDC goal but hedges the "independently " part of the traditional statement. NSSDC did note it does hold some such data (e.g. from various Caltech and University of Chicago experiments) and these have been essentially unused to date.

3.4.1 Summary Low-Level Recommendations/Priorities

- One viable approach to handling data at Full Telemetry Resolution (FTR) (or any other comparable data that is “unique” but “low-level” with “low frequency of access”) is to capture the data with as full a set as possible of associated metadata (code, electronic and scanned documentation, overview materials) to be handled by the archive by whatever methods are minimum cost. Options could include CD-WO media, although technical advances in large mass-storage and data compression technologies may be competitive approaches. SPDS and NSSDC should conduct testbed activities involving selected data sets to evaluate the feasibility and likely costs of such an approach, as well as to assess the likely usability of the resulting data products from an end-user perspective.

APPENDIX A: 1992 DATA SET RESTORATION PROPOSALS

Suggested Data Sets for Restoration or Recovery

Susan Kayser, 3 April, 1992

The data sets displayed in the tables are a suggested first and second cut for data sets suitable for restoration or recovery. They include the four already in progress. The remainder were selected from positive responses to the letter of 8/90 asking if additional data need processing, as published in the Data Census, and from those in the list supplied by J. Willett (the Data Census Extension). A few additional items were suggested by D. Bilitza for Ionospheric data, and by D. Batchelor for Solar data.

The criteria for selection were as follows. The first four items are those which were already selected. The remainder of the first cut were chosen for Heliospheric and Magnetospheric disciplines because they involved adding to or restoring long term synoptic field and plasma data sets valuable for understanding the large scale structure of the heliosphere and its variation with solar cycle, and the solar-terrestrial interaction; the Solar and Ionospheric candidates were the strongest recommendations of Bilitza and Batchelor. Except for the first four, they are not prioritized within each discipline. The second cut includes the remaining recommendations, and adds energetic particle data sets. Proposals from the Extension to collate data of a single spacecraft, or of a single type of data, were also put here. In addition, attention was paid to having all disciplines represented. The second cut selections are also unprioritized within each discipline.

With a few exceptions, data from Pioneer 10, 11, from ISEE-1,2,3, from DE 1,2, from IMP-8 and from SMM are not given high priority, because archive efforts are already active for these s/c. (The ISEE data archiving plans never included more than about half the time interval, and some of that was never received, but even though these are valuable data, they are in the second cut because they've already had one chance at archiving.) Voyager cruise data are listed as a generic item, even though they are years behind, because experiments are still actively receiving data.

Some policy issues have appeared with respect to candidate selection which must be settled at a higher level. In particular, the questions arise of whether non-NASA data sets should be included in the SPDS (relevant to Item 5 and possibly 23), and of whether the SPDS is committed to archiving the full output of data-intensive experiments (see Item 25). Another issue to be settled is whether candidates for accessibility, rather than simple survival, are to be considered at this time. Three such candidates have been identified, and are described in a separate list at the end.

The descriptions below are listed by experimenter and by type of experiment. See Appendix A for an explanation of AIM data set listings.

Appendix A lists all the AIM file entries relevant to each of the 38 data sets, i.e. the experiment name and the associated datasets already at the NSSDC, or otherwise known. If only the experiment name is shown, no data from that experiment have been archived.

Appendix B presents the AIM Brief Descriptions for most of the experiments in the first cut (in the case of related experiments, only one sample description is included), indicated by a * after the NSSDC ID in Appendix A.

The full list, with an additional section containing the remaining items from the Data Census Extension, is presented in the spread sheet at the end.

The first cut.

H1. Meyer Compression and restoring ISEE-3 Cosmic Ray Data

In progress. He has about 600 ISEE tapes; NSSDC holdings are primarily raw data and plots. Long term cosmic ray records are important to an understanding of the heliosphere.(He also has about 100 tapes from OGO-5 and Spacelab-2 each, which may be worth doing as well.)

M 2. Russell Archiving the full revolution Magnetic Field data, ISEE-1, 2

Extensive plan, in progress. Magnetic fields are top priority for understanding the magnetosphere. Here are most of the existing NSSDC holdings (excluding short time intervals):

60-MS FLUXGATE MAGNETOM DATA,TAPE	DD	1	1977-11-07	1978-01-01	77-102A-04D
4-S AVGD. MAGNETOMETER DATA, TAPE	DD	1	1977-11-03	1979-01-07	77-102A-04E
24-HR MAG FLD SUMMARY PLOTS,FICHE	FR	168	1977-10-22	1987-09-26	77-102A-04G
FLUXGATE MAGNETOMETER 4 S MAG FLD	DD	4	1979-03-22	1983-06-28	77-102A-04L
ONE-MINUTE AVERAGED MAGNETIC FLD	DD	71	1980-01-13	1984-01-10	77-102A-04Q
4-S RESOL-B-FLD DATA (12-S AVG)	DD	5	1982-08-26	1986-07-06	77-102A-04T
4-S RESOL FLD DATA, OPTICAL DSX	KV	1	1977-10-22	1980-03-01	77-102A-04V

M3. Kurth Digitizing analog Plasma Wave data from DE-1, ISEE 1-2

Trial run in progress, related to Item 4. NSSDC holdings are plots on microfilm for ISEE; the nature of the optical disk contents for 3 months of DE data isn't provided. Without digitization, these data are only minimally useful.

M 4. Inan Digitizing and archiving Plasma Wave data DE-1 ISEE 1

This item and #1 are related, and common formats will be used.

S 5. Michels Archiving digital coronagraph images

Dave B. suggested this because the NRL doesn't have a policy of preserving data Whether the SPDS wishes to include non-NASA data is a policy issue yet to be decided.

S 6. Chupp Restoring or archiving hard X-ray data from SMM

Dave B. mentioned this, and it's in both the Data Census and the Extension. Chupp will get back to me with a clarification of what is needed. These are among the X-ray data which should be available for solar cycle study.

S 7. Hoeksema Archiving digital solar magnetic synoptic charts (Stanford)

These digitized solar magnetograms, from ground based observations plus models, are valuable for correlations of the solar wind with the solar surface. Some tapes exist and need only be copied for archiving, but they may not yet contain the complete set of charts.

S 8. Acton Archiving of Mapping X-ray Heliometer Images OSO-8.

The Data Census shows more SMM data are available, too. Documentation is scanty. NSSDC holdings are primarily OSO and SMM images on fiche. (Dave B. suggested this data set also.) These are among the X-ray data which should be available for solar cycle study.

H 9. Simpson Restoring Cosmic Ray record.

Experiments on all IMPs go back to 1962 and there are similar data from OGO 4, 6 and maybe others. Simpson didn't respond for most of his experiments in the Data Census, but even if it has all been archived, much of it is quite old, going back to the '60s, and should be restored. A continuous cosmic ray record is important, especially for heliospheric structure studies.

H 10. Krimigus Archive low E particle fluxes from Voyager-1, restore IMP-8 data

Data Census shows more data are available. All deep space particle and field measurements are unique and irreplaceable, and should be available. Present NSSDC holdings are either for short intervals or long averages, with the exception of a large number of "merge tapes" contributed by Gunther. Long term cruise data holdings are:

HR AVG 1-2,14-25 MEV PROT FLX,TPE	DD	5	1975-08-01	1988-12-31	73-078A-08B
DAILY AVG PRO FLX GT 10,30,60 MEV	DD	1	1972-09-26	1982-05-02	73-078A-08E
HOUR PROT FLX 1,2,4,10,30,60 MEV	DD	2	1974-01-01	1988-10-29	73-078A-08G

DAILY AVERAGED FLUX PLOTS, MFICHE	FR	1	1973-10-30	1988-10-28	73-078A-08H
DAILY AVERAGED FLUXES	DD 1	1	974-01-10	1988-10-29	73-078A-08I
20.48-SEC RATES ON MERGE TAPES	DD	354	1973-10-30	1990-09-04	73-078A-08J

H 11. Gurnett Archive Plasma Wave data from Voyager

Data Census shows more data are available. This is a similar to Item 3, but in deep space. Even as plots, very little cruise data have been archived:

24 HR PLASMA WAVE PLOTS, MFILM	MO	2	1979-01-19	1980-11-30	77-084A-13A

H 12. Rosenbauer Archive resolution SW plasma data from Helios 1, 2 Ness Archive resolution magnetic field data from Helios

Can we get European data? Are data from all magnetometers on each s/c needed? These are the only inner heliosphere Solar Wind solar wind plasma and field data for these years, and so are valuable for large scale structure studies. Only hourly averages are at the NSSDC for most of the time:

HOURLY AVG. PLASMA DATA	DD	1	1974-12-12	1980-12-31	74-097A-09A
HOURLY AVG. PLASMA DATA	DD	1	1976-01-17	1980-03-08	76-003A-09A
8 SEC AVG MAG FIELD VECTOR DATA	DD	4	1974-12-10	1976-04-30	74-097A-0IA
HOURLY AVG MAG FIELD VECTOR DATA	DD	2	1974-12-10	1979-06-30	74-097A-0IB
HOURLY AVERAGED MAGNETIC FIELD	DD	1	1974-12-14	1977-12-31	74-097A-02A
HOURLY AVG MAG FIELD VECTOR DATA	DD	1	1976-01-15	1979-06-26	76-003A-0IA
HOURLY AVERAGED MAGNETIC FIELD	DD	1	1976-01-17	1977-12-31	76-003A-02A

H 13. Lazarus Archive Voyager and Mariner Solar Wind plasma data

Voyager cruise data only. Restoring (and obtaining higher resolution) plasma data from Faraday cup and other exps. on Mariner 5, OGO-s, etc. as well as Voyager will support the long term records of SW plasma data. Only hourly averages for Voyager are at the NSSDC, and not much of that:

ONE HOUR AVG PLASMA PARAM.(Mar.5)	DD	1	1967-06-14	1967-11-21	67-060A-03B
PLASMA PARAM WITH B-FINE TIME TAP	DD	1	1967-06-14	1967-11-21	67-060A-03D
HOUR AVERAGED SOLAR WIND PLASMA	DD	1	1977-08-21	1985-12-26	77-084A-06F
HOUR AVERAGED SOLAR WIND PLASMA	DD	1	1977-08-21	19~5-12-26	77-076A-06F

M14. Frank Recover and restore particle data, mostly from LEPEDEAs

Much of the Iowa particle data from LEPEDEAs on IMP 4-8, Injun 5, ISEE, OGO 1-5, and others exist only as microfilm/ slides of plots, or raw data on old tapes. Data Census shows more data are available from IMP-G,H,I, Injun-5, and OGO 3, 5, and Frank is going to get back to me next week on how much they are interested in working on. These data not only provide plasma moments for long periods in many parts of the magnetosphere but can help trace energy transfer.

M 15. Barnes Restore and archive plasma parameters from Pioneer 7, 12 (PVO)

Solar wind plasma parameters from Pioneer Venus provide the only long-term inner heliosphere measurements, critical in understanding the large scale structure of the heliosphere. These data exist, but have apparently not yet been archived digitally. Data from some other older Pioneers might be worth retrieving, also, for near-Earth measurements.

28DAY, 20MIN AVG SOL WIND PLASMA	FR	2	1978-12-06	1986-12-23	78-OSIA-18D

M 16. McPherron Restore ATS-I Magnetic Field Vectors; maybe some other s/c

Data Census shows more data are available. Field data should be available from as many s/c as possible, simultaneously, to understand how the magnetosphere behaves.

15 SEC VECT MAG FIELD CORR. -TAPE	DD	22	1966-12-07	1968-12-29	66-IIOA-02E

M 17. Fairfield Archive remainder of Fairfield's tape for Mag. field on IMPs

Fairfield told King that he had additional unarchived tapes for IMP-8 in his office. Magnetic field data are needed to understand how the magnetosphcre behaves.

2.5 SEC MAG FLD VECTRS, MAG TAPES	DD	156	1967-05-24	1969-02-10	67-OSIA-IID

I 18. Whitteker Digitizing topside sounder ionograms from Alouette 1, 2; ISIS 1, 2

These swept frequency ionograms presently exist in analog form on over 12,500 reels of microfilm. Only a few percent of these have been reduced to electron density profiles, and these are stored on over 300 7-track tapes. The topside sounder provides the only global image of the topside ionosphere.

I 19. Meier Restoring Airglow data from OG0 1-4

Data Census shows more data are available. At present, NSSDC has 50 books of strip charts from OG0 4 Ly-α and UV Airglow, "poorly documented". No digital data are listed by AIM. This was among the few Ionospheric candidates. We need guidance as to the importance of such data.

I 20. Knudsen Obtain plasma parameters from PVO (RPA)

Data Census shows more data are available. This has the same rationale as Item 15. No Level 1 or higher (processed) data have been archived.

S 21 Wu Archive spectrometer data from Spacelab I, AE, ground based.

There is no information about the scope of this Data Census Extension proposal, but the data seem worth preserving. Only one space data set is archived (from Spacelab 1, on optical disk).

S 22. Dere Solar UV spectra, X-ray images

Various sources will be used, probably from HRTS program (rockets, shuttle), now on film and CCD. Short wavelength images are rare, and worth preserving

S 23 Mariska Digitizing solar spectra

Dave B. says this is a collection of spectra from an assortment of sources (Solwind, maybe rockets, shuttle, SMM...) which would be valuable if digitized. Mariska is in Japan until the end of March.

S 24. Novick Stellar, Solar X-tal Spectroscopy from OSO-8, STS-3/OSS-1

Data Census shows more data are available. NSSDC has some of this already, as shown
below. Consolidation may be valuable. Short wavelength data are rare.

MERGED X-RAY DATA	DD	462	1975-07-24	1978-09-IS	75-057A-03A

H 25. Garrard Cosmic Ray data from IMP 7(?), 8, ISEE-3, Voyagers, HEAO

Data Census Extension proposal. The Data Census shows that about 12 GB (150 tapes) of IMP-7,8 full resolution count rates and 600 full-resolution HEAO-3 data exist. No Voyager Cosmic Ray data have been archived. It isn't clear which experiments, if any are relevant from IMP-7 and the HEAOs. Long term cosmic ray records reveal much about the latitudinal structure of the heliosphere, and putting together a cohesive data set would be helpful. A policy decision is needed on whether such voluminous data sets are to be archived.

H 2. Voyager Archive Voyager cruise data actively.

There are very few cruise data in the NSSDC holdings. Here are the V-I holdings; only six experiments have sent anything for archiving, and none includes recent data (V-2 is similar):

UV SPECTRAL DATA RECORDS	DD	1	1977-09-12	1979-11-IS	77 084A-04A
HOUR AVERAGE IMF, HG COORD	DD	1	1977-08-20	1981-08-23	77-084A-OSF
HOUR AVERAGED SOLAR WIND PLASMA	DD	1	1977-08-21	1985-12-26	77-084A-07B
PLANETARY RADIO ASTRONOMY DATA	DD	4	1977-09-05	1980-03-31	77-084A-IOC
24 HR PLASMA WAVE PLOTS, MFILM	MO	2	1979-01-19	1980-11-30	77-084A-13A

H27. ISEE Archive remaining data

Only about half of the ISEE time period is included in the archive plans, and some of what was included has never been received The magnetic field data, however, are line item #3, above. The Data Census shows cosmic ray data in particular is still missing.

M 28. McEntire Restore and archive magnetospheric field and particle data

Data Census Extension proposal, for ion data from AMPTE/CCE, IMP-7, ISEE- 1, and magnetic field data from MAGSAT, Triad, Viking, GOES, etc. MAGSAT has a lot of "data sets" which are programs, models, etc. Such a data set would be invaluable for studying magnetospheric structure, by providing simultaneous measurements from different places, and under many conditions. This proposal might fall in the class of making data more available, rather than restoring it.

M 29. Spjeldvik Restore and archive Energetic Particle data from IMP-7, 8, ISEE-l

Data Census Extension proposal. This seems to duplicate Item 30, but is proposed by an outside scientist, whereas the PI, in Item 30, has not suggested performing the work.

M 30. Williams Archive additional energetic particle data IMP-H, J, ISEE-1, 2.

Data Census shows more data are available. Spjeldvik, in Item 32, has proposed doing the work.

M 31. Habbal Collect and archive DE data (and some AE, Skylab)

Data Census Extension proposal. This would appear to duplicate ongoing DE archive efforts. Clarification is needed Certainly, the DE data should be archived, for a good polar view of the magnetosphere where much of the activity occurs.

M 32. Gosling Archive fast plasma, SW data from IMP-H, J, ISEE-1, 3

Data Census shows more data are available. Many NSSDC holding are old, and might profit from restoration. (There are only 24 tapes at the NSSDC from these four experiments.) Solar wind plasma data is vital for both heliospheric and magnetospheric studies.

M 33. Gloeckler Archive Charge-Energy-Mass data from IMP-H, AMPTE/CCE

Data Census shows more data are available. Similar experiments have been flown by this group for a long time, and only a small amount of data have been archived digitally (listed below). However, the nature of the experiment makes it difficult to archive the data in a form an outsider can use easily. It is valuable for composition studies.

IMP-H,SOLR IONS+ELEC,100KEV					
ALL COUNT RATES ON ENCYCLO. TAPES	DD	38	1972-09-25	1974-05-09	72-073A-03B
SUMMARY DATA ON MAG TAPE	DD	14	1972-09-25	1978-06-06	72-073A-03C
AMPTE/CCE,CHARGE-E-MASS SPECTROMETER					
CHARGE-ENERGY-MASS SPECTRUM SFDU	DD	16	1984-08-27	1988-06-27	84-088A-03B

I 34. Archive Visible Airglow data from AE-C, D, E and DE-2

Data Census shows more data are available. This was among the few Ionospheric candidates, similar to Item 19, but not as old. We need guidance as to the importance of such data

I 35. McCormick Archive Aerosol data from ERBS, Nimbus 7, SAGE

Data Census shows more data are available. This was among the few Ionospheric candidates. We need guidance as to the importance of such data There is also a question whether these data belong to the Earth Science division.

Data sets proposed for improvement of accessibility:

S 36 Kreplin Reformatting Solar UV, X-ray fluxes from SOLRAD 11.

There are about 50 tapes which need reformatting from DEC10 to VAX words. A program to do this needs final testing. These fluxes continue a long-term sequence of experiments on SOLRADS and provide a synoptic record.

S 37. Gurman Archive all of SMM data on WORM

Data Census Extension proposal, to make data more accessible. Most of it is now on Exabyte, although some (see below) is on WORM. It is held at the SDAC. The SMM data are the most important solar data, since data at wavelengths shorter than the visible are rare. (Note that some of the SMM PIs are directly represented here (Items 6, 22), so there may be competing plans.)

UV SPECT & POLAR (W SP)DATA & S/W	KV	5	1980-02-14	1989-11-27	80-014A-02D

S 38. Strong Archive hi-res. soft and X-ray solar images from SMM, Solar-A

Data Census Extension proposal. His raw data are on Exabyte, not easily accessible. (The NSSDC holdings are mostly fiche images.) The SMM data is valuable for solar studies, since data at wavelengths shorter than the visible are rare.

SELECTED SOLAR FLARE IMAGE SERIES	DD	45	1980-03-23	1980-11-18	80-014A-053

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