[redacted]

#724

PIONEER 10
30-MINUTE INTERPLANETARY DATA-SFDU
72-012A-05G

PIONEER 11
30-MINUTE INTERPLANETARY DATA-SFDU
73-019A-05H

[redacted]

Table of Contents

1. Introduction

2. Errata/Change Log

3. LINKS TO RELEVANT INFORMATION IN THE ONLINE NSSDC INFORMATION SYSTEM

4. Catalog Materials

    a. Associated Documents

    b. Core Catalog Materials

---

1. INTRODUCTION:

The documentation for this data set was originally on paper, kept in NSSDC's Data Set Catalogs (DSCs). The paper documentation in the Data Set Catalogs have been made into digital images, and then collected into a single PDF file for each Data Set Catalog. The inventory information in these DSCs is current as of July 1, 2004. This inventory information is now no longer maintained in the DSCs, but is now managed in the inventory part of the NSSDC information system. The information existing in the DSCs is now not needed for locating the data files, but we did not remove that inventory information.

The offline tape datasets have now been migrated from the original magnetic tape to Archival Information Packages (AIP's).

A prior restoration may have been done on data sets, if a requestor of this data set has questions; they should send an inquiry to the request office to see if additional information exists.

2. ERRATA/CHANGE LOG:

NOTE: Changes are made in a text box, and will show up that way when displayed on screen with a PDF reader.

When printing, special settings may be required to make the text box appear on the printed output.

Version	Date	Person	Page	Description of Change
01				
02				

3 LINKS TO RELEVANT INFORMATION IN THE ONLINE NSSDC INFORMATION SYSTEM:

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

[NOTE: This link will take you to the main page of the NSSDC Master Catalog. There you will be able to perform searches to find additional information]

4. CATALOG MATERIALS:

a. Associated Documents To find associated documents you will need to know the document ID number and then click here. http://nssdcftp.gsfc.nasa.gov/miscellaneous/documents/

b. Core Catalog Materials

72-012A-05G SPHE-00668

PIONEER 10

30-MINUTE INTERPLANETARY DATA-SFDU

THIS DATA SET CONSISTS OF 6 TAPES. THE D TAPES ARE 9-TRACK, 6250 BPI, ASCII, AND THE C TAPES ARE 3480 CARTRIDGES. THESE TAPES WERE CREATED ON THE VAX, AND HAVE A ASCII LABEL FOR EACH TAPE. THE TAPES LABELS CAN BE FOUND ON THE FOLLOWING PAGES. THE D AND C NUMBERS ALONG WITH THEIR TIME SPANS ARE AS FOLLOWS:

D#	C#	FILES	TIMESPANS
D-098116	C-029875	6	03/03/72-12/31/73
D-098117	C-029876	8	01/01/74-12/31/76
D-098118	C-029877	12	01/01/77-12/31/81
D-098119	C-029878	12	01/01/82-12/31/86
D-098120	C-029879	10	01/01/87-12/31/90
D-108167	C-031912	8	01/01/91-12/31/93

UNIVERSITY OF CALIFORNIA, SAN DIEGO UCSD

BERKELEY • DAVIS • IRVINE • LOS ANGELES • RIVERSIDE • SAN DIEGO • SAN FRANCISCO SANTA BARBARA • SANTA CRUZ

CENTER FOR ASTROPHYSICS AND
SPACE SCIENCES (CASS) 0111

9500 GILMAN DRIVE
LA JOLLA, CALIFORNIA 92093-0111

November 25, 1992

Dr. John F. Cooper
NSSDC Suite 300
7601 Ora Glenn Drive
Greenbelt, MD 20770

Dear Dr. Cooper,

Enclosed are all UCSD Trapped Radiation Detector data tapes that you are expecting. The following volumes are included:

Pioneer 10:
- USA_NASA_NSSD_P10E_0001
- USA_NASA_NSSD_P10E_0002
- USA_NASA_NSSD_P10E_0003
- USA_NASA_NSSD_P10E_0004
- USA_NASA_NSSD_P10E_0005

Pioneer 11:
- USA_NASA_NSSD_P11E_0001
- USA_NASA_NSSD_P11E_0002
- USA_NASA_NSSD_P11E_0003
- USA_NASA_NSSD_P11E_0004
- USA_NASA_NSSD_P11E_0005

Note that this is a complete set of tapes and they supersede any that may have been sent previously. Please feel free to contact Dr. Walker Fillius or me in the event of any questions or problems. I can be reached as frederick@cass.span or at (619) 534-0170.

Sincerely,

Timothy B Frederick

Timothy Frederick
Data Processor

cc: Joe King
Larry Lasher
Walker Fillius

PIONEER 10 TRAPPED RADIATION DETECTOR EXPERIMENT - INTERPLANETARY CRUISE DATA

P10_01 - Pioneer 10 TRD Volume #1

```
   )ESC.SFD;1              65
FORMAT.SFD;1               76
TRD_P10_72A.DAT;1       18995
TRD_P10_72B.DAT;1       32309
TRD_P10_73A.DAT;1       28755
TRD_P10_73B.DAT;1       33599

Total of 6 files, 113799 blocks.
```

P10_02 - Pioneer 10 TRD Volume #2

```
VOLDESC.SFD;1              67
FORMAT.SFD;1               76
TRD_P10_74A.DAT;1       27324
TRD_P10_74B.DAT;1       27169
TRD_P10_75A.DAT;1       21158
TRD_P10_75B.DAT;1       19850
TRD_P10_76A.DAT;1        9352
TRD_P10_76B.DAT;1       10333

Total of 8 files, 115329 blocks.
```

P10_03 - Pioneer 10 TRD Volume #3

```
VOLDESC.SFD;3              67
   MAT.SFD;2               76
TRD_P10_77A.DAT;2       11004
TRD_P10_77B.DAT;1       10301
TRD_P10_78A.DAT;1        8656
TRD_P10_78B.DAT;1        9925
TRD_P10_79A.DAT;1        2848
TRD_P10_79B.DAT;1        9176
TRD_P10_80A.DAT;1        9022
TRD_P10_80B.DAT;1       13750
TRD_P10_81A.DAT;1       12386
TRD_P10_81B.DAT;1       15367

Total of 12 files, 102578 blocks.
```

P10_04 - Pioneer 10 TRD Volume #4

```
VOLDESC.SFD;1              67
FORMAT.SFD;1               76
TRD_P10_82A.DAT;1       15118
TRD_P10_82B.DAT;1       14742
TRD_P10_83A.DAT;1       13261
TRD_P10_83B.DAT;1       15033
TRD_P10_84A.DAT;1       10133
TRD_P10_84B.DAT;1        8072
TRD_P10_85A.DAT;1        5204
TRD_P10_85B.DAT;1        6881
   _P10_86A.DAT;1       12411
TRD_P10_86B.DAT;1        8916

Total of 12 files, 109914 blocks.
```

P10_05 - Pioneer 10 TRD Volume #5

```
VOLDESC.SFD;1              67
F~MAT.SFD;1                76
T.._P10_87A.DAT;1        7721
TRD_P10_87B.DAT;1        8846
TRD_P10_88A.DAT;1       11349
TRD_P10_88B.DAT;1        9988
TRD_P10_89A.DAT;1        9102
TRD_P10_89B.DAT;1        9243
TRD_P10_90A.DAT;1        5749
TRD_P10_90B.DAT;1        1509

Total of 10 files, 63650 blocks.
```

CCSD3ZF0000100000001CCSD3VS00002MRK**001

Vol_Ident: USA_NASA_NSSD_P10E_0001

_Creation_Date: 1992-04-20

Medium_Description: 1/2 inch, 9 track, 6250 bpi magnetic tape

Technical_Contact: Richard Bentley
UCSD/CASS/0111
9500 Gilman Drive
La Jolla, CA 92093-0111
U.S.A
Telephone: (619) 534-4987
Electronic Mail (NSI/DECnet): CASS::RICH

Prev_Vols: none
CCSD$$MARKERMRK**001CCSD3SS00002MRK**002

Data_Set_Name: Pioneer 10 TRD Cruise Data Archive

Data_Source: Pioneer 10 Trapped Radiation Detector

Print from tape

Scientific_Contact: Dr. Walker Fillius
UCSD/CASS/0111
9500 Gilman Drive
La Jolla, CA 92093-0111
U.S.A
Telephone: (619) 534-3315
Electronic Mail (NSI/DECnet): CASS::WALKER

Spacecraft_Characteristics: Pioneer 10 was launched on March 3, 1972, and encountered Jupiter in December, 1973. Since the encounter, it has been on an escape trajectory from the solar system, and at the end of 1990 it was at a distance of about 51 AU from the sun, a celestial latitude of +3 degrees, and a celestial longitude (measured eastward from the vernal equinox) of 73 degrees. The spacecraft was instrumented with a full suite of instruments for fields and particles, including magnetometer, plasma sensors, and four energetic particle and cosmic ray instruments. Other instruments included an ultraviolet photometer, infrared photometer, imaging photopolarimeter, and micrometeoroid detector. The spacecraft is spin stabilized, with the spin axis oriented toward the earth.

Investigation_Objectives: The UCSD instruments on Pioneers 10 and 11 were originally intended and designed to measure trapped radiation; hence the name, Trapped Radiation Detector, or UCSD TRD. However, being detectors for energetic charged particles, they count cosmic rays quite well, and are particularly well suited to study the following aspects of cosmic ray modulation: (a) the cosmic ray gradient, (b) transient events, (c) the heliospheric configuration, (d) anisotropy measurements. The motivation is to use cosmic rays as tracers of the heliospheric magnetic field configuration, solar wind interaction regions, solar wind termination boundary, etc. This information, of course, helps describe the earth's neighborhood, and also gives a detailed look at one star's outer atmosphere.

Instrument_Attributes:

A. Sensor Characteristics:

From: NCFMRS::DAVEG 16-JUN-1993 12:35:49.43
To: NCF::MYERS
CC:
Subj: HERE ARE THE LISTINGS YOU WANTED. THE FORMATS ARE BEING PRINTED.--DG

TRD_P10_72A.DAT;1

FILE 1 RECORD 1 1800 BYTES

Pioneer 10UCSD H Sum 18001972-03-03T02:16:40.987 1972-03-03T02:18:49.988M40
000 B 4 -2 -2 19.7 31.0 21.6 19.7 31.
0 21.6 19.7 21.6 0.35E+01 0.17E+01 0.70E+00 0.69E+04 0.12E+03 0.52E+01
0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+0
0 0.24E+01 0.00E+00 0.50E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+
00 0.14E+01 0.19E+01 0.23E+01 0.14E+01 0.15E+01 0.15
E+01 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.14E+01 0.00E+00 0.1
0E+01 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0
.00E+00-0.15E+01-0.16E+01-0.54E+00-0.95E+00-0.16E+01-0.19E+01 0.00E+00 0.00E+00
0.00E+00 0.00E+00 0.00E+00 0.00E+00-0.71E+00 0.00E+0
0-0.10E+01 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 8 10 8 12
7 7 0 0 0 0 0 0 3 2 2 0 0
0 0 0 0 138 67 3 354913 22252 127 0
0 0 0 0 0
5 0 1 0 0 0 0 0 0 1199
2 14990 11992 17988 10493 10493 0
0 0 0 0 0 4497 2998 2998 0 0
0 0 0 0336.2298.3241.3 0.0 0
.0 0.0 0.9E-12 0.2E-11 0.6E-10 0.0E+00 0.0E+00 0.0E+00 0.1E+01 0.1E+01 0.1E+01
0.0E+00 0.0E+00 0.0E+00-0.1E+01-0.1E+01-0.2E+01 0.0E
+00 0.0E+00 0.0E+00 0.2E-11 0.1E-10 0.2E-09 0.0E+00 0.0E+00 0.0E+00 0.3E-11 0.1E
-10 0.2E-09-0.1E-08-0.1E-08-0.1E-08 0.1E-11 0.8E-11
0.7E-10 0.1E-03 0.1E-03 0.1E-03 14 7 7 0 0 0Interplanetary 90.000
000 0.991 90.001 162.621 0.991 90.000 162.61
0.00
8 5.276 89.637 263.870
0 0.000 0.000 0.000 0.000 0.000 0.000
0.000 0.000 0.000 0.000

TRD_P10_72B.DAT;1

FILE 1 RECORD 1 1800 BYTES

Pioneer 10UCSD H Sum 18001972-07-01T00:00:02.134 1972-07-01T00:29:59.994M40
120 A 8 1000687 1001022 15.0 32.8 11.2 15.0 32.
8 12.8 15.0 12.8 0.24E+01 0.17E+01 0.83E+00 0.00E+00 0.00E+00 0.00E+00
0.40E+01 0.69E+00 0.42E+00 0.00E+00 0.00E+00 0.00E+0
0 0.00E+00 0.00E+00 0.00E+00 0.34E+00 0.17E+00 0.24E+00 0.00E+00 0.00E+00 0.00E+
00 0.24E+01 0.47E+01 0.40E+01 0.00E+00 0.00E+00 0.00
E+00 0.30E+01 0.38E+01 0.68E+01 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.0
0E+00 0.26E+01 0.57E+01 0.39E+01 0.00E+00 0.00E+00 0
.00E+00-0.22E+01-0.14E+01-0.81E+00 0.00E+00 0.00E+00 0.00E+00-0.21E+01-0.54E+00-
0.28E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+0
0 0.00E+00-0.38E+00-0.18E+00-0.26E+00 0.00E+00 0.00E+00 0.00E+00 128 132 135 0
0 0 112 119 119 0 0 0 0 0 0 31 33
32 0 0 0 1066 299 90 0 0 0 1361
44 14 0 0 0
0 0 0 4 1 2 0 0 0 19187
2 197868 202365 0 0 0 167888 1
78381 178381 0 0 0 0 0 0 46469 49467
47968 0 0 0420.5418.5420.6314.0225

.0 0.0 0.1E-11 0.1E-11 0.1E-11 0.0E+00 0.0E+00 0.0E+00 0.3E+01 0.3E+01 0.3E+01
0.0E+00 0.0E+00 0.0E+00-0.5E+00-0.5E+00-0.5E+00 0.0E
+00 0.0E+00 0.0E+00 0.6E-12 0.6E-12 0.5E-12 0.5E-11 0.3E-09 0.0E+00 0.4E-11 0.4E
-11 0.4E-11 0.5E-11 0.3E-09-0.1E-08 0.1E-13 0.1E-13
0.1E-13 0.5E-11 0.3E-09 0.1E-03 119 119 110   1   1   0Interplanetary 86.486 5
5.690   1.871 92.072 257.399   1.017 90.000 279.25
    5.234 89.855 273.621   86.48
  55.690   1.871 92.072 257.407   1.017 90.000 27
9.277   5.234 89.855 273.623

TRD_P10_73A.DAT;1

FILE 1   RECORD   1   1800 BYTES

 Pioneer 10UCSD   H Sum 18001973-01-01T00:00:18.524 1973-01-01T00:29:54.537M40
304 A 4 4306618 4306785 11.2 32.8   8.0 11.2 32.
8   9.6 11.2   8.1 0.86E+01 0.50E+01 0.31E+01 0.00E+00 0.00E+00 0.00E+00
0.15E+02 0.14E+01 0.19E+01 0.00E+00 0.00E+00 0.00E+0
0 0.00E+00 0.00E+00 0.00E+00 0.26E+01 0.11E+01 0.49E+00 0.00E+00 0.00E+00 0.00E+
00 0.14E+01 0.10E+01 0.15E+01 0.00E+00 0.00E+00 0.00
E+00 0.11E+01 0.10E+01 0.67E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.0
0E+00 0.20E+01 0.17E+01 0.87E+00 0.00E+00 0.00E+00 0
.00E+00-0.15E+01-0.17E+01-0.15E+01 0.00E+00 0.00E+00 0.00E+00-0.13E+01-0.19E+01-
0.94E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+0
0 0.00E+00-0.11E+01-0.97E+00-0.12E+01 0.00E+00 0.00E+00 0.00E+00   8   8   8   0
   0   0   3   5   4   0   0   0   0   0   0   8 10
   7   0   0   0   887   326   84   0   0   0   455
      28   15   0   0   0
0   0   0   23   11   4   0   0   0 19199
2 191992 191992   0   0   0   71997 1
19995   95996   0   0   0   0   0   0 191992 239990 1
67993   0   0   0428.5429.0409.8 0.0 0
.0 0.0 0.2E-12 0.2E-12 0.3E-12 0.0E+00 0.0E+00 0.0E+00 0.2E+01 0.2E+01 0.2E+01
0.0E+00 0.0E+00 0.0E+00-0.6E+00-0.6E+00-0.8E+00 0.0E
+00 0.0E+00 0.0E+00 0.1E-12 0.1E-12 0.2E-12 0.0E+00 0.0E+00 0.0E+00 0.5E-12 0.5E
-12 0.7E-12-0.1E-08-0.1E-08-0.1E-08 0.1E-13 0.1E-13
0.1E-13 0.1E-03 0.1E-03 0.1E-03   4   4   4   0   0   0Interplanetary 88.773 11
0.137   3.353 91.562 293.911   0.983 90.000 100.44
1   5.168 90.203 288.900   88.77
3 110.143   3.353 91.562 293.913   0.983 90.000 10
0.462   5.168 90.203 288.902

TRD_P10_73B.DAT;1

FILE 1   RECORD   1   1800 BYTES

Pioneer 10UCSD   H Sum 18001973-07-01T00:00:07.337 1973-07-01T00:19:31.351M40
  5 A 5 3540050   -2   9.6 32.8   6.8   9.6 32.
8   6.8   9.6   6.8 0.10E+02 0.47E+01 0.25E+01 0.00E+00 0.00E+00 0.00E+00
0.11E+02 0.19E+01 0.17E+01 0.00E+00 0.00E+00 0.00E+0
0 0.00E+00 0.00E+00 0.00E+00 0.13E+01 0.43E+00 0.92E+00 0.00E+00 0.00E+00 0.00E+
00 0.21E+01 0.16E+01 0.21E+01 0.00E+00 0.00E+00 0.00
E+00 0.85E+00 0.12E+01 0.19E+01 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.0

0E+00 0.20E+01 0.17E+01 0.28E+01 0.00E+00 0.00E+00 0
.00E+00-0.15E+01-0.16E+01-0.15E+01 0.00E+00 0.00E+00 0.00E+00-0.17E+01-0.14E+01-
0.10E+01 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+0
0 0.00E+00-0.11E+01-0.58E+00-0.44E+00 0.00E+00 0.00E+00 0.00E+00 10 12 10 0
   0   0   6   6   5   0   0   0   0   0   0 11 12
  10   0   0   0   636   282   47   0   0   0   698
       22   9   0   0   0
          0   0   16   3   4   0   0   0 11999
0 143988 119990   0   0   0   71994
71994   59995   0   0   0   0   0   0 131989 143988 1
19990   0   0   0407.3402.4399.2 0.0 0
.0 0.0 0.3E-12 0.2E-12 0.2E-12 0.0E+00 0.0E+00 0.0E+00 0.1E+01 0.1E+01 0.9E+00
0.0E+00 0.0E+00 0.0E+00-0.1E+01-0.1E+01-0.1E+01 0.0E
+00 0.0E+00 0.0E+00 0.3E-12 0.3E-12 0.3E-12 0.0E+00 0.0E+00 0.0E+00 0.5E-12 0.5E
-12 0.5E-12-0.1E-08-0.1E-08-0.1E-08 0.1E-13 0.1E-13
0.1E-13 0.1E-03 0.1E-03 0.1E-03   6   5   5   0   0   0Interplanetary 88.567 13
7.920   4.391 91.132 309.526   1.017 90.000 279.98
                                                                                0.00
1   5.103 90.540 304.403
0   0.000   0.000   0.000   0.000   0.000   0.000
0.000   0.000   0.000   0.000

73-019A-05H
Pioneer 11

73-019A-05H SPHE-00425

PIONEER 11

30-MINUTE INTERPLANETARY DATA-SFDU

THIS DATA SET CONSISTS OF 6 TAPES. THE D TAPES ARE 9-TRACK, 6250 BPI, ASCII, AND THE C TAPES ARE 3480 CARTRIDGES. THESE TAPES WERE CREATED ON THE VAX, AND HAVE A ASCII LABEL FOR EACH TAPE. THE TAPES LABELS CAN BE FOUND ON THE FOLLOWING PAGES. THE D AND C NUMBERS ALONG WITH THEIR TIME SPANS ARE AS FOLLOWS:

D#	C#	FILES	TIMESPANS
D-098121	C-029880	6	04/16/73-12/31/74
D-098122	C-029881	8	01/01/75-12/31/77
D-098123	C-029882	10	01/01/78-12/31/81
D-098124	C-029883	16	01/01/82-12/31/88
D-098125	C-029884	6	01/01/89-12/31/90
D-108168	C-031950	4	01/01/91-12/31/91

PIONEER 11 TRAPPED RADIATION DETECTOR EXPERIMENT - INTERPLANETARY CRUISE DATA

P11_01 - PIONEER 11 TRD VOLUME #1

```
LDESC.SFD;2              63
FORMAT.SFD;1             76
TRD_P11_73A.DAT;1     12927
TRD_P11_73B.DAT;1     33311
TRD_P11_74A.DAT;1     30474
TRD_P11_74B.DAT;1     33300

Total of 6 files, 110151 blocks.
```

P11_02 - PIONEER 11 TRD VOLUME #2

```
VOLDESC.SFD;2            63
FORMAT.SFD;1             76
TRD_P11_75A.DAT;1     23024
TRD_P11_75B.DAT;1     22599
TRD_P11_76A.DAT;1     10811
TRD_P11_76B.DAT;1     15599
TRD_P11_77A.DAT;1     24902
TRD_P11_77B.DAT;1     17093

Total of 8 files, 114167 blocks.
```

P11_03 - PIONEER 11 TRD VOLUME #3

```
VOLDESC.SFD;2            63
RMAT.SFD;1               76
RD_P11_78A.DAT;1      15075
TRD_P11_78B.DAT;1      9503
TRD_P11_79A.DAT;1     20317
TRD_P11_79B.DAT;1     18693
TRD_P11_80A.DAT;1     14720
TRD_P11_80B.DAT;1     14225
TRD_P11_81A.DAT;1     18264
TRD_P11_81B.DAT;1     11402

Total of 10 files, 122338 blocks.
```

P11_04 - PIONEER 11 TRD VOLUME #4

```
VOLDESC.SFD;2            63
FORMAT.SFD;1             76
TRD_P11_82A.DAT;1     15223
TRD_P11_82B.DAT;1     10301
TRD_P11_83A.DAT;1     11514
TRD_P11_83B.DAT;1      8262
TRD_P11_84A.DAT;1     11142
TRD_P11_84B.DAT;1      9939
TRD_P11_85A.DAT;1      6993
TRD_P11_85B.DAT;1      4972
TRD_P11_86A.DAT;1      7545
RD_P11_86B.DAT;1       4975
D_P11_87A.DAT;1        3439
TRD_P11_87B.DAT;1      3875
TRD_P11_88A.DAT;1      6100
TRD_P11_88B.DAT;1      5668
```

Total of 16 files, 110087 blocks.

P11_05 - PIONEER 11 TRD VOLUME #5

V DESC.SFD;1	63
FORMAT.SFD;1	76
TRD_P11_89A.DAT;1	5661
TRD_P11_89B.DAT;1	2971
TRD_P11_90A.DAT;1	2075
TRD_P11_90B.DAT;1	644

Total of 6 files, 11490 blocks.

D-108167
C-031950
1/1/91-12/31/91

CCSD3ZF0000100000001CCSD3VS00002MRK**001

Vol_Ident: USA_NASA_NSSD_P11E_0006

Vol_Creation_Date: 1994-08-02

Medium_Description: 1/2 inch, 9 track, 6250 bpi magnetic tape

Technical_Contact:
Richard Bentley
UCSD/CASS/0111
9500 Gilman Drive
La Jolla, CA 92093-0111
U.S.A
Telephone: (619) 534-4987
Electronic Mail (NSI/DECnet): CASS::RICH

Prev_Vols:
USA_NASA_NSSD_P11E_0001
USA_NASA_NSSD_P11E_0002
USA_NASA_NSSD_P11E_0003
USA_NASA_NSSD_P11E_0004
USA_NASA_NSSD_P11E_0005

Print from tape

CCSD$$MARKERMRK**001CCSD3SS00002MRK**002

Data_Set_Name: Pioneer 11 TRD Cruise Data Archive

Data_Source: Pioneer 11 Trapped Radiation Detector

Scientific_Contact:
Dr. Walker Fillius
UCSD/CASS/0111
9500 Gilman Drive
La Jolla, CA 92093-0111
U.S.A
Telephone: (619) 534-3315
Electronic Mail (NSI/DECnet): CASS::WALKER

Spacecraft_Characteristics: Pioneer 11 was launched on April 6, 1973, encountered Jupiter in December, 1974, and Saturn in September, 1979. Since the Saturn encounter, it has been on an escape trajectory from the solar system, and at the end of 1990 it was at a distance of about 32 AU from the sun, a celestial latitude of +16 degrees, and a celestial longitude (measured eastward from the vernal equinox) of 265 degrees. The spacecraft was instrumented with a full suite of instruments for fields and particles, including magnetometer, plasma sensors, and four energetic particle and cosmic ray instruments. Other instruments included an ultraviolet photometer, infrared photometer, imaging photopolarimeter, and micrometeoroid detector. The spacecraft is spin stabilized, with the spin axis oriented toward the earth.

Investigation_Objectives: The UCSD instruments on Pioneers 10 and 11 were originally intended and designed to measure trapped radiation; hence the name, Trapped Radiation Detector, or UCSD TRD. However, being detectors for energetic charged particles, they count cosmic rays quite well, and are particularly well suited to study the following aspects of cosmic ray modulation: (a) the cosmic ray gradient, (b) transient events, (c) the heliospheric configuration, (d) anisotropy measurements. The motivation is to use cosmic rays as tracers of the heliospheric magnetic field configuration, solar wind interaction

D-108167
C-0319[redacted]50
1/1/91 - 12/31/91

ASCII LIST OF nc3006

FILE 8 RECORD 1 1800 BYTES

Pioneer 11UCSD H Sum 18001991-02-02T02:51:37.150 1991-02-02T02:59:37.153M58215 A 33314449433144494 -19.1 38.3 -22.8 -19.1 38.
3 -22.8 -19.1 -22.8 0.17E+02 0.70E+01 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+0
0 0.00E+00 0.00E+00 0.00E+00 0.50E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.10E+01 0.10E+01 0.00E+00 0.00E+00 0.00E+00 0.00
E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.10E+01 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0
.00E+00-0.10E+01-0.10E+01 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+0
0 0.00E+00-0.10E+01 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 2 2 0 0 0 0 1 0 0 0 0 0 0 0 0 2 1
0 0 0 1 579 250 0 0 0 0 14 0 0 0 0 0
0 0 0 9 6 0 0 0 0 95998 95998 0 0 0 0 47999
0 0 0 0 0 0 0 0 95998 47999 0 0 0 47999411.0 0.0450.0 0.0 0
.0 0.0 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E
+00 0.0E+00 0.0E+00 0.6E-13 0.0E+00 0.1E-13 0.0E+00 0.0E+00 0.0E+00 0.6E-13-0.1E-08 0.1E-13-0.1E-08-0.1E-08-0.1E-08 0.6E-13 0.1E-03
0.1E-13 0.1E-03 0.1E-03 0.1E-03 1 0 1 0 0 0Interplanetary -2.000 -2.000 32.547 73.981 266.204 0.985 90.000 132.75
4 9.987 90.194 297.587 105.430 87.220 32.547 73.981 266.204 0.985 90.000 13
2.760 9.987 90.194 297.587

ASCII LIST OF nc3006

FILE 8 RECORD 2 1800 BYTES

Pioneer 11UCSD H Sum 18001991-02-02T03:00:25.155 1991-02-02T03:29:13.153M58215 A 33314449433144418 -19.1 38.3 -22.8 -19.1 38.
3 -22.8 -19.1 -22.8 0.59E+01 0.89E+01 0.86E+01 0.00E+00 0.00E+00 0.00E+00 0.50E+01 0.36E+01 0.20E+01 0.00E+00 0.00E+00 0.00E+0
0 0.00E+00 0.00E+00 0.00E+00 0.17E+01 0.83E+00 0.50E+00 0.00E+00 0.00E+00 0.00E+00 0.11E+01 0.12E+01 0.12E+01 0.00E+00 0.00E+00 0.00
E+00 0.10E+01 0.14E+01 0.10E+01 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.90E+00 0.90E+00 0.10E+01 0.00E+00 0.00E+00 0
.00E+00-0.14E+01-0.11E+01-0.13E+01 0.00E+00 0.00E+00 0.00E+00-0.10E+01-0.84E+00-0.10E+01 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+0
0 0.00E+00-0.15E+01-0.15E+01-0.10E+01 0.00E+00 0.00E+00 0.00E+00 4 4 4 0 0 0 2 3 2 0 0 0 0 0 0 4 4
4 0 0 0 1226 569 186 0 0 0 41 33 12 0 0 0
0 0 0 30 9 2 0 0 0 191996 191996 191996 0 0 0 95998 1
43997 95998 0 0 0 0 0 0 191996 191996 191996 0 0 0423.0412.0450.0 0.0 0
.0 0.0 0.9E-14 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.1E+01 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00-0.1E+01 0.0E+00 0.0E+00 0.0E
+00 0.0E+00 0.0E+00 0.4E-13 0.6E-13 0.1E-13 0.0E+00 0.0E+00 0.0E+00 0.5E-13 0.6E-13 0.1E-13-0.1E-08-0.1E-08-0.1E-08 0.3E-13 0.6E-13
0.1E-13 0.1E-03 0.1E-03 0.1E-03 2 2 2 0 0 0Interplanetary 105.430 87.220 32.547 73.981 266.204 0.985 90.000 132.76
0 9.987 90.194 297.587 105.430 87.220 32.547 73.981 266.204 0.985 90.000 13
2.780 9.987 90.195 297.588

CCSD3ZF0000100000001CCSD3VS00002MRK**001

DSC#724

Vol_Ident: USA_NASA_NSSD_P10E_0001

1_Creation_Date: 1992-04-20

Medium_Description: 1/2 inch, 9 track, 6250 bpi magnetic tape

Technical_Contact:
Richard Bentley
UCSD/CASS/0111
9500 Gilman Drive
La Jolla, CA 92093-0111
U.S.A
Telephone: (619) 534-4987
Electronic Mail (NSI/DECnet): CASS::RICH

Prev_Vols: none
CCSD$$MARKERMRK**001CCSD3SS00002MRK**002

Data_Set_Name: Pioneer 10 TRD Cruise Data Archive

Data_Source: Pioneer 10 Trapped Radiation Detector

Scientific_Contact:
Dr. Walker Fillius
UCSD/CASS/0111
9500 Gilman Drive
La Jolla, CA 92093-0111
U.S.A
Telephone: (619) 534-3315
Electronic Mail (NSI/DECnet): CASS::WALKER

Spacecraft_Characteristics: Pioneer 10 was launched on March 3, 1972, and encountered Jupiter in December, 1973. Since the encounter, it has been on an escape trajectory from the solar system, and at the end of 1990 it was at a distance of about 51 AU from the sun, a celestial latitude of +3 degrees, and a celestial longitude (measured eastward from the vernal equinox) of 73 degrees. The spacecraft was instrumented with a full suite of instruments for fields and particles, including magnetometer, plasma sensors, and four energetic particle and cosmic ray instruments. Other instruments included an ultraviolet photometer, infrared photometer, imaging photopolarimeter, and micrometeoroid detector. The spacecraft is spin stabilized, with the spin axis oriented toward the earth.

Investigation_Objectives: The UCSD instruments on Pioneers 10 and 11 were originally intended and designed to measure trapped radiation; hence the name, Trapped Radiation Detector, or UCSD TRD. However, being detectors for energetic charged particles, they count cosmic rays quite well, and are particularly well suited to study the following aspects of cosmic ray modulation: (a) the cosmic ray gradient, (b) transient events, (c) the heliospheric configuration, (d) anisotropy measurements. The motivation is to use cosmic rays as tracers of the heliospheric magnetic field configuration, solar wind interaction regions, solar wind termination boundary, etc. This information, of course, helps describe the earth's neighborhood, and also gives a detailed look at one star's outer atmosphere.

Instrument_Attributes:

A. Sensor Characteristics:

The Trapped Radiation Detector on Pioneer 10 includes five different sensors (C, E, M, SP, and SE). Three (C, E, and M) are operated in a pulse mode, and three (C, SP, and SE) are read out through an electrometer. The pulses are counted above three integral discriminators whose thresholds are in the ratio 1 : 2.12 : 4.5.

The electrometer has two overlapping quasilogarithmic ranges from 10**-14 amps to 10**-9 amps for the low current range, and 10**-10 to 10**-5 amps for the high current range. The signal is processed by a quasilogarithmic analog-to-digital converter, and presented to the encoder as a pulse train plus a range identifier bit. The pulse train is encoded on a scale from 250 (lowest current in range) to 0 (highest current in range). These two ranges are combined by our data reduction program to a single logarithmic scale with a slope of 50 counts per decade from 450 at 10**-14 amperes to 0 at 10**-5 amperes. The electrometer data channels are too insensitive to be useful in interplanetary space. Furthermore, the electrometer input commutator on Pioneer 10 failed during the first month after launch, causing the data to be mixed. The electrometer data are recorded as received; but they should not be used.

The P.I. and his team at UCSD have done extensive testing and calibrations of the flight sensors and surrogates. However, it is often impossible to anticipate and cover all flight conditions and to predict actual responses precisely. Therefore the calibration data given here must be regarded as representative, but not necessarily precise enough for any unanticipated use.

The following table gives the best known values for the attributes of each channel from launch to Jupiter encounter in December, 1973.

****
****

Representative Characteristics
of the
UCSD Pioneer 10 Trapped Radiation Detector
from
Launch to Jupiter Encounter

Sensor Name	Channel Name	Discrimination Levels	Particle Response	Geometric Factor
C (Cerenkov Counter)	C1	31 photoelectrons	Electrons >6 MeV	11.5 sqcmsr
			Protons >480 MeV	15.5 sqcmsr
			Alphas >480 MeV/n	33 sqcmsr
			Heavies >480 MeV/n	85.7 sqcmsr
	C2	65 photoelectrons	Electrons >9 MeV	4.5 sqcmsr
			Protons >550 MeV	4.5 sqcmsr
			Alphas >550 MeV/n	25 sqcmsr
			Heavies >550 MeV/n	85.7 sqcmsr
	C3	135 photoelectrons	Electrons >13 MeV	0.5 sqcmsr
			Protons >650 MeV	0.47 sqcmsr
			Alphas >650 MeV/n	13.3 sqcmsr
			Heavies >650 MeV/n	85.7 sqcmsr
	CDC		Not functional	
E (Electron Scatter	E1H	0.089 MeV	Electrons >0.16 MeV	0.013 sqcmsr
			Nucleons >80 MeV/n	0.038 sqcm

Detector)	E2H	0.19 MeV	Electrons >0.255 MeV Nucleons >80 MeV/n	0.0104 sqcmsr 0.038 sqcm
	E3H	0.40 MeV	Electrons >0.46 MeV Nucleons >80 MeV/n	0.0057 sqcmsr 0.038 sqcm
M (Minimum Ionizing Particle Counter)	M1H	0.40 MeV	Nucleons >80 MeV/n Electrons >35 MeV	0.038 sqcm 0.038 sqcm
	M2H	0.85 MeV	Nucleons >80 MeV/n Electrons	0.038 sqcm nil
	M3H	1.77 MeV	Nucleons >80 MeV/n Electrons	0.038 sqcm nil
SP (Scintillator)	SPDC		Not functional	
SE (Scintillator)	SEDC		Not functional	

****
****

B. The TRD as a Cosmic Ray Instrument:

Although there are other cosmic ray instruments aboard the Pioneer 10 and 11 spacecraft, the UCSD Radiation Detector has made a niche for itself because it offers several advantages which are unique among the instruments on board. The UCSD Cerenkov counter has a high energy threshold, a capability for measuring anisotropies, good statistics and time resolution, and an unbroken reliability record. Its water-alcohol radiator gives it a velocity threshold of 2/3 the speed of light. In the cosmic ray environment it detects nuclei of energy above about 500 MeV/nucleon. This threshold is the highest on board the spacecraft, and puts the output of this detector in a range where long-term modulation stands out without many of the local and transient effects seen at lower energies. Also, this threshold is more nearly comparable to neutron monitors than any other currently in space.

Besides the Cerenkov counter, the UCSD Radiation Detector package contains a shielded solid state detector which is useful for cosmic ray studies. The energy threshold of this detector is 80 MeV/nucleon, which is not unique; nor are the statistics outstanding. However, it has an exceptional record of reliability and longevity. Along with the Cerenkov detector, it has a continuous data record from launch to late 1990, when declining power output from the spacecraft forced the TRD to be turned off.

Although the UCSD sensors have not been calibrated on a heavy ion beam, the importance of heavy particles in cosmic rays led us to estimate the relative responses of our main cosmic ray channels to protons and heavy nuclei. The following table summarizes the relative proportions of the observed counting rates from protons and heavier elements in the cosmic radiation during the period from launch to Jupiter encounter.

****
****

Comparative Cosmic Ray Responses of Four UCSD Data Channels

****

	Z = 1 Energy Range	Relative Response (Ratio)	Z > 1 Energy Range
M3L	80<E<300 MeV	50 : 50	>80 MeV/nucl
M1L	>80 MeV	90 : 10	>80 MeV/nucl
C1	>500 MeV	80 : 20	>500 MeV/nucl
C3	>500 MeV	30 : 70	>500 MeV/nucl

****
****

C. Data_Channel_Identifiers:

The data tapes contain 27 separate channels of data, divided between 21 channels of pulse counting data and 6 channels of encoded electrometer data. The 6 electrometer channels are named CDC, SEDC, SPDC, CAL1, CAL2, and CAL3. The 21 pulse counting channels are created from three sensors (C, E, and M), three discrimination levels (1, 2, and 3), and three voltage modes (H, L, and U), as follows: C1, C2, C3, E1H, E2H, E3H, E1L, E2L, E3L, E1U, E2U, E3U, M1H, M2H, M3H, M1L, M2L, M3L, M1U, M2U, and M3U. The voltage modes apply to the two solid state sensors, E and M, and stand for high-voltage, low-voltage, and undetermined voltage. In high voltage mode, both the solid state diodes are totally depleted; they were operated in this mode for all planetary encounters and periodic calibration checks in interplanetary cruise. For most of interplanetary cruise the solid state diodes are operated in low voltage mode, where they are not totally depleted, and have a smaller geometric factor than when totally depleted. Occasionally the reduction program is unable to determine the voltage mode, and readings at these times are classified in the "unknown" channels.

D. Measurement_Sequencing:

The instrument accumulation period and commutation sequence sometimes affects the data acquisition, and must be known to understood the data records. An internal timing generator determines the accumulation period and the length of the commutation cycle. It is independent of the spacecraft roll rate, and runs off the spacecraft clock allowing for the different bit rates and formats.

The table below shows the accumulation period and the commutation cycle period for the various spacecraft operating modes. Also shown is the commutator cycle parameter N, which keys the commutation sequence as described in the following paragraph.

The commutation sequence can be specified by writing the sensor labels in sequence; e.g.: C1 C1 C1 C1 M1 E1 E1 E1 M1 CDC CDC CDC ... This can be compressed to C1*4 M1 E1*3 M1 CDC*3 ... In this notation the commutation sequence is

C1*N M1 E1*(N-1) M1 CDC*(N-1)
C2*N M2 E2*(N-1) M2 SEDC*(N-1)

C3*N M3 E3*(N-1) M3 SPDC*(N-1)

where N is 2, 4, or 8 as shown in the table. Every sixteenth commutation cycle, the first M1, M2, and M3 are replaced by an electrometer calibration current, so that the sequence reads

C1*N CAL1 E1*(N-1) M1 CDC*(N-1)
C2*N CAL2 E2*(N-1) M2 SEDC*(N-1)
C3*N CAL3 E3*(N-1) M3 SPDC*(N-1)

Angular sectoring of the information is determined by the timing generator in conjunction with the spacecraft roll rate. In the most favorable case where the accumulation period is 3/2 sec and the roll rate is 5 rpm, the sectors are 45 degrees wide, and one complete revolution is taken from one channel before the commutator advances to the next channel. In unfavorable operating modes an accumulation may endure over many revolutions.

****
****

Table of
Accumulation Period and Commutator Period
Versus Spacecraft Operating Modes

****

Operating Mode		Accumulation	Commutator	Commutation
Bit Rate	Format	Period (sec)	Key N	Cycle Period (sec)
---	---	---	-	---
16	A	192	2	3456
	A/D	384	2	6912
	B	12	2	216
	B/D	24	2	432
32	A	96	2	1728
	A/D	192	2	3456
	B	6	2	108
	B/D	12	2	216
64	A	48	2	864
	A/D	96	2	1728
	B	3	4	108
	B/D	6	2	108
128	A	24	2	432
	A/D	48	2	864
	B	3/2	8	108
	B/D	3	4	108
256	A	12	2	216
	A/D	24	2	432
	B	3/2	8	108
	B/D	3/2	8	108
512	A	6	2	108
	A/D	12	2	216
	B	3/2	8	108
	B/D	3/2	8	108
1024	A	3	4	108

	A/D	6	2	108
	B	3/2	8	108
	B/D	3/2	8	108
2048	A	3/2	8	108
	A/D	3	4	108
	B	3/2	8	108
	B/D	3/2	8	108

****
****

Data_Set_Parameters: The data set consists of counts per accumulation period and encoded currents from each channel of the instrument, along with time, ephemeris, and housekeeping information. Refer to the keyword, "Instrument_Attributes" for a discussion of the data channels. It is expected that the counts per accumulation period will be divided by the length of the accumulation period to obtain counting rates, but the data are recorded without this division operation in order to preserve statistical information.

Data_Set_Quality: During the encounter of Pioneer 10 with Jupiter in December, 1973, the photomultiplier tube in the Cerenkov detector experienced a small gain decrease, caused by irradiation. The change was small, and is estimated as a factor of 0.888 +- 0.005. The archival data set contains the observed counting rates, and where calibrations are necessary, these must be corrected to allow for the gain change.

Within the first month after launch, there was a partial failure in the Pioneer 10 instrument which manifested itself in two ways: the electrometer channels became mixed, and pulse channel C1 recorded a predictable number of spurious counts. The electrometer channels are best left alone, but the problem with channel C1 (nicknamed the "gremlin") is well enough understood to be corrected. The data on the archive tape are as received from the spacecraft and uncorrected. The spurious counts can be subtracted as explained below.

From April, 1972 until Jupiter encounter in December, 1973, the anomaly in channel C1 consisted of 2.0 extra counts per accumulation period. Following encounter, the number of extra counts was lower and less consistent, averaging 0.7 counts per accumulation period. As the accumulation period varies from 1.5 to 384 seconds (See the section labeled "D: Measurement Sequencing" under the keyword, Instrument_Attributes.), the impact on the counting rate varies from 1.33 to 0.002 counts per second. Typically in interplanetary space channel C1 registers about 5 counts per second, and so the uncorrected gremlin contributes an error of from 25% to 0.04%. Because the telemetry bit rate has decreased during the course of the mission, the effect of the uncorrected gremlin has become negligible.

The gremlin can be corrected by subtracting 2.0 or 0.7 counts per accumulation period from the total number of counts. A formula for this correction is given under the keyword "Data_Usage". When rectified in this way, the gremlin is negligible during all phases of the mission.

Data_Processing_Overview:

A. Experimenter Data Record:

Data processing starts with the Experimenter Data Record (EDR), which is provided by NASA Ames Research Center and is basically just the data bits stripped from the telemetry stream, along with timing markers, status, and housekeeping information.

B: Data Reduction:

Our reduction program interprets the telemetry bit stream and combines it with ephemeris information to produce sequential readings labeled with time, data channel, spacecraft orientation, and other pertinent information. Optionally, this most complete and detailed data set can be written out onto a file or tape called a Binary Reduction Tape (BRT). Because of cost, this option was not exercised for the majority of cruise data. Instead, we rely on Summary Tapes, from which we can derive average rates over some averaging interval.

C: Summary Tapes:

The most used output of the reduction program is the Summary Tape, which contains statistical summaries of the readings, channel by channel, for a given averaging interval. In interplanetary cruise, the basic averaging interval was 30 minutes, and these half hour summaries are our most important archival data product. Further processing includes editing to eliminate bad data points, and summary compression. The summary format was designed so that a contiguous sequence of records can be compressed to produce a summary record for a longer time interval; e.g.: 48 half hour records can be combined to produce a 24 hour summary record. Most of our scientific analyses on the interplanetary cruise data have used 24 hour summary data.

D: Editing:

The summary data set has been edited in order to remove bad data. Most such data are the result of telemetry reception and ground-based transmission errors, which usually produce gross discrepancies. An editing program is used to processes the Summary Tapes. This program operates on an individual summary record, and makes an assessment of each data channel based upon the statistical consistency of readings within the record. Readings that are outside an envelope of statistical probability are identified and purged by modifying the summary record. Modified records then lack some of the statistical parameters, but not those needed to calculate the average counting rates. In some cases the entire record is eliminated.

Data_Usage: For the pulse height channels of the UCSD TRD, most data analysis applications use NCOUNT, the total number of counts for some channel in some time interval, and TOTIME, the total amount of live time for that channel in that interval. The average counting rate is NCOUNT/TOTIME, with a statistical error of SQRT(NCOUNT)/TOTIME. Valid average rates can be obtained for a number of contiguous intervals by summing NCOUNT and TOTIME separately before performing square roots and quotients.

To correct for the gremlin in Pioneer 10 channel C1, obtain the average counting rate as (NCOUNT-GREMLIN*NREAD)/TOTIME, where GREMLIN=2.0 before encounter in December, 1973, and 0.7 after encounter. The statistical error is SQRT(NCOUNT-GREMLIN*NREAD)/TOTIME.

In some places, such as after editing, erroneous data have been eliminated by placing a negative number in the data field. Since all quantities except temperatures are inherently positive numbers, it is obvious that negative quantities are invalid.

The named times for the beginning and end of each summary record refer to the times of the first and last readings within the summary average window. For example, for the first summary of a day, the beginning time is not 00:00:00.000, but rather the time of the first reading after this instant. Similarly, the ending time is the time of the last record before 00:30:00.000. To identify a preselected time interval, the user must look for a record that is contained within his desired window.

Data_Organization:

A. EDR: The raw data are provided by NASA to UCSD in the Experiment Data Record. UCSD does not have a complete set of EDR's, owing to a GAO recommendation to return data tapes for recycling. All EDR's since about 1975, however, have been copied onto higher density media before returning the original tapes. All data for which EDR's do not exist are recorded on BRT's.

B. BRT: The Binary Reduction Tape contains all the data from the UCSD TRD in its most elemental form, consisting of sequential readings along with all relevant ancillary information. BRT's are kept for some portions of the data, but a complete set does not exist because of cost.

C. SUM: UCSD Summary Tapes contain contains statistical summaries of the readings, channel by channel, for a given averaging interval. In interplanetary cruise, the basic averaging interval was 30 minutes. During planetary encounters, the averaging interval was 108 seconds (the commutation cycle period during these events). All records are the same size and format, and represent all the data for each summary interval. Besides beginning and ending on predetermined timing boundaries, new records are started whenever the spacecraft bit rate or format changes. Thus there may be more than one summary record for some timing intervals. When no data were taken, there is no record for that interval.

D. Homogeneous/Inhomogeneous Summaries: Because statistics are kept on the readings in each summary record, it is necessary to start a new summary record whenever the spacecraft bit rate or format changes. Otherwise the statistics would not apply to a homogeneous data set. The archival cruise data set from UCSD consists of homogeneous summaries of half hour length. Other summary data sets exist. Sometimes it is useful to perform data analysis with summary records that are of a given time length regardless of spacecraft status changes. It is possible to produce summary records over such an inhomogeneous data set, but certain statistical data must be ignored. As long as the user looks only at the average counting rate given by the total number of counts (NCOUNT) divided by the total live time (TOTIME), it is safe to use inhomogeneous summaries. One that has been most useful, and shared with other users, consists of inhomogeneous summaries of 24 hour length.

E. UCSD TRD Interplanetary Cruise ASCII Archive: The archival cruise data set from UCSD consists of homogeneous summaries of half hour length. The records are organized six months of data to a file. All

records are the same size and format, and contain all the data for each summary interval represented. Records are synchronized to begin and end every half hour on the half hour in spacecraft event time. Besides these boundaries, new records are started whenever the spacecraft bit rate or format changes. Thus there may be more than one summary record for some half hour intervals. When no data were taken, there is no record for that interval.

File_Class_Relationships: See Data_Organization. The EDR, BRT, and initial SUM data files are generated in UCSD's own format, and used internally to UCSD. The UCSD TRD Interplanetary Cruise ASCII Archive is a type of summary tape specially formated to meet the requirements of the NSSDC.

Lit_References:

Axford, W.I., W. Fillius, L.J. Gleeson, and W.-H. Ip, "Cosmic-Ray Gradients from Pioneer-10 and Pioneer-11," Astrophys. J., 210, 603-613, Dec. 1, 1976.

Fillius, W., and I. Axford, "Large-Scale Modulation of >500 MeV/Nucleon Galactic Cosmic Rays Seen From 1 to 30 AU, J. Geophys. Res., 90, 517-520, Jan. 1, 1985

Ip, W.-H., W. Fillius, A. Mogro-Campero, L.J. Gleeson, and W.I. Axford, "Quiet Time Interplanetary Cosmic Ray Anisotropies Observed From Pioneer 10 and 11," J. Geophys. Res., 83, 1633-1640, April 1, 1978.

Fillius, W., "Cosmic Ray Gradients in the Heliosphere," Adv. Space Res., Vol. 9, No. 4, pp. (4)209-(4)219, 1989.

CCSD$$MARKERMRK**002CCSD3KS00002MRK**003

Vol_Time_Coverage: 1972-03-03 to 1973-12-31

File_Naming_Convention: TRD files are named according to the start time of the data contained in the file as follows: TRD_PXX_YYZ.DAT. Here PXX stands for either P10 or P11, YY stands for the last two digits of the year, and Z stands for the flags "A" or "B", to indicate the first or last six months of a year, respectively.

File_Time_Coverage:

TRD_P10_72A.DAT	72/03/03 thru 72/06/30
TRD_P10_72B.DAT	72/07/01 thru 72/12/31
TRD_P10_73A.DAT	73/01/01 thru 73/06/30
TRD_P10_73B.DAT	73/07/01 thru 73/12/31

/* Note: other volumes will contain the following:

TRD_P10_74A.DAT	74/01/01 thru 74/06/30
TRD_P10_74B.DAT	74/07/01 thru 74/12/31
TRD_P10_75A.DAT	75/01/01 thru 75/06/30
TRD_P10_75B.DAT	75/07/01 thru 75/12/31
TRD_P10_76A.DAT	76/01/01 thru 76/06/30
TRD_P10_76B.DAT	76/07/01 thru 76/12/31
TRD_P10_77A.DAT	77/01/01 thru 77/06/30
TRD_P10_77B.DAT	77/07/01 thru 77/12/31
TRD_P10_78A.DAT	78/01/01 thru 78/06/30
TRD_P10_78B.DAT	78/07/01 thru 78/12/31
TRD_P10_79A.DAT	79/01/01 thru 79/06/30

```
                        TRD_P10_79B.DAT          79/07/01 thru 79/12/31
                        TRD_P10_80A.DAT          80/01/01 thru 80/06/30
                        TRD_P10_80B.DAT          80/07/01 thru 80/12/31
                        TRD_P10_81A.DAT          81/01/01 thru 81/06/30
                        TRD_P10_81B.DAT          81/07/01 thru 81/12/31

                        TRD_P10_82A.DAT          82/01/01 thru 82/06/30
                        TRD_P10_82B.DAT          82/07/01 thru 82/12/31
                        TRD_P10_83A.DAT          83/01/01 thru 83/06/30
                        TRD_P10_83B.DAT          83/07/01 thru 83/12/31
                        TRD_P10_84A.DAT          84/01/01 thru 84/06/30
                        TRD_P10_84B.DAT          84/07/01 thru 84/12/31
                        TRD_P10_85A.DAT          85/01/01 thru 85/06/30
                        TRD_P10_85B.DAT          85/07/01 thru 85/12/31
                        TRD_P10_86A.DAT          86/01/01 thru 86/06/30
                        TRD_P10_86B.DAT          86/07/01 thru 86/12/31

                        TRD_P10_87A.DAT          87/01/01 thru 87/06/30
                        TRD_P10_87B.DAT          87/07/01 thru 87/12/31
                        TRD_P10_88A.DAT          88/01/01 thru 88/06/30
                        TRD_P10_88B.DAT          88/07/01 thru 88/12/31
                        TRD_P10_89A.DAT          89/01/01 thru 89/06/30
                        TRD_P10_89B.DAT          89/07/01 thru 89/12/31
                        TRD_P10_90A.DAT          90/01/01 thru 90/06/30
                        TRD_P10_90B.DAT          90/07/01 thru 90/12/31
                        */

CCSD$$MARKERMRK**003CCSD3RF0000300000001
REFERENCETYPE=$VMS;
LABEL=ATTACHED;
REFERENCE=FORMAT.SFD;
LABEL=NSSD3IF0005600000001;
REFERENCE=TRD_P10_72A.DAT;
REFERENCE=TRD_P10_72B.DAT;
REFERENCE=TRD_P10_73A.DAT;
REFERENCE=TRD_P10_73B.DAT;

/* EOF for VOLDESC.SFD */
/* FORMAT.SFD File follows */
CCSD3FF0000500000001CCSD3CS00004MRK**001
ADIDNAME=NSSD0056;
CCSD$$MARKERMRK**001CCSD3KS00002MRK**002

Subm_Name:      Dr. Walker Fillius

Subm_Addr:      UCSD/CASS/0111
                9500 Gilman Drive
                La Jolla, CA 92093-0111
                U.S.A
                Telephone: (619) 534-3315
                Electronic Mail (NSI/DECnet): CASS::WALKER

Subm_Date: 1992-06-01

Title:  Format for Pioneer 10 TRD Cruise Data Archive Data Set

Descr:  Format description of the Pioneer 10 Trapped Radiation Detector's
        cruise phase archive data set, March, 1972 through December, 1990

Rel_Date:  1992-06-01
```

CCSD$$MARKERMRK**002CCSD3DF0000200000001

File_Class_Name: UCSD TRD Interplanetary Cruise ASCII Archive

Record_Type_Name: Half hour homogeneous summaries

Algorithms: Records contain statistical information on the readings from each data channel during each summary time interval. For pulse data the statistical quantities are the number of readings, total number of counts, total accumulation time, rms deviation of readings, maximum residue, and minimum residue. Average counting rates are the most useful product. These can be computed as the quotient of the total number of counts divided by the total accumulation time. Statistical error (one standard deviation) is the square root of the total number of counts divided by the total accumulation time. Valid average rates can be obtained for a number of contiguous intervals by summing total counts and total accumulation time separately before performing square roots and quotients.

File_Class_Syntax: All records in the UCSD TRD interplanetary cruise ASCII archive files are of the same type, size, and format.

File_Class_Field_Relationships:

Time: The named times for the beginning and end of each summary record refer to the times of the first and last readings within the summary average window. For example, for the first summary of a day, the beginning time is not 00:00:00.000, but rather the time of the first reading after this instant. Similarly, the ending time is the time of the last record before 00:30:00.000. To identify a preselected time interval, the user must look for a record that is contained within his desired window.

File_Class_Misc: See Record and Field specifications.

Record_Name: Half hour homogeneous summaries

Record_Structure: All data records are of the same length.

Record_Length: 1800 ASCII characters or bytes

Record_Field_Names:

SAT, UCSD, HMI, DELT, BYR, BMON, BDAY, BHR, BMIN, BSEC, BMSEC, EYR, EMON, EDAY, EHR, EMIN, ESEC, EMSEC, EDRTAP, TDF, TBR, BRTLT, ERTLT, PMIN(3), PMAX(3), PAVE(3), PRMS(21), PRESMAX(21), PRESMIN(21), NREAD(21), NCOUNT(21), TOTIME(21), AVG(6), ERMS(6), ERESMAX(6), ERESMIN(6), AVGA(6), ECMAX(6), ECMIN(6), MREAD(6), NFMOD, BATCCLT, BATCLNG, BRADPS, BCLTPSC, BALGPSC, BRADES, BCLTESC, BALGESC, BRADJS, BCLTJSC, BALGJSC, BSPARE, EATCCLT, EATCLNG, ERADPS, ECLTPSC, EALGPSC, ERADES, ECLTESC, EALGESC, ERADJS, ECLTJSC, EALGJSC, ESPARE, FSPARE

Record_Syntax:

Field Number	Name	Format	Description
1	SAT	A11	Spacecraft identifier (" Pioneer 10" or " Pioneer 11)

2	UCSD	A8	Label ("UCSD ")
3	HMI	A5	Summary type, Homogeneous/InH ("H Sum" or "I Sum")
4	DELT	I6	Time width of summary window (seconds)
5a	BYR	I4	Four digit year at beginning of summary (1972-1990)
5b	BDASH1	A1	Subfield separator ("-")
5c	BMON	I2	Month at beginning of summary (01-12)
5d	BDASH2	A1	Subfield separator ("-")
5e	BDAY	I2	Day of month at beginning of summary (01-31)
5f	BT	A1	Subfield separator ("T")
5g	BHR	I2	Hour of day at beginning of summary (00-23)
5h	BCOLON1	A1	Subfield separator (":")
5i	BMIN	I2	Minute of hour at beginning of summary (00-59)
5j	BCOLON2	A1	Subfield separator (":")
5k	BSEC	I2	Second of minute at beginning of summary (00-60)
5l	BDOT	A1	Subfield separator (".")
5m	BMSEC	I3	Millisec of second at beginning of summary (000-999)
6	BLANK	A1	Field separator (" ")
7a	EYR	I4	Four digit year at end of summary (1972-2001)
7b	EDASH1	A1	Subfield separator ("-")
7c	EMON	I2	Month at end of summary (01-12)
7d	EDASH2	A1	Subfield separator ("-")
7e	EDAY	I2	Day of month at end of summary (01-31)
7f	ET	A1	Subfield separator ("T")
7g	EHR	I2	Hour of day at end of summary (00-23)
7h	ECOLON1	A1	Subfield separator (":")
7i	EMIN	I2	Minute of hour at end of summary (00-59)
7j	ECOLON2	A1	Subfield separator (":")
7k	ESEC	I2	Second of minute at end of summary (00-60)
7l	EDOT	A1	Subfield separator (".")
7m	EMSEC	I3	Millisecond of second at end of summary (000-999)
8	EDRTAP	A6	UCSD name of source EDR
9	TDF	A3	Telemetry data format (" A ", "A/D", " B ", or "B/D")
10	TBR	I1	Code for telemetry bit rate (bits/s=2**(3+TBR))
11	BRTLT	I8	Round trip light time at beginning of summary (ms)
12	ERTLT	I8	Round trip light time at end of summary (ms)

Housekeeping Parameters

13-15	PMIN(I)	3*F6.1	Minimum values of 3 housekeeping parameters
16-18	PMAX(I)	3*F6.1	Maximum values of 3 housekeeping parameters
19-21	PAVE(I)	3*F6.1	Average values of 3 housekeeping parameters The 3 are Pulse-Electronics Temperature (deg F), High-Voltage Regulator Current (micro-A), and Detector C Temperature (deg F), respectively. PAVE(2) is not used and is left blank.

Pulse Channel Data for 21 Channels

22-42	PRMS(I)	21*E9.2E2	RMS Deviation of readings in summary interval
43-63	PRESMAX(I)	21*E9.2E2	Maximum residue normalized to RMS deviation
64-84	PRESMIN(I)	21*E9.2E2	Minimum residue normalized to RMS deviation
85-105	NREAD(I)	21*I4	Number of readings in summary
106-126	NCOUNT(I)	21*I9	Total number of counts in all readings
127-147	TOTIME(I)	21*I8	Total accumulation time for all readings (ms) The 21 pulse-counting channels are, in order, C1, C2, C3, E1H, E2H, E3H, E1L, E2L, E3L, E1U, E2U, E3U, M1H, M2H, M3H, M1L, M2L, M3L, M1U, M2U, M3U.

Electrometer Channel Data for 6 Channels

148-153	AVG(I)	6*F5.1	Average reading for channel I (0.0-450.0)
154-159	ERMS(I)	6*E8.1E2	RMS deviation of current in amperes

160-165	ERESMAX(I)	6*E8.1E2	Maximum residue of current in amperes
166-171	ERESMIN(I)	6*E8.1E2	Minimum residue of current in amperes
172-177	AVGA(I)	6*E8.1E2	Average current in amperes
178-183	ECMAX(I)	6*E8.1E2	Maximum current in amperes
184-189	ECMIN(I)	6*E8.1E2	Minimum current in amperes
190-195	MREAD(I)	6*I4	Number of readings in summary The 6 electrometer channels are, in order, CDC, SEDC, SPDC, CAL1, CAL2, CAL3.

Attitude and Trajectory Data

196	NFMOD	A14	Data type ("Interplanetary")
197	BATCCLT	F8.3	Ecliptic colatitude of S/C spin vector at beginning time of summary record
198	BATCLNG	F8.3	Ecliptic longitude of S/C spin vector at beginning time of summary record
199	BRADPS	F8.3	Radial distance from sun to S/C at beginning time of summary record
200	BCLTPSC	F8.3	Ecliptic colatitude of S/C at beginning time of summary record
201	BALGPSC	F8.3	Ecliptic longitude of S/C at beginning time of summary record
202	BRADES	F8.3	Radial distance from sun to earth at beginning time of summary record
203	BCLTESC	F8.3	Ecliptic colatitude of earth at beginning time of summary record
204	BALGESC	F8.3	Ecliptic longitude of earth at beginning time of summary record
205	BRADJS	F8.3	Radial distance from sun to Jupiter at beginning time of summary record
206	BCLTJSC	F8.3	Ecliptic colatitude of Jupiter at beginning time of summary record
207	BALGJSC	F8.3	Ecliptic longitudeof Jupiter at beginning time of summary record
208	BSPARE	6*A8	Blank fill
209	EATCCLT	F8.3	Ecliptic colatitude of S/C spin vector at end time of summary record
210	EATCLNG	F8.3	Ecliptic longitude of S/C spin vector at end time of summary record
211	ERADPS	F8.3	Radial distance from sun to S/C at end time of summary record
212	ECLTPSC	F8.3	Ecliptic colatitude of S/C at end time of summary record
213	EALGPSC	F8.3	Ecliptic longitude of S/C at end time of summary record
214	ERADES	F8.3	Radial distance from sun to earth at end time of summary record
215	ECLTESC	F8.3	Ecliptic colatitude of earth at end time of summary record
216	EALGESC	F8.3	Ecliptic longitude of earth at end time of summary record
217	ERADJS	F8.3	Radial distance from sun to Jupiter at end time of summary record
218	ECLTJSC	F8.3	Ecliptic colatitude of Jupiter at end time of summary record
219	EALGJSC	F8.3	Ecliptic longitude of Jupiter at end time of summary record
220	ESPARE	6*A8	Blank fill
221	FSPARE	A7	Blank fill

Field_Name: Spacecraft identifier

Field_Mnemonic: SAT
Field_Units: ASCII characters
Field_Resolution: not applicable
Field_Range: "Pioneer 10" or "Pioneer 11"
Field_Description: This parameter is used to identify the spacecraft which carried the instrument which acquired the data in this archive. The spacecraft are named according to a convention in which the literal name indicates that the spacecraft belongs to a series of interplanetary and planetary probes built under the aegis of the NASA Ames Research Center in Mountain View, California, and the number indicates the chronological position of the spacecraft in that series.
Field_Representation: 11 ASCII characters (A11)

Field_Name: Identifier of the institution responsible for the instrument
Field_Mnemonic: "UCSD "
Field_Units: ASCII characters
Field_Resolution: not applicable
Field_Range: UCSD
Field_Description: This parameter identifies the University of California, San Diego as the institution which designed, built, and carried out the primary data analysis for this instrument.
Field_Representation: 8 ASCII characters (A8)

Field_Name: Summary type
Field_Mnemonic: HMI
Field_Units: ASCII characters
Field_Resolution: not applicable
Field_Range: "H Sum" or "I Sum"
Field_Description: Identifies whether the statistical information in the summary record is homogeneous or inhomogeneous.
Field_Representation: 5 ASCII characters (A5)

Field_Name: Time width of summary window
Field_Mnemonic: DELT
Field_Units: seconds
Field_Resolution: 1 second
Field_Range: Exactly 1800 for the half hour summaries in the UCSD cruise data archive. Other values of DELT are in use by UCSD in other data sets.
Field_Description: Indicates the nominal width of the averaging intervals.
Field_Representation: 6 ASCII characters (I6)

Field_Name: Beginning time
Field_Mnemonic: BTIME
Field_Units: CCSDS ASCII Time Code, form A (YYYY-MM-DDThh:mm:ss.ddd)
Field_Resolution: one millisecond
Field_Range: 1973-04-06T00:00:00.000 to 1990-12-31T23:30:00.000
Field_Description: Time of first reading within the summary averaging interval
Field_Representation: 23 ASCII characters

Field_Name: Blank
Field_Mnemonic: BLANK
Field_Units: One ASCII character
Field_Resolution: not applicable
Field_Range: " "
Field_Description: A blank space to separate the beginning time field from the ending time field.
Field_Representation: 1 ASCII character (A1)

Field_Name: Ending time

Field_Mnemonic: ETIME
Field_Units: CCSDS ASCII Time Code, form A (YYYY-MM-DDThh:mm:ss.ddd)
Field_Resolution: one millisecond
Field_Range: 1973-04-06T00:29:59.999 to 1990-12-31T23:59:59.999
Field_Description: Time of last reading within the summary averaging interval
Field_Representation: 23 ASCII characters

Field_Name: EDR tape name
Field_Mnemonic: EDRTAP
Field_Units: Six ASCII characters
Field_Resolution: not applicable
Field_Range: "M00000" to "M99999"
Field_Description: The identifier given to the source EDR in the internal
        UCSD tape filing system
Field_Representation: 6 ASCII characters (A6)

Field_Name: Telemetry data format
Field_Mnemonic: TDF
Field_Units: Three ASCII characters
Field_Resolution: not applicable
Field_Range: " A ", "A/D", " B ", or "B/D"
Field_Description: Identifier of the data format in use by the spacecraft
        telemetry system during the data transmission. This parameter affects
        the operating mode of the instrument.
Field_Representation: 3 ASCII characters (A3)

Field_Name: Telemetry bit rate
Field_Mnemonic: TBR
Field_Units: One ASCII character
Field_Resolution: not applicable
Field_Range: 1 through 8
Field_Description: Identifier of the data bit rate in use by the spacecraft
        telemetry system during the data transmission. This parameter affects
        the operating mode of the instrument. The bit rate, in bits per
        second, is given by the formula 2**(3+TBR), and covers the range from
        16 bps through 2048 bps in eight binary steps.
Field_Representation: 1 ASCII character (I1)

Field_Name: Beginning round trip light time
Field_Mnemonic: BRTLT
Field_Units: milliseconds
Field_Resolution: one millisecond
Field_Range: Approximately 0 to 50000000
Field_Description: Round trip light travel time from earth to the spacecraft
        and back at the beginning time of the summary.
Field_Representation: 8 ASCII characters (I8)

Field_Name: Ending round trip light time
Field_Mnemonic: ERTLT
Field_Units: milliseconds
Field_Resolution: one millisecond
Field_Range: Approximately 0 to 50000000
Field_Description: Round trip light travel time from earth to the spacecraft
        and back at the ending time of the summary.
Field_Representation: 8 ASCII characters (I8)

Field_Name: Minimum values for each of 3 housekeeping parameters
Field_Mnemonic: PMIN(I)
Field_Units: degrees F, micro-amperes, and degrees F respectively
Field_Resolution: Determined by spacecraft A/D converter. Approximately 3

degrees F and 2 microamperes.
Field_Range: Approximately -50 to +50 degrees F and 0 to 100 microamperes.
Field_Description: Minimum values transmitted during the averaging interval for 3 housekeeping parameters. The 3 housekeeping parameters are Pulse-Electronics Temperature (deg F), High-Voltage Regulator Current (micro-A), and Detector C Temperature (deg F), respectively.
Field_Representation: 18 ASCII characters (3*F6.1)

Field_Name: Maximum values for each of 3 housekeeping parameters
Field_Mnemonic: PMAX(I)
Field_Units: degrees F, micro-amperes, and degrees F respectively
Field_Resolution: Determined by spacecraft A/D converter. Approximately 3 degrees F and 2 microamperes.
Field_Range: Approximately -50 to +50 degrees F and 0 to 100 microamperes.
Field_Description: Maximum values transmitted during the averaging interval for 3 housekeeping parameters. The 3 housekeeping parameters are Pulse-Electronics Temperature (deg F), High-Voltage Regulator Current (micro-A), and Detector C Temperature (deg F), respectively.
Field_Representation: 18 ASCII characters (3*F6.1)

Field_Name: Average values for each of 3 housekeeping parameters
Field_Mnemonic: PAVE(I)
Field_Units: degrees F, micro-amperes, and degrees F respectively
Field_Resolution: Determined by spacecraft A/D converter. Approximately 3 degrees F and 2 microamperes.
Field_Range: Approximately -50 to +50 degrees F and 0 to 100 microamperes.
Field_Description: Average values transmitted during the averaging interval for 3 housekeeping parameters. The 3 housekeeping parameters are Pulse-Electronics Temperature (deg F), High-Voltage Regulator Current (micro-A), and Detector C Temperature (deg F), respectively. I=2 is not used.
Field_Representation: 18 ASCII characters (3*F6.1)

Field_Name: Root mean square deviation for each of 21 pulse-counting channels
Field_Mnemonic: PRMS(I)
Field_Units: counts
Field_Resolution: Approximately one per cent
Field_Range: 0 to 10**7
Field_Description: RMS deviation, computed over the readings in the summary interval, for each of 21 pulse height channels. The 21 pulse-counting channels are, in order, C1, C2, C3, E1H, E2H, E3H, E1L, E2L, E3L, E1U, E2U, E3U, M1H, M2H, M3H, M1L, M2L, M3L, M1U, M2U, M3U.
Field_Representation: 189 ASCII characters (21*E9.2E2)

Field_Name: Maximum residue for each of 21 pulse-counting channels
Field_Mnemonic: PRESMAX(I)
Field_Units: Normalized to RMS deviation
Field_Resolution: Approximately one per cent
Field_Range: 0 to 10**7
Field_Description: The maximum residue is the difference between the maximum reading and the mean reading, normalized by dividing by the rms deviation. The maximum is computed over the readings in the summary interval, for each of 21 pulse height channels. The 21 pulse-counting channels are, in order, C1, C2, C3, E1H, E2H, E3H, E1L, E2L, E3L, E1U, E2U, E3U, M1H, M2H, M3H, M1L, M2L, M3L, M1U, M2U, M3U.
Field_Representation: 189 ASCII characters (21*E9.2E2)

Field_Name: Minimum residue for each of 21 pulse-counting channels
Field_Mnemonic: PRESMIN(I)
Field_Units: Normalized to RMS deviation

Field_Resolution: Approximately one per cent
Field_Range: 0 to 10**7
Field_Description: The minimum residue is the difference between the mean reading and the minimum reading, normalized by dividing by the rms deviation. The minimum is computed over the readings in the summary interval, for each of 21 pulse height channels. The 21 pulse-counting channels are, in order, C1, C2, C3, E1H, E2H, E3H, E1L, E2L, E3L, E1U, E2U, E3U, M1H, M2H, M3H, M1L, M2L, M3L, M1U, M2U, M3U.
Field_Representation: 189 ASCII characters (21*E9.2E2)

Field_Name: Number of readings in summary for each of 21 pulse-counting channels
Field_Mnemonic: NREAD(I)
Field_Units: Integer count
Field_Resolution: One
Field_Range: 0 to several thousand
Field_Description: The number of readings during the summary averaging interval, from each of 21 pulse-counting channels. The 21 pulse-counting channels are, in order, C1, C2, C3, E1H, E2H, E3H, E1L, E2L, E3L, E1U, E2U, E3U, M1H, M2H, M3H, M1L, M2L, M3L, M1U, M2U, M3U.
Field_Representation: 84 ASCII characters (21*I4)

Field_Name: Total number of counts for each of 21 pulse-counting channels
Field_Mnemonic: NCOUNT(I)
Field_Units: Counts
Field_Resolution: One
Field_Range: 0 to 10**9 - 1
Field_Description: The total number of counts during the summary averaging interval, summed over all readings from each of 21 pulse-counting channels. The 21 pulse-counting channels are, in order, C1, C2, C3, E1H, E2H, E3H, E1L, E2L, E3L, E1U, E2U, E3U, M1H, M2H, M3H, M1L, M2L, M3L, M1U, M2U, M3U.
Field_Representation: 189 ASCII characters (21*I9)

Field_Name: Total accumulation time for each of 21 pulse-counting channels
Field_Mnemonic: TOTIME(I)
Field_Units: Milliseconds
Field_Resolution: One millisecond
Field_Range: 0 to 3600000
Field_Description: The total live time during the summary averaging interval, summed over all readings from each of 21 pulse-counting channels. The 21 pulse-counting channels are, in order, C1, C2, C3, E1H, E2H, E3H, E1L, E2L, E3L, E1U, E2U, E3U, M1H, M2H, M3H, M1L, M2L, M3L, M1U, M2U, M3U.
Field_Representation: 168 ASCII characters (21*I8)

Field_Name: Average reading for each of 6 electrometer channels
Field_Mnemonic: AVG(I)
Field_Units: Quasilogarithmic A/D conversion
Field_Resolution: 0.2 per cent
Field_Range: 0.0 to 450.0
Field_Description: Average reading over the summary interval, computed for each of six electrometer channels. The electrometer has two overlapping quasilogarithmic ranges from 10**-14 amps to 10**-9 amps for the low current range, and 10**-10 to 10**-5 amps for the high current range. The signal is processed by a quasilogarithmic analog-to-digital converter, and presented to the encoder as a pulse train plus a range identifier bit. The pulse train is encoded on a scale from 250 (lowest current in range) to 0 (highest current in range). These two ranges are combined by our data reduction program to a

single logarithmic scale with a slope of 50 counts per decade from 450 at 10**-14 amperes to 0 at 10**-5 amperes. The 6 electrometer channels are, in order, CDC, SEDC, SPDC, CAL1, CAL2, and CAL3.
Field_Representation: 30 ASCII characters (6*F5.1)

Field_Name: RMS deviation of current for each of 6 electrometer channels
Field_Mnemonic: ERMS(I)
Field_Units: Amperes
Field_Resolution: Approximately 5 per cent
Field_Range: 0 to 10**-5
Field_Description: RMS deviation of the current in amperes, computed over all the readings in the summary interval, for each of six electrometer channels. The 6 electrometer channels are, in order, CDC, SEDC, SPDC, CAL1, CAL2, and CAL3.
Field_Representation: 48 ASCII characters (6*E8.1E2)

Field_Name: Maximum residue of current for each of 6 electrometer channels
Field_Mnemonic: ERESMAX(I)
Field_Units: Amperes
Field_Resolution: Approximately 5 per cent
Field_Range: 0 to 10**-5
Field_Description: The maximum residue is the difference between the maximum current and the average current during the summary interval, computed for each of six electrometer channels. The 6 electrometer channels are, in order, CDC, SEDC, SPDC, CAL1, CAL2, and CAL3.
Field_Representation: 48 ASCII characters (6*E8.1E2)

Field_Name: Minumum residue of current for each of 6 electrometer channels
Field_Mnemonic: ERESMIN(I)
Field_Units: Amperes
Field_Resolution: Approximately 5 per cent
Field_Range: 0 to 10**-5
Field_Description: The minimum residue is the difference between the average current and the minimum current during the summary interval, computed for each of six electrometer channels. The 6 electrometer channels are, in order, CDC, SEDC, SPDC, CAL1, CAL2, and CAL3.
Field_Representation: 48 ASCII characters (6*E8.1E2)

Field_Name: Average current in for each of 6 electrometer channels
Field_Mnemonic: AVGA(I)
Field_Units: Amperes
Field_Resolution: Approximately 5 per cent
Field_Range: 10**-14 to 10**-5
Field_Description: The average current in amperes, computed over all the readings in the summary interval, for each of six electrometer channels. The 6 electrometer channels are, in order, CDC, SEDC, SPDC, CAL1, CAL2, and CAL3.
Field_Representation: 48 ASCII characters (6*E8.1E2)

Field_Name: Maximum current for each of 6 electrometer channels
Field_Mnemonic: ECMAX(I)
Field_Units: Amperes
Field_Resolution: Approximately 5 per cent
Field_Range: 10**-14 to 10**-5
Field_Description: The maximum current in amperes, over all the readings in the summary interval, for each of six electrometer channels. The 6 electrometer channels are, in order, CDC, SEDC, SPDC, CAL1, CAL2, and CAL3.
Field_Representation: 48 ASCII characters (6*E8.1E2)

Field_Name: Minimum current for each of 6 electrometer channels
Field_Mnemonic: ECMIN(I)
Field_Units: Amperes
Field_Resolution: Approximately 5 per cent
Field_Range: 10**-14 to 10**-5
Field_Description: The minimum current in amperes, over all the readings in the summary interval, for each of six electrometer channels. The 6 electrometer channels are, in order, CDC, SEDC, SPDC, CAL1, CAL2, and CAL3.
Field_Representation: 48 ASCII characters (6*E8.1E2)

Field_Name: Number of readings in summary for each of 6 electrometer channels
Field_Mnemonic: MREAD(I)
Field_Units: Integer count
Field_Resolution: One
Field_Range: 0 to several thousand
Field_Description: The number of readings during the summary averaging interval, from each of six electrometer channels. The 6 electrometer channels are, in order, CDC, SEDC, SPDC, CAL1, CAL2, and CAL3.
Field_Representation: 24 ASCII characters (6*I4)

Field_Name: Data reduction mode
Field_Mnemonic: NFMOD
Field_Units: ASCII characters
Field_Resolution: not applicable
Field_Range: "Interplanetary"
Field_Description: Specifies one of several modes for running the data reduction program. Only the one mode was used in generating the Pioneer 10 TRD Cruise Data Archive, but other modes were used in generating other data sets.
Field_Representation: 14 ASCII characters (A14)

Field_Name: Ecliptic colatitude of S/C spin vector at beginning time of summary record
Field_Mnemonic: BATCCLT
Field_Units: Degrees
Field_Resolution: 0.1 degree
Field_Range: 0 to 180.0
Field_Description: The ecliptic colatitude is measured southward from the ecliptic zenith.
Field_Representation: 8 ASCII characters (F8.3)

Field_Name: Ecliptic longitude of S/C spin vector at beginning time of summary record
Field_Mnemonic: BATCLNG
Field_Units: Degrees
Field_Resolution: Approximately 0.1 degree
Field_Range: 0 to 360.0
Field_Description: The ecliptic longitude is measured in the ecliptic plane eastward from the Vernal Equinox.
Field_Representation: 8 ASCII characters (F8.3)

Field_Name: Radial distance from sun to S/C at beginning time of summary record
Field_Mnemonic: BRADPS
Field_Units: Astronomical units (AU). One AU = 1.495985*10**13 cm.
Field_Resolution: 0.001 AU
Field_Range: Approximately 1 to 33 AU
Field_Description: One component of the spacecraft position coordinates given in spherical polar coordinates referenced to the ecliptic plane, with

point of origin at the sun.
Field_Representation: 8 ASCII characters (F8.3)

Field_Name: Ecliptic colatitude of S/C at beginning time of summary record
Field_Mnemonic: BCLTPSC
Field_Units: Degrees
Field_Resolution: Approximately 0.1 degree
Field_Range: 0 to 180.0 degrees
Field_Description: One component of the spacecraft position coordinates given in spherical polar coordinates referenced to the ecliptic plane, with point of origin at the sun. The ecliptic colatitude is measured southward from the ecliptic zenith.
Field_Representation: 8 ASCII characters (F8.3)

Field_Name: Ecliptic longitude of S/C at beginning time of summary record
Field_Mnemonic: BALGPSC
Field_Units: Degrees
Field_Resolution: Approximately 0.1 degree
Field_Range: 0 to 360.0 degrees
Field_Description: One component of the spacecraft position coordinates given in spherical polar coordinates referenced to the ecliptic plane, with point of origin at the sun. The ecliptic longitude is measured in the ecliptic plane eastward from the Vernal Equinox.
Field_Representation: 8 ASCII characters (F8.3)

Field_Name: Radial distance from sun to earth at beginning time of summary record
Field_Mnemonic: BRADES
Field_Units: Astronomical units (AU). One AU = 1.495985*10**13 cm.
Field_Resolution: 0.001 AU
Field_Range: Approximately 1 AU
Field_Description: One component of the earth's position coordinates given in spherical polar coordinates referenced to the ecliptic plane, with point of origin at the sun.
Field_Representation: 8 ASCII characters (F8.3)

Field_Name: Ecliptic colatitude of earth at beginning time of summary record
Field_Mnemonic: BCLTESC
Field_Units: Degrees
Field_Resolution: Approximately 0.1 degree
Field_Range: Approximately 90 degrees
Field_Description: One component of the earth's position coordinates given in spherical polar coordinates referenced to the ecliptic plane, with point of origin at the sun. The ecliptic colatitude is measured southward from the ecliptic zenith.
Field_Representation: 8 ASCII characters (F8.3)

Field_Name: Ecliptic longitude of earth at beginning time of summary record
Field_Mnemonic: BALGESC
Field_Units: Degrees
Field_Resolution: Approximately 0.1 degree
Field_Range: 0 to 360.0 degrees
Field_Description: One component of the earth's position coordinates given in spherical polar coordinates referenced to the ecliptic plane, with point of origin at the sun. The ecliptic longitude is measured in the ecliptic plane eastward from the Vernal Equinox.
Field_Representation: 8 ASCII characters (F8.3)

Field_Name: Radial distance from sun to Jupiter at beginning time of summary record

Field_Mnemonic: BRADJS
Field_Units: Astronomical units (AU). One AU = 1.495985*10**13 cm.
Field_Resolution: 0.001 AU
Field_Range: Approximately 5 AU
Field_Description: One component of Jupiter's position coordinates given in spherical polar coordinates referenced to the ecliptic plane, with point of origin at the sun.
Field_Representation: 8 ASCII characters (F8.3)

Field_Name: Ecliptic colatitude of Jupiter at beginning time of summary record
Field_Mnemonic: BCLTJSC
Field_Units: Degrees
Field_Resolution: Approximately 0.1 degree
Field_Range: Approximately 90 degrees
Field_Description: One component of Jupiter's position coordinates given in spherical polar coordinates referenced to the ecliptic plane, with point of origin at the sun. The ecliptic colatitude is measured southward from the ecliptic zenith.
Field_Representation: 8 ASCII characters (F8.3)

Field_Name: Ecliptic longitude of Jupiter at beginning time of summary record
Field_Mnemonic: BALGJSC
Field_Units: Degrees
Field_Resolution: Approximately 0.1 degree
Field_Range: 0 to 360.0 degrees
Field_Description: One component of Jupiter's position coordinates given in spherical polar coordinates referenced to the ecliptic plane, with point of origin at the sun. The ecliptic longitude is measured in the ecliptic plane eastward from the Vernal Equinox.
Field_Representation: 8 ASCII characters (F8.3)

Field_Name: Blank fill
Field_Mnemonic: BSPARE
Field_Units: ASCII characters
Field_Resolution: not applicable
Field_Range: " "
Field_Description: Blank characters to fill space in the record
Field_Representation: 48 ASCII characters (6A8)

Field_Name: Ecliptic colatitude of S/C spin vector at ending time of summary record
Field_Mnemonic: EATCCLT
Field_Units: Degrees
Field_Resolution: 0.1 degree
Field_Range: 0 to 180.0
Field_Description: The ecliptic colatitude is measured southward from the ecliptic zenith.
Field_Representation: 8 ASCII characters (F8.3)

Field_Name: Ecliptic longitude of S/C spin vector at ending time of summary record
Field_Mnemonic: EATCLNG
Field_Units: Degrees
Field_Resolution: Approximately 0.1 degree
Field_Range: 0 to 360.0
Field_Description: The ecliptic longitude is measured in the ecliptic plane eastward from the Vernal Equinox.
Field_Representation: 8 ASCII characters (F8.3)

Field_Name: Radial distance from sun to S/C at ending time of summary record
Field_Mnemonic: ERADPS
Field_Units: Astronomical units (AU). One AU = 1.495985*10**13 cm.
Field_Resolution: 0.001 AU
Field_Range: Approximately 1 to 33 AU
Field_Description: One component of the spacecraft position coordinates give
in spherical polar coordinates referenced to the ecliptic plane, with
point of origin at the sun.
Field_Representation: 8 ASCII characters (F8.3)

Field_Name: Ecliptic colatitude of S/C at ending time of summary record
Field_Mnemonic: ECLTPSC
Field_Units: Degrees
Field_Resolution: Approximately 0.1 degree
Field_Range: 0 to 180.0 degrees
Field_Description: One component of the spacecraft position coordinates given
in spherical polar coordinates referenced to the ecliptic plane, with
point of origin at the sun. The ecliptic colatitude is measured
southward from the ecliptic zenith.
Field_Representation: 8 ASCII characters (F8.3)

Field_Name: Ecliptic longitude of S/C at ending time of summary record
Field_Mnemonic: EALGPSC
Field_Units: Degrees
Field_Resolution: Approximately 0.1 degree
Field_Range: 0 to 360.0 degrees
Field_Description: One component of the spacecraft position coordinates given
in spherical polar coordinates referenced to the ecliptic plane, with
point of origin at the sun. The ecliptic longitude is measured in the
ecliptic plane eastward from the Vernal Equinox.
Field_Representation: 8 ASCII characters (F8.3)

Field_Name: Radial distance from sun to earth at ending time of summary
record
Field_Mnemonic: ERADES
Field_Units: Astronomical units (AU). One AU = 1.495985*10**13 cm.
Field_Resolution: 0.001 AU
Field_Range: Approximately 1 AU
Field_Description: One component of the earth's position coordinates given in
spherical polar coordinates referenced to the ecliptic plane, with
point of origin at the sun.
Field_Representation: 8 ASCII characters (F8.3)

Field_Name: Ecliptic colatitude of earth at ending time of summary record
Field_Mnemonic: ECLTESC
Field_Units: Degrees
Field_Resolution: Approximately 0.1 degree
Field_Range: Approximately 90 degrees
Field_Description: One component of the earth's position coordinates given in
spherical polar coordinates referenced to the ecliptic plane, with
point of origin at the sun. The ecliptic colatitude is measured
southward from the ecliptic zenith.
Field_Representation: 8 ASCII characters (F8.3)

Field_Name: Ecliptic longitude of earth at ending time of summary record
Field_Mnemonic: EALGESC
Field_Units: Degrees
Field_Resolution: Approximately 0.1 degree
Field_Range: 0 to 360.0 degrees
Field_Description: One component of the earth's position coordinates given in

```
        spherical polar coordinates referenced to the ecliptic plane, with
        point of origin at the sun.  The ecliptic longitude is measured in the
        ecliptic plane eastward from the Vernal Equinox.
Field_Representation:  8 ASCII characters (F8.3)

Field_Name:  Radial distance from sun to Jupiter at ending time of summary
        record
Field_Mnemonic:  ERADJS
Field_Units:  Astronomical units (AU).  One AU = 1.495985*10**13 cm.
Field_Resolution:  0.001 AU
Field_Range:  Approximately 5 AU
Field_Description:  One component of Jupiter's position coordinates given in
        spherical polar coordinates referenced to the ecliptic plane, with
        point of origin at the sun.
Field_Representation:  8 ASCII characters (F8.3)

Field_Name:  Ecliptic colatitude of Jupiter at ending time of summary record
Field_Mnemonic:  ECLTJSC
Field_Units:  Degrees
Field_Resolution:  Approximately 0.1 degree
Field_Range:  Approximately 90 degrees
Field_Description:  One component of Jupiter's position coordinates given in
        spherical polar coordinates referenced to the ecliptic plane, with
        point of origin at the sun.  The ecliptic colatitude is measured
        southward from the ecliptic zenith.
Field_Representation:  8 ASCII characters (F8.3)

Field_Name:  Ecliptic longitude of Jupiter at ending time of summary record
Field_Mnemonic:  EALGJSC
Field_Units:  Degrees
Field_Resolution:  Approximately 0.1 degree
Field_Range:  0 to 360.0 degrees
Field_Description:  One component of Jupiter's position coordinates given in
        spherical polar coordinates referenced to the ecliptic plane, with
        point of origin at the sun.  The ecliptic longitude is measured in the
        ecliptic plane eastward from the Vernal Equinox.
Field_Representation:  8 ASCII characters (F8.3)

Field_Name:  Blank fill
Field_Mnemonic:  ESPARE
Field_Units:  ASCII characters
Field_Resolution:  not applicable
Field_Range:  " "
Field_Description:  Blank characters to fill space in the record
Field_Representation:  48 ASCII characters (6A8)

Field_Name:  Blank fill
Field_Mnemonic:  FSPARE
Field_Units:  ASCII characters
Field_Resolution:  not applicable
Field_Range:  " "
Field_Description:  Blank characters to fill space in the record
Field_Representation:  7 ASCII characters (A7)

/* EOF for FORMAT.SFD file */
```

D-10816-75 not the same in C-03195 FDLIST
1/1/91 - 12/31/91

DSC # 724

CCSD3ZF0000100000001CCSD3VS00002MRK**001

Vol_Ident: USA_NASA_NSSD_P11E_0006

Vol_Creation_Date: 1994-08-02

Medium_Description: 1/2 inch, 9 track, 6250 bpi magnetic tape

Technical_Contact:
Richard Bentley
UCSD/CASS/0111
9500 Gilman Drive
La Jolla, CA 92093-0111
U.S.A
Telephone: (619) 534-4987
Electronic Mail (NSI/DECnet): CASS::RICH

Prev_Vols:
USA_NASA_NSSD_P11E_0001
USA_NASA_NSSD_P11E_0002
USA_NASA_NSSD_P11E_0003
USA_NASA_NSSD_P11E_0004
USA_NASA_NSSD_P11E_0005

Print from tape

CCSD$$MARKERMRK**001CCSD3SS00002MRK**002

Data_Set_Name: Pioneer 11 TRD Cruise Data Archive

Data_Source: Pioneer 11 Trapped Radiation Detector

Scientific_Contact:
Dr. Walker Fillius
UCSD/CASS/0111
9500 Gilman Drive
La Jolla, CA 92093-0111
U.S.A
Telephone: (619) 534-3315
Electronic Mail (NSI/DECnet): CASS::WALKER

Spacecraft_Characteristics: Pioneer 11 was launched on April 6, 1973, encountered Jupiter in December, 1974, and Saturn in September, 1979. Since the Saturn encounter, it has been on an escape trajectory from the solar system, and at the end of 1990 it was at a distance of about 32 AU from the sun, a celestial latitude of +16 degrees, and a celestial longitude (measured eastward from the vernal equinox) of 265 degrees. The spacecraft was instrumented with a full suite of instruments for fields and particles, including magnetometer, plasma sensors, and four energetic particle and cosmic ray instruments. Other instruments included an ultraviolet photometer, infrared photometer, imaging photopolarimeter, and micrometeoroid detector. The spacecraft is spin stabilized, with the spin axis oriented toward the earth.

Investigation_Objectives: The UCSD instruments on Pioneers 10 and 11 were originally intended and designed to measure trapped radiation; hence the name, Trapped Radiation Detector, or UCSD TRD. However, being detectors for energetic charged particles, they count cosmic rays quite well, and are particularly well suited to study the following aspects of cosmic ray modulation: (a) the cosmic ray gradient, (b) transient events, (c) the heliospheric configuration, (d) anisotropy measurements. The motivation is to use cosmic rays as tracers of the heliospheric magnetic field configuration, solar wind interaction

regions, solar wind termination boundary, etc. This information, of course, helps describe the earth's neighborhood, and also gives a detailed look at one star's outer atmosphere.

Instrument_Attributes:

A. Sensor Characteristics:

The Trapped Radiation Detector on Pioneer 11 includes five different sensors (C, E, M, SP, and SE). Three (C, E, and M) are operated in a pulse mode, and three (C, SP, and SE) are read out through an electrometer. The pulses are counted above three integral discriminators whose thresholds are in the ratio 1 : 2.12 : 4.5.

The electrometer has two overlapping quasilogarithmic ranges from 10**-14 amps to 10**-9 amps for the low current range, and 10**-10 to 10**-5 amps for the high current range. The signal is processed by a quasilogarithmic analog-to-digital converter, and presented to the encoder as a pulse train plus a range identifier bit. The pulse train is encoded on a scale from 250 (lowest current in range) to 0 (highest current in range). These two ranges are combined by our data reduction program to a single logarithmic scale with a slope of 50 counts per decade from 450 at 10**-14 amperes to 0 at 10**-5 amperes. The electrometer data channels are too insensitive to be useful in interplanetary space.

The P.I. and his team at UCSD have done extensive testing and calibrations of the flight sensors and surrogates. However, it is often impossible to anticipate and cover all flight conditions and to predict actual responses precisely. Therefore the calibration data given here must be regarded as representative, but not necessarily precise enough for any unanticipated use.

The following table gives the best known values for the attributes of each channel from launch to Jupiter encounter in December, 1974.

Representative Characteristics
of the
UCSD Pioneer 11 Trapped Radiation Detector
from
Launch to Jupiter Encounter

Sensor Name	Channel Name	Discrimination Levels	Particle Response	Geometric Factor
C (Cerenkov Counter)	C1	31 photoelectrons	Electrons >5 MeV	13.5 sqcmsr
			Protons >480 MeV	17.8 sqcmsr
			Alphas >480 MeV/n	34.5 sqcmsr
			Heavies >480 MeV/n	85.7 sqcmsr
	C2	65 photoelectrons	Electrons >8 MeV	5.9 sqcmsr
			Protons >550 MeV	6.5 sqcmsr
			Alphas >550 MeV/n	27 sqcmsr
			Heavies >550 MeV/n	85.7 sqcmsr
	C3	135 photoelectrons	Electrons >12 MeV	1.0 sqcmsr
			Protons >650 MeV	0.93 sqcmsr
			Alphas >650 MeV/n	15.8 sqcmsr

			Heavies >650 MeV/n	85.7 sqcmsr
	CDC	10**-13 to 10**-5 amp	Electrons >1 MeV	35 sqcmsr
E (Electron Scatter Detector)	E1H	0.089 MeV	Electrons >0.16 MeV	0.013 sqcmsr
			Nucleons >80 MeV/n	0.038 sqcm
	E2H	0.19 MeV	Electrons >0.255 MeV	0.0104 sqcmsr
			Nucleons >80 MeV/n	0.038 sqcm
	E3H	0.40 MeV	Electrons >0.46 MeV	0.0057 sqcmsr
			Nucleons >80 MeV/n	0.038 sqcm
M (Minimum Ionizing Particle Counter)	M1H	0.40 MeV	Nucleons >80 MeV/n	0.038 sqcm
			Electrons >35 MeV	0.038 sqcm
	M2H	0.85 MeV	Nucleons >80 MeV/n	0.038 sqcm
			Electrons	nil
	M3H	1.77 MeV	Nucleons >80 MeV/n	0.038 sqcm
			Electrons	nil
SP (Scintillator)	SPDC	10**-14 to 10**-5 amp	Protons >150 keV	7.4*10**-23 amp/evsqcmsrs
			Electrons >10 keV	7.4*10**-23 amp/evsqcmsrs
SE (Scintillator)	SEDC	10**-14 to 10**-5 amp	Protons >150 keV	2*10**-24 amp/evsqcmsrs
			Electrons >10 keV	1.4*10**-23 amp/evsqcmsrs

****
****

B. The TRD as a Cosmic Ray Instrument:

Although there are other cosmic ray instruments aboard the Pioneer 10 and 11 spacecraft, the UCSD Radiation Detector has made a niche for itself because it offers several advantages which are unique among the instruments on board. The UCSD Cerenkov counter has a high energy threshold, a capability for measuring anisotropies, good statistics and time resolution, and an unbroken reliability record. Its water-alcohol radiator gives it a velocity threshold of 2/3 the speed of light. In the cosmic ray environment it detects nuclei of energy above about 500 MeV/nucleon. This threshold is the highest on board the spacecraft, and puts the output of this detector in a range where long-term modulation stands out without many of the local and transient effects seen at lower energies. Also, this threshold is more nearly comparable to neutron monitors than any other currently in space.

Besides the Cerenkov counter, the UCSD Radiation Detector package contains a shielded solid state detector which is useful for cosmic ray studies. The energy threshold of this detector is 80 MeV/nucleon, which is not unique; nor are the statistics outstanding. However, it has an exceptional record of reliability and longevity. Along with the Cerenkov detector, it has a continuous data record from launch to late 1990, when declining power output from the spacecraft forced the TRD to be turned off.

Although the UCSD sensors have not been calibrated on a heavy ion beam, the importance of heavy particles in cosmic rays led us to estimate the relative responses of our main cosmic ray channels to

protons and heavy nuclei. The following table summarizes the relative proportions of the observed counting rates from protons and heavier elements in the cosmic radiation during the period from launch to Jupiter encounter.

****
****

Comparative Cosmic Ray Responses of Four UCSD Data Channels

****

	Z = 1 Energy Range	Relative Response (Ratio)	Z > 1 Energy Range
M3L	80<E<300 MeV	50 : 50	>80 MeV/nucl
M1L	>80 MeV	90 : 10	>80 MeV/nucl
C1	>500 MeV	80 : 20	>500 MeV/nucl
C3	>500 MeV	30 : 70	>500 MeV/nucl

****
****

C. Data_Channel_Identifiers:

The data tapes contain 27 separate channels of data, divided between 21 channels of pulse counting data and 6 channels of encoded electrometer data. The 6 electrometer channels are named CDC, SEDC, SPDC, CAL1, CAL2, and CAL3. The 21 pulse counting channels are created from three sensors (C, E, and M), three discrimination levels (1, 2, and 3), and three voltage modes (H, L, and U), as follows: C1, C2, C3, E1H, E2H, E3H, E1L, E2L, E3L, E1U, E2U, E3U, M1H, M2H, M3H, M1L, M2L, M3L, M1U, M2U, and M3U. The voltage modes apply to the two solid state sensors, E and M, and stand for high-voltage, low-voltage, and undetermined voltage. In high voltage mode, both the solid state diodes are totally depleted; they were operated in this mode for all planetary encounters and periodic calibration checks in interplanetary cruise. For most of interplanetary cruise the solid state diodes are operated in low voltage mode, where they are not totally depleted, and have a smaller geometric factor than when totally depleted. Occasionally the reduction program is unable to determine the voltage mode, and readings at these times are classified in the "unknown" channels.

D. Measurement_Sequencing:

The instrument accumulation period and commutation sequence sometimes affects the data acquisition, and must be known to understood the data records. An internal timing generator determines the accumulation period and the length of the commutation cycle. It is independent of the spacecraft roll rate, and runs off the spacecraft clock allowing for the different bit rates and formats.

The table below shows the accumulation period and the commutation cycle period for the various spacecraft operating modes. Also shown

is the commutator cycle parameter N, which keys the commutation sequence as described in the following paragraph.

The commutation sequence can be specified by writing the sensor labels in sequence; e.g.: C1 C1 C1 C1 M1 E1 E1 E1 M1 CDC CDC CDC ... This can be compressed to C1*4 M1 E1*3 M1 CDC*3 ... In this notation the commutation sequence is

```
C1*N M1 E1*(N-1) M1 CDC*(N-1)
C2*N M2 E2*(N-1) M2 SEDC*(N-1)
C3*N M3 E3*(N-1) M3 SPDC*(N-1)
```

where N is 2, 4, or 8 as shown in the table. Every sixteenth commutation cycle, the first M1, M2, and M3 are replaced by an electrometer calibration current, so that the sequence reads

```
C1*N CAL1 E1*(N-1) M1 CDC*(N-1)
C2*N CAL2 E2*(N-1) M2 SEDC*(N-1)
C3*N CAL3 E3*(N-1) M3 SPDC*(N-1)
```

Angular sectoring of the information is determined by the timing generator in conjunction with the spacecraft roll rate. In the most favorable case where the accumulation period is 3/2 sec and the roll rate is 5 rpm, the sectors are 45 degrees wide, and one complete revolution is taken from one channel before the commutator advances to the next channel. In unfavorable operating modes an accumulation may endure over many revolutions.

****

Table of
Accumulation Period and Commutator Period
Versus Spacecraft Operating Modes

****

Operating Mode		Accumulation	Commutator	Commutation
Bit Rate	Format	Period (sec)	Key N	Cycle Period (sec)
16	A	192	2	3456
	A/D	384	2	6912
	B	12	2	216
	B/D	24	2	432
32	A	96	2	1728
	A/D	192	2	3456
	B	6	2	108
	B/D	12	2	216
64	A	48	2	864
	A/D	96	2	1728
	B	3	4	108
	B/D	6	2	108
128	A	24	2	432
	A/D	48	2	864
	B	3/2	8	108
	B/D	3	4	108

256	A	12	2	216
	A/D	24	2	432
	B	3/2	8	108
	B/D	3/2	8	108
512	A	6	2	108
	A/D	12	2	216
	B	3/2	8	108
	B/D	3/2	8	108
1024	A	3	4	108
	A/D	6	2	108
	B	3/2	8	108
	B/D	3/2	8	108
2048	A	3/2	8	108
	A/D	3	4	108
	B	3/2	8	108
	B/D	3/2	8	108

****
****

Data_Set_Parameters: The data set consists of counts per accumulation period and encoded currents from each channel of the instrument, along with time, ephemeris, and housekeeping information. Refer to the keyword, "Instrument_Attributes" for a discussion of the data channels. It is expected that the counts per accumulation period will be divided by the length of the accumulation period to obtain counting rates, but the data are recorded without this division operation in order to preserve statistical information.

Data_Set_Quality: During the encounter of Pioneer 11 with Jupiter in December, 1974, the photomultiplier tube in the Cerenkov detector experienced a small gain increase, caused by irradiation. The change was small, and is estimated as a factor of 1.084 +- 0.005. The archival data set contains the observed counting rates, and where calibrations are necessary, these must be corrected to allow for the gain change.

Data_Processing_Overview:

A. Experimenter Data Record:

Data processing starts with the Experimenter Data Record (EDR), which is provided by NASA Ames Research Center and is basically just the data bits stripped from the telemetry stream, along with timing markers, status, and housekeeping information.

B: Data Reduction:

Our reduction program interprets the telemetry bit stream and combines it with ephemeris information to produce sequential readings labeled with time, data channel, spacecraft orientation, and other pertinent information. Optionally, this most complete and detailed data set can be written out onto a file or tape called a Binary Reduction Tape (BRT). Because of cost, this option was not exercised for the majority of cruise data. Instead, we rely on Summary Tapes, from which we can derive average rates over some averaging interval.

C: Summary Tapes:

The most used output of the reduction program is the Summary Tape, which contains statistical summaries of the readings, channel by channel, for a given averaging interval. In interplanetary cruise, the basic averaging interval was 30 minutes, and these half hour summaries are our most important archival data product. Further processing includes editing to eliminate bad data points, and summary compression. The summary format was designed so that a contiguous sequence of records can be compressed to produce a summary record for a longer time interval; e.g.: 48 half hour records can be combined to produce a 24 hour summary record. Most of our scientific analyses on the interplanetary cruise data have used 24 hour summary data.

D: Editing:

The summary data set has been edited in order to remove bad data. Most such data are the result of telemetry reception and ground-based transmission errors, which usually produce gross discrepancies. An editing program is used to processes the Summary Tapes. This program operates on an individual summary record, and makes an assessment of each data channel based upon the statistical consistency of readings within the record. Readings that are outside an envelope of statistical probability are identified and purged by modifying the summary record. Modified records then lack some of the statistical parameters, but not those needed to calculate the average counting rates. In some cases the entire record is eliminated.

ata_Usage: For the pulse height channels of the UCSD TRD, most data analysis applications use NCOUNT, the total number of counts for some channel in some time interval, and TOTIME, the total amount of live time for that channel in that interval. The average counting rate is NCOUNT/TOTIME, with a statistical error of SQRT(NCOUNT)/TOTIME. Valid average rates can be obtained for a number of contiguous intervals by summing NCOUNT and TOTIME separately before performing square roots and quotients.

In some places, such as after editing, erroneous data have been eliminated by placing a negative number in the data field. Since all quantities except temperatures are inherently positive numbers, it is obvious that negative quantities are invalid.

The named times for the beginning and end of each summary record refer to the times of the first and last readings within the summary average window. For example, for the first summary of a day, the beginning time is not 00:00:00.000, but rather the time of the first reading after this instant. Similarly, the ending time is the time of the last record before 00:30:00.000. To identify a preselected time interval, the user must look for a record that is contained within his desired window.

Data_Organization:

A. EDR: The raw data are provided by NASA to UCSD in the Experiment Data Record. UCSD does not have a complete set of EDR's, owing to a GAO recommendation to return data tapes for recycling. All EDR's since about 1975, however, have been copied onto higher density media before returning the original tapes. All data for which EDR's do not

exist are recorded on BRT's.

B. BRT: The Binary Reduction Tape contains all the data from the UCSD TRD in its most elemental form, consisting of sequential readings along with all relevant ancillary information. BRT's are kept for some portions of the data, but a complete set does not exist because of cost.

C. SUM: UCSD Summary Tapes contain contains statistical summaries of the readings, channel by channel, for a given averaging interval. In interplanetary cruise, the basic averaging interval was 30 minutes. During planetary encounters, the averaging interval was 108 seconds (the commutation cycle period during these events). All records are the same size and format, and represent all the data for each summary interval. Besides beginning and ending on predetermined timing boundaries, new records are started whenever the spacecraft bit rate or format changes. Thus there may be more than one summary record for some timing intervals. When no data were taken, there is no record for that interval.

D. Homogeneous/Inhomogeneous Summaries: Because statistics are kept on the readings in each summary record, it is necessary to start a new summary record whenever the spacecraft bit rate or format changes. Otherwise the statistics would not apply to a homogeneous data set. The archival cruise data set from UCSD consists of homogeneous summaries of half hour length. Other summary data sets exist. Sometimes it is useful to perform data analysis with summary records that are of a given time length regardless of spacecraft status changes. It is possible to produce summary records over such an inhomogeneous data set, but certain statistical data must be ignored. As long as the user looks only at the average counting rate given by the total number of counts (NCOUNT) divided by the total live time (TOTIME), it is safe to use inhomogeneous summaries. One that has been most useful, and shared with other users, consists of inhomogeneous summaries of 24 hour length.

E. UCSD TRD Interplanetary Cruise ASCII Archive: The archival cruise data set from UCSD consists of homogeneous summaries of half hour length. The records are organized six months of data to a file. All records are the same size and format, and contain all the data for each summary interval represented. Records are synchronized to begin and end every half hour on the half hour in spacecraft event time. Besides these boundaries, new records are started whenever the spacecraft bit rate or format changes. Thus there may be more than one summary record for some half hour intervals. When no data were taken, there is no record for that interval.

File_Class_Relationships: See Data_Organization. The EDR, BRT, and initial SUM data files are generated in UCSD's own format, and used internally to UCSD. The UCSD TRD Interplanetary Cruise ASCII Archive is a type of summary tape specially formated to meet the requirements of the NSSDC.

Lit_References:

Axford, W.I., W. Fillius, L.J. Gleeson, and W.-H. Ip, "Cosmic-Ray Gradients from Pioneer-10 and Pioneer-11," Astrophys. J., 210, 603-613, Dec. 1, 1976.

Fillius, W., and I. Axford, "Large-Scale Modulation of >500 MeV/Nucleon Galactic Cosmic Rays Seen From 1 to 30 AU, J. Geophys. Res., 90, 517-520, Jan. 1, 1985

, W.-H., W. Fillius, A. Mogro-Campero, L.J. Gleeson, and W.I. Axford, "Quiet Time Interplanetary Cosmic Ray Anisotropies Observed From Pioneer 10 and 11," J. Geophys. Res., 83, 1633-1640, April 1, 1978.

Fillius, W., "Cosmic Ray Gradients in the Heliosphere," Adv. Space Res., Vol. 9, No. 4, pp. (4)209-(4)219, 1989.

CCSD$$MARKERMRK**002CCSD3KS00002MRK**003

Vol_Time_Coverage: 1991-01-01 to 1991-12-31

/* other volumes will cover
1973-04-16 to 1974-12-31
1975-01-01 to 1977-12-31
1978-01-01 to 1981-12-31
1982-01-01 to 1988-12-31
1989-01-01 to 1990-12-31
*/

File_Naming_Convention: TRD files are named according to the start time of the data contained in the file as follows: TRD_PXX_YYZ.DAT. Here PXX stands for either P10 or P11, YY stands for the last two digits of the year, and Z stands for the flags "A" or "B", to indicate the first or last six months of a year, respectively.

ile_Time_Coverage: TRD_P11_91A.DAT 91/01/01 thru 91/06/30
TRD_P11_91B.DAT 91/07/01 thru 91/12/31

/* Note: other volumes will contain the following:
TRD_P11_73A.DAT 73/01/01 thru 73/06/30
TRD_P11_73B.DAT 73/07/01 thru 73/12/31
TRD_P11_74A.DAT 74/01/01 thru 74/06/30
TRD_P11_74B.DAT 74/07/01 thru 74/12/31
TRD_P11_75A.DAT 75/01/01 thru 75/06/30
TRD_P11_75B.DAT 75/07/01 thru 75/12/31
TRD_P11_76A.DAT 76/01/01 thru 76/06/30
TRD_P11_76B.DAT 76/07/01 thru 76/12/31
TRD_P11_77A.DAT 77/01/01 thru 77/06/30
TRD_P11_77B.DAT 77/07/01 thru 77/12/31
TRD_P11_78A.DAT 78/01/01 thru 78/06/30
TRD_P11_78B.DAT 78/07/01 thru 78/12/31
TRD_P11_79A.DAT 79/01/01 thru 79/06/30
TRD_P11_79B.DAT 79/07/01 thru 79/12/31
TRD_P11_80A.DAT 80/01/01 thru 80/06/30
TRD_P11_80B.DAT 80/07/01 thru 80/12/31
TRD_P11_81A.DAT 81/01/01 thru 81/06/30
TRD_P11_81B.DAT 81/07/01 thru 81/12/31
TRD_P11_82A.DAT 82/01/01 thru 82/06/30
TRD_P11_82B.DAT 82/07/01 thru 82/12/31
TRD_P11_83A.DAT 83/01/01 thru 83/06/30
TRD_P11_83B.DAT 83/07/01 thru 83/12/31
TRD_P11_84A.DAT 84/01/01 thru 84/06/30
TRD_P11_84B.DAT 84/07/01 thru 84/12/31
TRD_P11_85A.DAT 85/01/01 thru 85/06/30

```
                        TRD_P11_85B.DAT          85/07/01 thru 85/12/31
                        TRD_P11_86A.DAT          86/01/01 thru 86/06/30
                        TRD_P11_86B.DAT          86/07/01 thru 86/12/31
                        TRD_P11_87A.DAT          87/01/01 thru 87/06/30
                        TRD_P11_87B.DAT          87/07/01 thru 87/12/31
                        TRD_P11_88A.DAT          88/01/01 thru 88/06/30
                        TRD_P11_88B.DAT          88/07/01 thru 88/12/31
                        TRD_P11_89A.DAT          89/01/01 thru 89/06/30
                        TRD_P11_89B.DAT          89/07/01 thru 89/12/31
                        TRD_P11_90A.DAT          90/01/01 thru 90/06/30
                        TRD_P11_90B.DAT          90/07/01 thru 90/12/31
                        */

CCSD$$MARKERMRK**003CCSD3RF0000300000001
REFERENCETYPE=$VMS;
LABEL=ATTACHED;
REFERENCE=FORMAT.SFD;
LABEL=NSSD3IF0006900000001;
REFERENCE=TRD_P11_91A.DAT
REFERENCE=TRD_P11_91B.DAT

/* Files on other volumes in this dataset are as follows:
REFERENCE=TRD_P11_73A.DAT
REFERENCE=TRD_P11_73B.DAT
REFERENCE=TRD_P11_74A.DAT
REFERENCE=TRD_P11_74B.DAT
REFERENCE=TRD_P11_75A.DAT
REFERENCE=TRD_P11_75B.DAT
REFERENCE=TRD_P11_76A.DAT
REFERENCE=TRD_P11_76B.DAT
REFERENCE=TRD_P11_77A.DAT
REFERENCE=TRD_P11_77B.DAT
REFERENCE=TRD_P11_78A.DAT
REFERENCE=TRD_P11_78B.DAT
REFERENCE=TRD_P11_79A.DAT
REFERENCE=TRD_P11_79B.DAT
REFERENCE=TRD_P11_80A.DAT
REFERENCE=TRD_P11_80B.DAT
REFERENCE=TRD_P11_81A.DAT
REFERENCE=TRD_P11_81B.DAT
REFERENCE=TRD_P11_82A.DAT
REFERENCE=TRD_P11_82B.DAT
REFERENCE=TRD_P11_83A.DAT
REFERENCE=TRD_P11_83B.DAT
REFERENCE=TRD_P11_84A.DAT
REFERENCE=TRD_P11_84B.DAT
REFERENCE=TRD_P11_85A.DAT
REFERENCE=TRD_P11_85B.DAT
REFERENCE=TRD_P11_86A.DAT
REFERENCE=TRD_P11_86B.DAT
REFERENCE=TRD_P11_87A.DAT
REFERENCE=TRD_P11_87B.DAT
REFERENCE=TRD_P11_88A.DAT
REFERENCE=TRD_P11_88B.DAT
REFERENCE=TRD_P11_89A.DAT
REFERENCE=TRD_P11_89B.DAT
REFERENCE=TRD_P11_90A.DAT
REFERENCE=TRD_P11_90B.DAT
*/
```