#626

PIONEER VENUS

COMPOSITE DATA (CD) TAPE

78-051A-01B,02C,12B,12C,13B,16C,18B

78-078D-09B
78-078E-03B
78-078F-03B
78-078G-03B

PIONEER VENUS

COMPOSITE DATA (CD) TAPE

78-051A-01B,02C,12B,12C,16C,18B,

78-078D-09B, 78-078E-03B,

78-078F-03B, 78-078G-03B

THESE DATA SETS HAVE BEEN RESTORED. ORIGINALLY THERE WAS ONE 9-TRACK, 1600 BPI TAPE WRITTEN IN ASCII CONTAINING 7 PIONEER VENUS 1 AND 4 PIONEER VENUS PROBES DATA SETS. THERE IS ONE RESTORED TAPE. THE DR TAPE IS A 3480 CARTRIDGE AND THE DS TAPE IS 9-TRACK, 6250 BPI. THE ORIGINAL TAPE WAS CREATED ON THE MODCOMP IV COMPUTER FROM 2 BLOCKED EBCDIC TAPES CREATED ON THE UADS (UNIFIED ABSTRACT DATA SYSTEM) AND WAS RESTORED ON THE MRS SYSTEM. THE FOLLOWING PAGES CONTAIN A LISTING OF THE DATA SET ID'S WITH EXPERIMENT AND DATA SET NAMES, AND A LISTING OF THE TAPE BY FILE NUMBER AND NUMBER OF RECORDS. THE DR AND DS NUMBERS ALONG WITH THE CORRESPONDING D NUMBERS AND THE TIME SPANS ARE AS FOLLOWS:

DR#	DS#	D#	FILES	TIME SPAN
DR004180	DS004180	D056396	1-85	12/05/78 - 09/01/81

ID	FILES	TIME SPAN	ORBITS
78-051A-01B	83	12/05/78 - 08/07/81	1-975
78-051A-02C	5,6,84&85	12/05/78 - 09/01/81	1-1000
78-051A-12B	8-22	04/04/79 - 06/03/79	121-181
78-051A-12C	23-81	06/08/79 - 08/08/79	186-247
78-051A-13B	23-81	06/08/79 - 08/08/79	186-247
78-051A-16C	3-4	12/08/78 - 01/13/79	4-40
78-051A-18B	82	12/11/78	7
78-078D-09B	1-2	12/09/78	5
78-078E-03B	1-2	12/09/78	5
78-078F-03B	1-2	12/09/78	5
78-078G-03B	1-2	12/09/78	5

FILE 7 CONTAINS NO USEFUL INFORMATION AND SHOULD BE IGNORED.

Original OLI info

REQ. AGENT	RAND NO.	ACQ. AGENT
PAR	V0180	WSC

PIONEER VENUS

COMPOSITE DATA (CD) TAPE

This data set catalog consists of 1 tape containing 7 Pioneer Venus 1 and 4 Pioneer Venus Probes data sets. The tape is 9-track, 1600 BPI, ASCII with 80-byte card image records. It was created on NSSDC's MODCOMP IV computer from 2 blocked EBCDIC tapes created on the UADS (Unified Abstract Data System) IBM 360 computer. The following is a listing of the files ordered by data set ID with orbit numbers and time spans for each data set. The following pages contain a listing of the data set ID's with experiment and data set names, and a listing of the tape by file number and number of records.

The format for each data set is either in the first file of a data set group, the header of a data file, or has been attached.

D-56396 C-23663

ID	FILES	TIME SPAN	ORBITS
78-051A-01B	83	12/05/78 - 08/07/81	1-975
78-051A-02C	5,6,84&85	12/05/78 - 09/01/81	1-1000
78-051A-12B	8-22	04/04/79 - 06/03/79	121-181
78-051A-12C	23-81	06/08/79 - 08/08/79	186-247
78-051A-13B	23-81	06/08/79 - 08/08/79	186-247
78-051A-16C	3-4	12/08/78 - 01/13/79	4-40
78-051A-18B	82	12/11/78	7
78-078D-09B	1-2	12/09/78	5
78-078E-03B	1-2	12/09/78	5
78-078F-03B	1-2	12/09/78	5
78-078G-03B	1-2	12/09/78	5

File 7 contains no useful information and should be ignored.

PIONEER VENUS CD TAPES

NSSDC ID	EXPERIMENT NAME	PI	DATA SET NAME
78-051A-01B	ELECTRON TEMPERATURE PROBE	BRACE	CD OETP OBSERVED IONOPAUSE LOCATIONS
78-051A-02C	RADAR ALTIMETER	PETTENGIL	CD ORAD COMPOSITE DATA
78-051A-12B	TRIAXIAL FLUXGATE MAGNETOMETER	RUSSELL	CD 32 SEC. TOTAL MAGNETIC FIELD DATA
78-051A-12C	TRAIXIAL FLUXGATE MAGNETOMETER	RUSSELL	CD 32 SEC. MERGED TOTAL MAGNETIC FIELD + PEAK ELECTRIC FIELD
78-051A-13B	ELECTRIC FIELD DETECTOR	SCARF	CD 32 SEC. MERGED TOTAL MAGNETIC FIELD + PEAK ELECTRIC FIELD
78-051A-16C	TEMPERATURE SOUNDER	TAYLOR	CD ZONAL AIR TEMPERATURE VS. LATITUDE
78-051A-18B	SOLAR WIND PLASMA ANALYZER	BARNES	CD VELOCITY, AZIMUTH ANGLE, POLAR ANGLE, DENSITY + TEMPERATURE DATA
78-078D-09B	ATMOSPHERIC CIRCULATION PATTERNS	COUNSELMAN	CD RELATIVE CRUSTAL AND ATMOSPHERIC VELOCITY COMPONENTS DATA
78-078E-03B	ATMOSPHERIC CIRCULATION PATTERNS	COUNSELMAN	CD RELATIVE CRUSTAL AND ATMOSPHERIC VELOCITY COMPONENTS DATA
78-078F-03B	ATMOSPHERIC CIRCULATION PATTERNS	COUNSELMAN	CD RELATIVE CRUSTAL AND ATMOSPHERIC VELOCITY COMPONENTS DATA
78-078G-03B	ATMOSPHERIC CIRCULATION PATTERNS	COUNSELMAN	CD RELATIVE CRUSTAL AND ATMOSPHERIC VELOCITY COMPONENTS DATA

PIONEER VENUS CD TAPE 001 FORMAT

ID	File	Filename	File Description	File Source	Logical Record Length (Bytes)	Physical Record Length (Bytes)	No. Physical Records in File
78-078D-09B 78-078E-03B 78-078F-03B 78-078G-03B	1	DLBIFMT	Format of DLBIMIT CD File	MIT	80	80	32
	2	DLBIMIT	Results of DLBI Winds Expt.	MIT	80	80	1017
78-051A-16C	3	OIRCD	Format of OIRTEMP CD File	JPL	80	80	12
	4	OIRTEMP	OIR Zonal Time Ave of Temp vs Lat	JPL	80	80	30
78-051A-02C	5	ORADFMT	Revised Format of ORAD CD Files	MIT	80	80	282
	6	ORAD003	ORAD Altimetry Data-base Version 1	MIT	80	80	32193
(IGNORE)	7	OIRTEST	OIR Temperature Profile Test Data	JPL	80	80	10
78-051A-12B	8	OMAG121	Total Magnetic Field OMAG121	UCLA	80	80	294
	9	OMAG161	Total Magnetic Field Orbit 161	UCLA	80	80	358
	10	OMAG162	Total Magnetic Field Orbit 162	UCLA	80	80	278
	11	OMAG163	Total Magnetic Field Orbit 163	UCLA	80	80	343
	12	OMAG164	Total Magnetic Field Orbit 164	UCLA	80	80	348
	13	OMAG165	Total Magnetic Field Orbit 165	UCLA	80	80	329
	14	OMAG168	Total Magnetic Field Orbit 168	UCLA	80	80	328
	15	OMAG171	Total Magnetic Field Orbit 171	UCLA	80	80	347
	16	OMAG172	Total Magnetic Field Orbit 172	UCLA	80	80	263

PIONEER VENUS CD TAPE 001 FORMAT (CONTD)

ID	File	Filename	File Description	File Source	Logical Record Length (Bytes)	Physical Record Length (Bytes)	No. Physical Records in File
78-051A-12B	17	OMAG173	Total Magnetic Field Orbit 173	UCLA	80	80	342
	18	OMAG174	Total Magnetic Field Orbit 174	UCLA	80	80	244
	19	OMAG176	Total Magnetic Field Orbit 176	UCLA	80	80	302
	20	OMAG178	Total Magnetic Field Orbit 178	UCLA	80	80	337
	21	OMAG179	Total Magnetic Field Orbit 179	UCLA	80	80	277
	22	OMAG181	Total Magnetic Field Orbit 181	UCLA	80	80	650
78-051A-12C 78-051A-13B	23	OMEG200	Total Mag & Peak Elec Fields 200	UCLA	80	80	293
	24	OMEG219	Total Mag & Peak Elec Fields 219	UCLA	80	80	123
BLANK FILE	25	OMEG224	Total Mag & Peak Elec Fields 224	UCLA	80	80	1
	26	OMGE186	Total Mag & Peak Elec Fields 186	UCLA	80	80	322
	27	OMGE189	Total Mag & Peak Elec Fields 189	UCLA	80	80	346
	28	OMGE191	Total Mag & Peak Elec Fields 191	UCLA	80	80	151
	29	OMGE192	Total Mag & Peak Elec Fields 192	UCLA	80	80	53
	30	OMGE193	Total Mag & Peak Elec Fields 193	UCLA	80	80	259
	31	OMGE194	Total Mag & Peak Elec Fields 194	UCLA	80	80	341
	32	OMGE195	Total Mag & Peak Elec Fields 195	UCLA	80	80	340

PIONEER VENUS CD TAPE 001 FORMAT (CONTD)

ID	File	Filename	File Description	File Source	Logical Record Length (Bytes)	Physical Record Length (Bytes)	No. Physical Records in File
78-051A-12C 78-051A-13B	33	OMGE196	Total Mag & Peak Elec Fields 196	UCLA	80	80	89
	34	OMGE198	Total Mag & Peak Elec Fields 198	UCLA	80	80	351
	35	OMGE199	Total Mag & Peak Elec Fields 199	UCLA	80	80	280
	36	OMGE201	Total Mag & Peak Elec Fields 201	UCLA	80	80	305
	37	OMGE202	Total Mag & Peak Elec Fields 202	UCLA	80	80	332
	38	OMGE203	Total Mag & Peak Elec Fields 203	UCLA	80	80	265
	39	OMGE204	Total Mag & Peak Elec Fields 204	UCLA	80	80	334
	40	OMGE205	Total Mag & Peak Elec Fields 205	UCLA	80	80	276
	41	OMGE206	Total Mag & Peak Elec Fields 206	UCLA	80	80	242
	42	OMGE207	Total Mag & Peak Elec Fields 207	UCLA	80	80	296
	43	OMGE208	Total Mag & Peak Elec Fields 208	UCLA	80	80	289
	44	OMGE209	Total Mag & Peak Elec Fields 209	UCLA	80	80	306
	45	OMGE210	Total Mag & Peak Elec Fields 210	UCLA	80	80	131
	46	OMGE211	Total Mag & Peak Elec Fields 211	UCLA	80	80	152
	47	OMGE212	Total Mag & Peak Elec Fields 212	UCLA	80	80	149
	48	OMGE213	Total Mag & Peak Elec Fields 213	UCLA	80	80	162

PIONEER VENUS CD TAPE 001 FORMAT (CONTD)

File	Filename	File Description	File Source	Logical Record Length (Bytes)	Physical Record Length (Bytes)	No. Physical Records in File
49	OMGE214	Total Mag & Peak Elec Fields 214	UCLA	80	80	128
50	OMGE215	Total Mag & Peak Elec Fields 215	UCLA	80	80	121
51	OMGE216	Total Mag & Peak Elec Fields 216	UCLA	80	80	148
52	OMGE217	Total Mag & Peak Elec Fields 217	UCLA	80	80	43
53	OMGE218	Total Mag & Peak Elec Fields 218	UCLA	80	80	56
54	OMGE220	Total Mag & Peak Elec Fields 220	UCLA	80	80	147
55	OMGE221	Total Mag & Peak Elec Fields 221	UCLA	80	80	116
56	OMGE222	Total Mag & Peak Elec Fields 222	UCLA	80	80	112
57	OMGE223	Total Mag & Peak Elec Fields 223	UCLA	80	80	116
58	OMGE224	Total Mag & Peak Elec Fields 224	UCLA	80	80	169
59	OMGE225	Total Mag & Peak Elec Fields 225	UCLA	80	80	118
60	OMGE226	Total Mag & Peak Elec Fields 226	UCLA	80	80	127
61	OMGE227	Total Mag & Peak Elec Fields 227	UCLA	80	80	147
62	OMGE228	Total Mag & Peak Elec Fields 228	UCLA	80	80	125
63	OMGE229	Total Mag & Peak Elec Fields 229	UCLA	80	80	175
64	OMGE230	Total Mag & Peak Elec Fields 230	UCLA	80	80	183

ID	File	Filename	File Description	File Source	Logical Record Length (Bytes)	Physical Record Length (Bytes)	No. Physical Records in File
78-051A-12C 78-051A-13B	65	OMGE231	Total Mag & Peak Elec Fields 231	UCLA	80	80	174
	66	OMGE232	Total Mag & Peak Elec Fields 232	UCLA	80	80	177
	67	OMGE233	Total Mag & Peak Elec Fields 233	UCLA	80	80	177
	68	OMGE234	Total Mag & Peak Elec Fields 234	UCLA	80	80	157
	69	OMGE235	Total Mag & Peak Elec Fields 235	UCLA	80	80	164
	70	OMGE236	Total Mag & Peak Elec Fields 236	UCLA	80	80	177
	71	OMGE237	Total Mag & Peak Elec Fields 237	UCLA	80	80	162
	72	OMGE238	Total Mag & Peak Elec Fields 238	UCLA	80	80	165
	73	OMGE239	Total Mag & Peak Elec Fields 239	UCLA	80	80	168
	74	OMGE240	Total Mag & Peak Elec Fields 240	UCLA	80	80	139
	75	OMGE241	Total Mag & Peak Elec Fields 241	UCLA	80	80	156
	76	OMGE242	Total Mag & Peak Elec Fields 242	UCLA	80	80	177
	77	OMGE243	Total Mag & Peak Elec Fields 243	UCLA	80	80	110
	78	OMGE244	Total Mag & Peak Elec Fields 244	UCLA	80	80	116
	79	OMGE245	Total Mag & Peak Elec Fields 245	UCLA	80	80	135

ID	File	Filename	File Description	File Source	Logical Record Length (Bytes)	Physical Record Length (Bytes)	No. Physical Records in File
78-051A-12C 78-051A-13B	80	OMGE246	Total Mag & Peak Elec Fields 246	UCLA	80	80	14
↓	81	OMGE247	Total Mag & Peak Elec Fields 247	UCLA	80	80	131
78-051A-18B	82	OPA007	Plasma Parameters Orbit 007	ARC	80	80	151

No tape label. Single EOF separation. Three EOF's following last file.

Pioneer Venus CD Tape 002 Format (NOW LAST 3 FILES OF CD 001)

File	Filename	File Description	File Source	Logical Record Length (Bytes)	Physical Record Length (Bytes)	No. Physical Records in File
83	78-051B-01B IONFIL	OETP's Observed Ionopause Locations	Goddard Space Flight Center	80	800	1785
84	78-051A-02C ORADCD	Description of ORAD CD Files	M.I.T.	80	800	29
85	78-051A-02C ORAD005	ORAD Altimetry Database Version 5	M.I.T.	80	800	55,590

No tape label. Single EOF seperation. Three EOF's following last file.

Enclosure 5(4)

78-07[illegible]-09B
78-0[illegible]-03B
78-07[illegible]-03B
78-0[illegible]-03B

DEPARTMENT OF EARTH AND PLANETARY SCIENCES

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

CAMBRIDGE, MASSACHUSETTS 02139

54-626
September 23, 1980

Dr. Lawrence Colin
Pioneer Venus Project Scientist
245-1
NASA Ames Research Center
Moffett Field, California 94035

Dear Larry:

Here is the "written input" you requested in your September 12th letter, to document the DLBI data that I deposited in UADS:

The numerical data in this deposition are the same that appear in graphical form in Figures 1, 2, and 3 of the paper, "Zonal and Meridional Circulation of the Lower Atmosphere of Venus Determined by Radio Interferometry", by C. C. Counselman III et al., in the Journal of Geophysical Research special issue on Pioneer Venus, vol. ___, pp. ____-____, October, 1980. A complete description of the data is contained in that paper and in the references cited therein.

Larry, please fill in the blanks if and when you can. Thanks.

Sincerely,

Chuck

Charles C. Counselman III

CCC/lp

TABLE 3*a*. Lower Atmosphere State Properties: Sounder Probe

Altitude, km	p, bars	T, K	ρ, kg/m^3	GRT	GRT, s
64.83	0.925 − 01	246.3	0.1964E + 00	1849.646	67778.8
64.00	0.1078E + 00	247.0	0.2282E + 00	1849.995	67799.7
63.00	0.1294E + 00	249.3	0.2716E + 00	1850.447	67826.8
62.00	0.1551E + 00	254.8	0.3183E + 00	1850.944	67856.6
61.00	0.1851E + 00	259.7	0.3728E + 00	1851.470	67888.2
60.00	0.2199E + 00	268.1	0.4291E + 00	1852.059	67923.5
59.00	0.2602E + 00	272.0	0.5004E + 00	1852.672	67960.3
58.00	0.3073E + 00	276.0	0.5825E + 00	1853.333	68000.0
57.00	0.3618E + 00	281.3	0.6732E + 00	1854.052	68043.1
56.00	0.4247E + 00	288.9	0.7694E + 00	1854.819	68089.1
55.00	0.4959E + 00	299.4	0.8671E + 00	1855.643	68138.6
54.00	0.5760E + 00	309.5	0.9745E + 00	1856.522	68191.3
53.00	0.6659E + 00	319.8	0.1091E + 01	1857.478	68248.7
52.00	0.7665E + 00	329.5	0.1219E + 01	1858.442	68306.5
51.00	0.8788E + 00	338.7	0.1360E + 01	1859.481	68368.8
50.00	0.1004E + 01	347.3	0.1515E + 01	1900.568	68434.1
49.00	0.1144E + 01	355.3	0.1688E + 01	1901.716	68503.0
48.00	0.1299E + 01	364.9	0.1867E + 01	1902.944	68576.6
47.00	0.1471E + 01	371.8	0.2075E + 01	1904.207	68652.4
46.00	0.1662E + 01	379.4	0.2298E + 01	1905.533	68732.0
45.00	0.1874E + 01	384.4	0.2558E + 01	1906.527	68791.6
44.00	0.2109E + 01	389.4	0.2843E + 01	1906.862	68811.7
43.00	0.2371E + 01	394.8	0.3153E + 01	1907.177	68830.6
42.00	0.2661E + 01	401.4	0.3482E + 01	1907.514	68850.8
41.00	0.2981E + 01	407.9	0.3839E + 01	1907.865	68871.9
40.00	0.3334E + 01	414.7	0.4223E + 01	1908.235	68894.1
39.00	0.3722E + 01	421.6	0.4638E + 01	1908.632	68917.9
38.00	0.4147E + 01	428.1	0.5092E + 01	1909.046	68942.8
37.00	0.4615E + 01	435.1	0.5575E + 01	1909.479	68968.8
36.00	0.5125E + 01	443.0	0.6082E + 01	1909.931	68995.9
35.00	0.5682E + 01	450.3	0.6636E + 01	1910.400	69024.0
34.00	0.6289E + 01	458.4	0.7217E + 01	1910.894	69053.6
33.00	0.6950E + 01	466.3	0.7841E + 01	1911.376	69082.6
32.00	0.7666E + 01	474.6	0.8500E + 01	1911.901	69114.1
31.00	0.8443E + 01	482.9	0.9200E + 01	1912.457	69147.4
30.00	0.9283E + 01	491.8	0.9935E + 01	1913.053	69183.2
29.00	0.1019E + 02	500.5	0.1072E + 02	1913.667	69220.0
28.00	0.1117E + 02	508.8	0.1155E + 02	1914.299	69257.9
27.00	0.1222E + 02	517.1	0.1244E + 02	1914.921	69295.3
26.00	0.1336E + 02	524.9	0.1340E + 02	1915.543	69332.6
25.00	0.1458E + 02	533.7	0.1438E + 02	1916.251	69375.0
24.00	0.1589E + 02	542.2	0.1543E + 02	1916.981	69418.9
23.00	0.1730E + 02	550.5	0.1654E + 02	1917.721	69463.3
22.00	0.1880E + 02	558.7	0.1771E + 02	1918.503	69510.2
21.00	0.2042E + 02	567.0	0.1895E + 02	1919.303	69558.2
20.00	0.2214E + 02	575.5	0.2025E + 02	1920.142	69608.5
19.00	0.2399E + 02	583.7	0.2162E + 02	1921.034	69662.0
18.00	0.2596E + 02	590.6	0.2312E + 02	1921.782	69706.9
17.00	0.2806E + 02	598.7	0.2466E + 02	1922.707	69762.4
16.00	0.3031E + 02	606.1	0.2629E + 02	1923.665	69819.9
15.00	0.3271E + 02	613.9	0.2799E + 02	1924.653	69879.2
14.00	0.3526E + 02	620.9	0.2982E + 02	1925.629	69937.7
13.00	0.3797E + 02	627.8	0.3175E + 02	1926.605	69996.3
12.00	0.4086E + 02	636.0	0.3371E + 02	1927.663	70059.8
11.00	0.4394E + 02	642.6	0.3586E + 02	1928.745	70124.7
10.00	0.4720E + 02	651.3	0.3798E + 02	1929.858	70191.5
9.00	0.5066E + 02	658.5	0.4028E + 02	1931.003	70260.2
8.00	0.5432E + 02	666.6	0.4262E + 02	1932.198	70331.9
7.00	0.5820E + 02	673.9	0.4514E + 02	1933.446	70406.7
6.00	0.6231E + 02	681.9	0.4770E + 02	1934.705	70482.3
5.00	0.6665E + 02	690.1	0.5037E + 02	1935.994	70559.7
4.00	0.7123E + 02	698.4	0.5314E + 02	1937.307	70638.4
3.00	0.7606E + 02	706.3	0.5602E + 02	1938.682	70720.9
2.00	0.8115E + 02	715.1	0.5893E + 02	1940.105	70806.3
1.00	0.8652E + 02	722.7	0.6208E + 02	1941.579	70894.8
0.00	0.9216E + 02	730.9	0.6528E + 02	1943.117	70987.0

Altitudes are relative to the sounder probe landing site. R_0 = 6052.0 km, g_0 = 8.8694 m/s^2, μ = 43.44. GRT 1849.646 = 18 hours, 49.646 minutes.

TABLE 3*b*. Lower Atmosphere State Properties: Day Probe

Altitude, km	p, bars	T, K	ρ, kg/m^3	GRT	GRT, s
66.85	0.6407E − 01	233.2	0.1436E + 00	1856.324	68179.4
66.00	0.7551E − 01	236.1	0.1673E + 00	1856.457	68187.4
65.00	0.9130E − 01	239.4	0.1995E + 00	1856.563	68193.8
64.00	0.1102E + 01	242.8	0.2374E + 00	1856.675	68200.5
63.00	0.1328E + 00	246.2	0.2820E + 00	1856.803	68208.2
62.00	0.1595E + 00	249.4	0.3345E + 00	1856.937	68216.2
61.00	0.1912E + 00	252.8	0.3955E + 00	1857.082	68224.9
60.00	0.2285E + 00	257.6	0.4641E + 00	1857.250	68235.0
59.00	0.2722E + 00	263.9	0.5395E + 00	1857.429	68245.8
58.00	0.3227E + 00	271.1	0.6228E + 00	1857.611	68256.6
57.00	0.3806E + 00	280.9	0.7091E + 00	1857.833	68270.0
56.00	0.4464E + 00	291.3	0.8022E + 00	1858.039	68282.4
55.00	0.5203E + 00	302.6	0.9004E + 00	1858.268	68296.1
54.00	0.6034E + 00	313.9	0.1007E + 01	1858.512	68310.7
53.00	0.6963E + 00	323.9	0.1126E + 01	1858.774	68326.4
52.00	0.8000E + 00	334.4	0.1254E + 01	1859.053	68343.2
51.00	0.9156E + 00	343.2	0.1398E + 01	1859.348	68360.9
50.00	0.1044E + 01	351.7	0.1557E + 01	1859.630	68377.8
49.00	0.1188E + 01	360.5	0.1727E + 01	1859.956	68397.4
48.00	0.1347E + 01	366.8	0.1926E + 01	1900.288	68417.3
47.00	0.1525E + 01	372.3	0.2148E + 01	1900.660	68439.6
46.00	0.1723E + 01	377.9	0.2392E + 01	1901.013	68460.8
45.00	0.1943E + 01	384.7	0.2650E + 01	1901.398	68483.9
44.00	0.2187E + 01	390.7	0.2938E + 01	1901.826	68509.6
43.00	0.2457E + 01	396.6	0.3253E + 01	1902.269	68536.1
42.00	0.2756E + 01	402.9	0.3593E + 01	1902.730	68563.8
41.00	0.3086E + 01	410.1	0.3953E + 01	1903.217	68593.0
40.00	0.3449E + 01	417.2	0.4343E + 01	1903.737	68624.2
39.00	0.3847E + 01	424.7	0.4761E + 01	1904.292	68657.5
38.00	0.4283E + 01	432.3	0.5208E + 01	1904.866	68691.9
37.00	0.4760E + 01	439.9	0.5689E + 01	1905.459	68727.6
36.00	0.5281E + 01	448.1	0.6198E + 01	1906.069	68764.1
35.00	0.5849E + 01	455.7	0.6751E + 01	1906.692	68801.5
34.00	0.6466E + 01	463.6	0.7336E + 01	1907.362	68841.7
33.00	0.7136E + 01	472.6	0.7943E + 01	1908.072	68884.3
32.00	0.7862E + 01	480.7	0.8607E + 01	1908.784	68927.0
31.00	0.8647E + 01	489.1	0.9305E + 01	1909.560	68973.6
30.00	0.9497E + 01	497.6	0.1005E + 02	1910.352	69021.1
29.00	0.1041E + 02	506.3	0.1083E + 02	1911.177	69070.6
28.00	0.1140E + 02	514.6	0.1166E + 02	1911.983	69119.0
27.00	0.1246E + 02	523.2	0.1254E + 02	1912.863	69171.8
26.00	0.1361E + 02	532.1	0.1346E + 02	1913.780	69226.8
25.00	0.1483E + 02	540.2	0.1446E + 02	1914.731	69283.8
24.00	0.1615E + 02	548.4	0.1550E + 02	1915.674	69340.5
23.00	0.1756E + 02	557.6	0.1658E + 02	1916.748	69404.9
22.00	0.1907E + 02	566.5	0.1772E + 02	1917.864	69471.9
21.00	0.2069E + 02	574.7	0.1894E + 02	1918.973	69538.4
20.00	0.2241E + 02	582.5	0.2024E + 02	1920.080	69604.8
19.00	0.2425E + 02	591.3	0.2158E + 02	1921.291	69677.4
18.00	0.2622E + 02	599.0	0.2302E + 02	1922.473	69748.4
17.00	0.2832E + 02	606.6	0.2454E + 02	1923.631	69817.9
16.00	0.3055E + 02	613.8	0.2615E + 02	1924.825	69889.5
15.00	0.3293E + 02	620.7	0.2787E + 02	1925.987	69959.2
14.00	0.3547E + 02	627.9	0.2966E + 02	1927.242	70034.5
13.00	0.3817E + 02	634.7	0.3156E + 02	1928.527	70111.6
12.00	0.4105E + 02	641.9	0.3354E + 02	1929.854	70191.2
11.00	0.4410E + 02	649.5	0.3559E + 02	1931.199	70271.9
10.00	0.4734E + 02	656.3	0.3778E + 02	1932.672	70360.3
9.00	0.5078E + 02	663.8	0.4003E + 02	1934.274	70456.4
8.00	0.5442E + 02	671.0	0.4240E + 02	1936.210	70572.6
7.00	0.5828E + 02	678.2	0.4489E + 02	1937.987	70679.2
6.00	0.6237E + 02	686.0	0.4744E + 02	1939.572	70774.3
5.00	0.6669E + 02	693.4	0.5014E + 02	1941.280	70876.8
4.00	0.7125E + 02	701.0	0.5294E + 02	1943.091	70985.5
3.00	0.7606E + 02	709.0	0.5578E + 02	1944.990	71099.4
2.00	0.8113E + 02	717.0	0.5875E + 02	1946.934	71216.1
1.00	0.8648E + 02	724.7	0.6185E + 02	1948.925	71335.5
0.00	0.9210E + 02	732.4	0.6509E + 02	1950.997	71459.8
−0.10	0.9268E + 02	733.0	0.6544E + 02	1951.183	71471.0

Altitudes are relative to the sounder probe landing site at 6052.0 km. R_0 = 6051.9 km, g_0 = 8.8697 m/s^2, μ = 43.44. GRT 1856.324 = 18 hours, 56.324 minutes.

TABLE 3c. Lower Atmosphere State Properties: Night Probe

Altitude, km	p, bars	T, K	ρ, kg/m^3	GRT	GRT, s
65.13	0.9046E − 01	238.3	0.1985E + 00	1859.820	68389.2
65.00	0.9279E − 01	238.5	0.2034E + 00	1859.836	68390.2
64.00	0.1121E + 00	241.3	0.2430E + 00	1859.960	68397.6
63.00	0.1350E + 00	245.9	0.2872E + 00	1900.096	68405.7
62.00	0.1621E + 00	251.1	0.3378E + 00	1900.234	68414.1
61.00	0.1939E + 00	257.7	0.3935E + 00	1900.384	68423.0
60.00	0.2310E + 00	261.9	0.4614E + 00	1900.545	68432.7
59.00	0.2744E + 00	267.5	0.5366E + 00	1900.719	68443.1
58.00	0.3245E + 00	274.8	0.6179E + 00	1900.917	68455.0
57.00	0.3823E + 00	281.6	0.7105E + 00	1901.116	68467.0
56.00	0.4482E + 00	291.8	0.8040E + 00	1901.336	68480.2
55.00	0.5226E + 00	301.7	0.9067E + 00	1901.564	68493.9
54.00	0.6065E + 00	311.6	0.1019E + 01	1901.805	68508.3
53.00	0.7005E + 00	332.1	0.1139E + 01	1902.071	68524.3
52.00	0.8054E + 00	322.0	0.1271E + 01	1902.347	68540.8
51.00	0.9227E + 00	340.2	0.1421E + 01	1902.629	68557.7
50.00	0.1054E + 01	348.7	0.1584E + 01	1902.932	68575.9
49.00	0.1199E + 01	357.8	0.1758E + 01	1903.251	68595.1
48.00	0.1361E + 01	366.9	0.1945E + 01	1903.586	68615.1
47.00	0.1540E + 01	373.4	0.2164E + 01	1903.947	68636.8
46.00	0.1739E + 01	379.1	0.2407E + 01	1904.330	68659.8
45.00	0.1961E + 01	386.1	0.2665E + 01	1904.730	68683.8
44.00	0.2206E + 01	392.3	0.2952E + 01	1905.159	68709.5
43.00	0.2478E + 01	398.6	0.3264E + 01	1905.606	68736.3
42.00	0.2778E + 01	404.8	0.3604E + 01	1906.063	68763.8
41.00	0.3109E + 01	410.9	0.3975E + 01	1906.554	68793.2
40.00	0.3474E + 01	416.7	0.4380E + 01	1907.050	68823.0
39.00	0.3877E + 01	422.2	0.4825E + 01	1907.577	68854.6
38.00	0.4319E + 01	430.9	0.5268E + 01	1908.152	68889.1
37.00	0.4801E + 01	438.8	0.5752E + 01	1908.725	68923.5
36.00	0.5327E + 01	448.0	0.6253E + 01	1909.352	68961.1
35.00	0.5899E + 01	456.2	0.6802E + 01	1909.984	68999.0
34.00	0.6521E + 01	464.1	0.7391E + 01	1910.606	69036.4
33.00	0.7196E + 01	473.1	0.8003E + 01	1911.326	69079.6
32.00	0.7927E + 01	481.5	0.8663E + 01	1912.032	69121.9
31.00	0.8717E + 01	490.2	0.9360E + 01	1912.797	69167.8
30.00	0.9571E + 01	499.0	0.1010E + 02	1913.597	69215.8
29.00	0.1049E + 02	507.6	0.1088E + 02	1914.403	69264.2
28.00	0.1149E + 02	516.0	0.1172E + 02	1915.248	69314.9
27.00	0.1255E + 02	524.9	0.1259E + 02	1916.142	69368.5
26.00	0.1370E + 02	533.0	0.1353E + 02	1917.015	69420.9
25.00	0.1493E + 02	541.6	0.1452E + 02	1917.951	69477.1
24.00	0.1626E + 02	550.1	0.1556E + 02	1918.925	69535.5
23.00	0.1767E + 02	558.5	0.1666E + 02	1919.918	69595.1
22.00	0.1919E + 02	566.8	0.1782E + 02	1920.924	69655.4
21.00	0.2081E + 02	574.6	0.1906E + 02	1921.958	69717.5
20.00	0.2255E + 02	582.8	0.2036E + 02	1923.043	69782.6
19.00	0.2440E + 02	591.0	0.2172E + 02	1924.193	69851.6
18.00	0.2638E + 02	599.3	0.2315E + 02	1925.440	69926.4
17.00	0.2849E + 02	607.4	0.2465E + 02	1926.706	70002.3
16.00	0.3073E + 02	616.5	0.2619E + 02	1928.077	70084.6
15.00	0.3311E + 02	624.0	0.2786E + 02	1929.372	70162.3
14.00	0.3565E + 02	631.4	0.2963E + 02	1930.681	70240.9
13.00	0.3835E + 02	639.6	0.3145E + 02	1932.073	70324.4
12.00	0.4121E + 02	646.8	0.3340E + 02	1933.402	70404.1
11.00	0.4425E + 02	654.1	0.3544E + 02	1934.888	70493.3
10.00	0.4748E + 02	660.8	0.3761E + 02	1936.424	70585.4
9.00	0.5090E + 02	668.8	0.3979E + 02	1937.930	70675.8
8.00	0.5452E + 02	676.5	0.4211E + 02	1939.484	70769.1
7.00	0.5836E + 02	682.9	0.4461E + 02	1941.099	70865.9
6.00	0.6242E + 02	689.8	0.4720E + 02	1942.755	70965.3
5.00	0.6671E + 02	697.0	0.4988E + 02	1944.469	71068.1
4.00	0.7125E + 02	704.6	0.5263E + 02	1946.251	71175.0
3.00	0.7604E + 02	711.6	0.5554E + 02	1948.082	71284.9
2.00	0.8109E + 02	719.1	0.5852E + 02	1950.018	71401.1
1.00	0.8642E + 02	726.3	0.6166E + 02	1952.009	71520.5
0.00	0.9203E + 02	733.8	0.6489E + 02	1954.037	71642.2
−0.65	0.9583E + 02	738.5	0.6708E + 02	1955.317	71719.0

Altitudes are relative to the sounder probe landing site at 6052.0 km. R_0 = 6051.4 km, g_0 = 8.8712 m/s^2, μ = 43.44. GRT 1859.820 = 18 hours, 59.820 minutes.

TABLE 3*d*. Lower Atmosphere State Properties: Night Probe

Altitude, km	*p*, bars	*T*, K	ρ, kg/m^3	GRT	GRT, s
61.28	0.1650E + 00	234.0	0.3687E + 00	1853.405	68004.3
61.00	0.1739E + 00	236.3	0.3850E + 00	1353.447	68006.8
60.00	0.2103E + 00	243.1	0.4522E + 00	1853.600	68016.0
59.00	0.2528E + 00	251.2	0.5263E + 00	1853.776	68026.6
58.00	0.3018E + 00	262.4	0.6018E + 00	1853.963	68037.8
57.00	0.3580E + 00	271.6	0.6897E + 00	1854.158	68049.5
56.00	0.4220E + 00	282.2	0.7826E + 00	1854.379	68062.8
55.00	0.4946E + 00	292.6	0.8846E + 00	1854.617	68077.0
54.00	0.5765E + 00	303.2	0.9954E + 00	1854.856	68091.4
53.00	0.6685E + 00	313.7	0.1116E + 01	1855.118	68107.1
52.00	0.7715E + 00	323.7	0.1248E + 01	1855.376	68122.6
51.00	0.8865E + 00	334.0	0.1391E + 01	1855.666	68139.9
50.00	0.1014E + 01	344.1	0.1545E + 01	1855.972	68158.3
49.00	0.1157E + 01	350.3	0.1731E + 01	1856.273	68176.4
48.00	0.1316E + 01	358.8	0.1924E + 01	1856.631	68197.9
47.00	0.1494E + 01	367.0	0.2134E + 01	1856.991	68219.5
46.00	0.1690E + 01	375.0	0.2364E + 01	1857.361	68241.7
45.00	0.1907E + 01	382.0	0.2620E + 01	1857.758	68265.5
44.00	0.2149E + 01	387.6	0.2910E + 01	1858.178	68290.7
43.00	0.2417E + 01	393.3	0.3226E + 01	1858.619	68317.2
42.00	0.2714E + 01	400.2	0.3561E + 01	1859.073	68344.4
41.00	0.3041E + 01	407.2	0.3922E + 01	1859.564	68373.9
40.00	0.3401E + 01	414.5	0.4311E + 01	1900.077	68404.6
39.00	0.3797E + 01	421.7	0.4731E + 01	1900.609	68436.5
38.00	0.4230E + 01	429.3	0.5179E + 01	1901.151	68469.1
37.00	0.4705E + 01	437.3	0.5656E + 01	1901.742	68504.5
36.00	0.5223E + 01	445.3	0.6167E + 01	1902.341	68540.4
35.00	0.5787E + 01	453.0	0.6719E + 01	1902.963	68577.8
34.00	0.6402E + 01	461.1	0.7302E + 01	1903.651	68619.1
33.00	0.7070E + 01	468.8	0.7934E + 01	1904.317	68659.0
32.00	0.7795E + 01	476.8	0.8602E + 01	1905.030	68701.8
31.00	0.8581E + 01	485.0	0.9310E + 01	1905.770	68746.2
30.00	0.9431E + 01	493.1	0.1007E + 02	1906.552	68793.1
29.00	0.1035E + 02	500.9	0.1088E + 02	1907.349	68840.9
28.00	0.1134E + 02	509.4	0.1172E + 02	1908.169	68890.1
27.00	0.1241E + 02	517.7	0.1262E + 02	1909.035	68942.1
26.00	0.1356E + 02	526.6	0.1356E + 02	1909.953	68997.2
25.00	0.1480E + 02	535.4	0.1455E + 02	1910.920	69055.2
24.00	0.1612E + 02	543.5	0.1562E + 02	1911.867	69112.0
23.00	0.1755E + 02	552.3	0.1673E + 02	1912.873	69172.4
22.00	0.1907E + 02	560.7	0.1790E + 02	1913.936	69236.1
21.00	0.2070E + 02	568.8	0.1915E + 02	1914.979	69298.8
20.00	0.2245E + 02	577.0	0.2047E + 02	1916.092	69365.5
19.00	0.2431E + 02	585.5	0.2184E + 02	1917.255	69435.3
18.00	0.2630E + 02	593.5	0.2331E + 02	1918.443	69506.6
17.00	0.2842E + 02	602.0	0.2483E + 02	1919.688	69581.3
16.00	0.3068E + 02	610.7	0.2641E + 02	1921.036	69662.1
15.00	0.3308E + 02	618.7	0.2809E + 02	1922.375	69742.5
14.00	0.3564E + 02	626.7	0.2986E + 02	1923.684	69821.0
13.00	0.3836E + 02	634.8	0.3171E + 02	1925.002	69900.1
12.00	0.4124E + 02	643.5	0.3361E + 02	1926.515	69990.9
11.00	0.4430E + 02	651.5	0.3564E + 02	1928.033	70082.0
10.00	0.4754E + 02	659.4	0.3774E + 02	1929.631	70177.8
9.00	0.5097E + 02	667.3	0.3995E + 02	1931.224	70273.5
8.00	0.5461E + 02	675.2	0.4226E + 02	1932.999	70379.9
7.00	0.5845E + 02	683.0	0.4468E + 02	1934.729	70483.7
6.00	0.6252E + 02	690.8	0.4720E + 02	1936.538	70592.3
5.00	0.6681E + 02	698.5	0.4983E + 02	1938.346	70700.7
4.00	0.7134E + 02	706.2	0.5256E + 02	1940.210	70812.6
3.00	0.7612E + 02	713.9	0.5540E + 02	1942.041	70922.5
2.00	0.8116E + 02	721.5	0.5835E + 02	1943.904	71034.2
1.00	0.8647E + 02	729.1	0.6142E + 02	1945.830	71149.8
0.98	0.8658E + 02	729.3	0.6148E + 02	1945.858	71151.5

Altitudes are relative to the sounder probe landing site at 6052.0 km. R_0 = 6053.0 km, g_0 = 8.8685 m/s^2, μ = 43.44. GRT 1853.405 = 18 hours, 53.405 minutes.

in Figure 10. They span 9 orders of magnitude, from 10^{-7} to 64 kg/m^3. The comparison of data obtained by the two extremely different techniques provides a test of accuracy of the entry mode data above 65 km. In Figure 10*a*, where densities below 65 km (filled symbols) were obtained from *p*, *T* measurements, the data from the two experiment modes fit together beautifully. Below 115 km, the day and sounder densities are the same within a few percent, while below 100 km

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ORADS

PIONEER VENUS

ORBITER RADAR MAPPER

Documentation of UADS/NSSDC Data Entries

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April 22, 1981

Introduction

The Radar Mapper experiment (ORAD) consists of a 14 inch directional S-band antenna which rotates in a plane perpendicular to the spin axis of the spacecraft, an 18 watt transmitter, and a receiver and associated control circuits. A detailed description of the instrument appears elsewhere[1].

The sensitivity of the system limits data taking to altitudes below 4700 km, corresponding to a period of about 25 minutes either side of periapsis. Within this interval, the instrument is pre-programmed to switch between several operating modes determined by the altitude of the spacecraft above the surface. Before each periapsis passage, uplink commands are transmitted to the instrument to allow it to estimate this altitude at all times during data taking.

The instrument operates in one of three distinct modes:

Altitude	Mode
4700 km - 700 km	Altimetry (single frequency)
Below 700 km	Altimetry (4 frequency) and single-sided Imaging
Below 700 km	Altimetry (4 frequency) and double-sided Imaging

Altimetric data is taken in all modes during that portion of each 12 second spacecraft roll in which the ORAD antenna points to the nadir. A series of radar pulses is transmitted, each modulated by phase inversion according to a pseudo-random code. The receiver detects the reflected pulses and de-convolves the modulation using the same code starting at 64 equally spaced time intervals. The 64 receiver outputs ('range cells') define a range window in which the peak of the radar echo may be located. The width of the time 'window' varies with altitude: above 1515 km, it is 384 microseconds wide, and below that altitude it is

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[1] Pettengill, G.H., Horwood, D.F., and Keller, C.H., Pioneer Venus Orbiter Radar Mapper: Design and Operation, **IEEE Trans. on Geosci. and Remote Sens., GE18**, 28-32, 1980.

256 microseconds wide. When operating in the double-sided imaging mode, the contents of the first 55 range cells are reported to the downlink telemetry system. In the other modes, the instrument detects the range cell containing the peak return value and reports the contents of 17 cells beginning 7 cells before the peak.

Below 700 km, 4 altimetric measurements are taken during each spacecraft roll. Uplink commands select whether these are to be made with the receiver tuned to the same frequency throughout, or to be offset by +3260, +9320, -9320 and -3260 Hz for the 4 measurements. Without the offsets, the four surface footprints almost lie on top of each other. When the offsets are enabled, the footprints shift away from the nadir and lie in a line along the sub-orbital track. Unfortunately, the signal-to-noise ratio is severely degraded at the 9320 Hz offsets and, for this reason, all data since orbit 295 have been taken with the offset feature disabled.

Single- or double-sided imaging data are taken during those portions of each roll in which the radar antenna views the planet at an angle of between 30 and 60 degrees from the nadir. Unmodulated pulses are transmitted and the receiver performs a fourier transform in frequency at 8 delays to synthesize an 8 x 8 cell map of the surface lying on one or both side(s) of the spacecraft. Design and sensitivity considerations limit useful imaging data to altitudes below 550 km. Because of the quantity and restricted interest of imaging data, there is currently no plan to include it in UADS or NSSDC entries. It may be obtained upon application to the principal investigator, Professor Gordon Pettengill, at M.I.T.

Low Frequency Data

Because the Orbiter Radar Mapper data are related to a non-rotating (crust-fixed) coordinate system, they have been entered into UADS in a somewhat different manner to those of other orbiter experiments.

The Low Frequency file (LFD) contains five ORAD data variables per 12 second UADS epoch. Rather than interpolating each variable to what it might have been if measured at that time, the data is entered roll-by-roll. The user should not assume that the data was taken within the roll defined by the LFD variable SCUT, although this is often the case when close to periapsis. The choice of which 12 second LFD record receives which ORAD roll data is determined by periapsis time, but this time is **not** that reported in the LFD header. ORAD analysis is very sensitive

to periapsis time so that it is a corrected value that is used when assigning ORAD roll 0 (the roll with RIP UT immediately prior to periapsis) to the central LFD record.

The five ORAD LFD variables are average values over the surface footprint, or, at altitudes below 700 km, averages over 4 footprints. The size of a footprint varies with altitude; the following table gives some representative dimensions:

Spacecraft Altitude (km)	Footprint Size (km, across x along track)
200	23 x 7
300	28 x 11
500	36 x 18
1000	49 x 39
2000	80 x 61
4000	101 x 101

Data Analysis

As described above, each altimetry measurement yields either 17 or 55 time-sampled values of radar echo power. These are read from the ORAD EDR files and are compared with a series of sample 'templates' constructed from a model[2] of radar scattering at small angles of incidence. In this model, the radar cross section per unit surface area at angles of incidence and observation θ is given by

$$(RHO \; C / 2) (COS^{4} \theta + C \; SIN^{2} \theta)^{-3/2}$$

where RHO is the Fresnel reflection coefficient for normal incidence. The parameter C is inversely related to the steepness of the surface undulations; for C larger than about 10, the average slope (in radians) over a scale length of the order of the radar wavelength (17 cm) is approximately given by SQRT(1/C). This subject is treated in greater detail in a recent paper by the Pioneer Venus

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[2] Hagfors, T., Remote probing of the moon by infrared and microwave emissions and by radar, **Radio Science**, **5**, 219-227, 1970.

Radar Team[3].

The theoretical templates have been computed for many values of spacecraft altitude, receiver offset frequency, and C parameter, and they also model the effects of the on-board deconvolution of the pseudo-random noise code. Partial derivatives of each template with respect to delay, offset frequency, and C are also available, so that statistical errors may be estimated during the fitting procedure. Each echo profile yields a value of RHO, C, and location within the altimeter time window. Using the spacecraft ephemeris obtained from ground tracking, and a knowledge of the precise time of the radar measurement, a value is derived for the mean planetary radius of the footprint.

LFD Variables

All ORAD LFD variables are floating point quantities. Data taken below 700 km are averaged over the 4 footprints, weighting each value by its estimated statistical error. If individual values are suspect, they are dropped from the average. In particular, all data taken at frequency offsets of +9320 and -9320 Hz have been deleted because of their low signal-to-noise ratio.

RLAT the Venus crust-fixed latitude of the center of the radar footprint(s) expressed in degrees. The coordinate system is that adopted by the IAU (and is also used in the SEDR ephemeris files).

RLON the Venus crust-fixed longitude of the footprint(s) expressed in degrees (0° to +360°, increasing eastwards counter to the direction of planetary rotation).

RRAD the average radius of the footprint(s) in kilometers relative to a mean planetary radius of 6051.2 km. Positive RRAD values denote elevated regions, and vice versa.

SLOP the root mean square meter-scale surface slope, in degrees, of the footprint(s). It is derived from the fitted value of the C parameter by

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[3] Pettengill, G.H., et al, Pioneer Venus radar results: altimetry and surface properties, J. Geophys. Res., 85 A13, 8261-8270, 1980.

$$SLOP = 360 * SQRT (1 / C) / \Pi$$

RRHO the average value of the Fresnel reflection coefficient for normal incidence of the footprint(s). This is a dimensionless quantity (less than unity) related to the surface dielectric constant ε by

$$RHO = SQRT \left| (1 - \varepsilon) / (1 + \varepsilon) \right|$$

Composite Data Files

To avoid the necessity of extracting all LFD data variables when plotting ORAD data, a single composite data file has been submitted to UADS. The file is designed to be handled as a single entity. It can be read directly into core memory on many large virtual storage computer systems (with 5 megabytes or more of addressable memory) and contains chain pointers to aid in an on-line graphical representation of all or part of the total ORAD database.

The file consists of 80 byte logical records and is arranged in eight sections; the first five sections are of fixed length and each fits exactly into an integral number of logical records. The remaining three sections are of varying length. Each begins at the start of a logical record, and the last record of each section is padded on the right with hexadecimal zeroes.

The sections have the following contents:

1. **Periapsis Times** ... 1000 double precision floating point fields containing the periapsis times of orbits 1-1000 expressed in units of milliseconds counting from midnight Dec 30/31st of the previous year. If no ORAD data is available for the orbit, the field will contain a zero value.

   The first of these fields does not contain a time value. No ORAD data was taken on orbit 1. Instead, the first 4 bytes of the field (i.e. of the file) contain the number of altimeter data values contained in the varying length sections of the file, expressed as a 32 bit binary integer.

2. **Semi-Major Axes** ... 1000 double-precision floating point fields containing the semi-major axes of the osculating orbital ellipse at periapsis for orbits 1-1000, expressed in kilometers.

3. **Eccentricities** ... 1000 double-precision floating point fields containing the eccentricity of the osculating orbital ellipse at periapsis for orbits 1-1000.

4. **Data-Source Codes** ... 1000 16-bit binary integers indicating the source of ORAD data for orbits 1-1000. The codes are as follows:

0: no data available
1: quick-look data
2: first processing of EDR/SEDR tapes
3: re-processing of EDR/SEDR tapes

5. **Data-Editing Levels** ... 1000 16-bit binary integers indicating the number of times that ORAD data for orbits 1-1000 has been processed by the interactive CYTHP editing system.

6. **Altimetry Data** ... seven arrays of 32-bit fields. The dimension of each array is given by the integer field located in the first 4 bytes of the first record of the file. There is no padding between the arrays. The first six arrays contain floating point variables:

1: Crust-fixed latitudes (RLAT)
2: Crust-fixed longitudes (RLON)
3: Planetary radius relative to 6051.2 km (RRAD)
4: Hagfors scattering law parameter (C)
5: Fresnel reflection coefficient (RRHO)
6: Spacecraft radial velocity (km/sec)

and the seventh array contains a pair of binary integers in each 32 bit field:

Bits 0-19 : Orbit number
Bits 20-31: Roll number relative to periapsis + 128

7. **Latitude Pointers** ... an array of 32 bit integers that index the data arrays in the sixth section of the file, used to reference the data in that section by increasing value of RLAT. Thus if, in a Fortran program, the data arrays are read into variables RLAT(N), RLON(N), etc, and the latitude pointers into ILAT(N), the sequence RLAT(ILAT(I)) will increase monotonically with increasing I value.

8. **Longitude Pointers** ... an array of 32 bit integers that index the data arrays in the sixth section of the file, used to reference the data in that section by increasing value of RLON. Thus if, in a Fortran program, the data arrays are read into variables RLAT(N), RLON(N), etc, and the longitude pointers into ILON(N), the sequence RLON(ILON(I)) will increase monotonically with increasing I value.

Error Analysis

An analysis of purely **statistical** errors shows that values of SLOP and RRHO obtained from the profile fitting procedure are usually highly correlated, while RRAD is only slightly correlated with either. At an altitude of 200 km, the statistical error in RRAD is of the order of 30 meters, while the errors in SLOP and RRHO approach 10 %. At 4000 km altitude, the error in RRAD varies between 100 and 300 meters (it varies with SLOP), while errors in SLOP and RRHO are on the order of 30 %. These formal errors are very much smaller than the following known **systematic** errors:

1. **Estimation of on-board clock time pulses.** This chiefly affects RRAD according to

$$ERR(RRAD) = RADVEL * ERR(RIP)$$

where ERR(RIP) is an inaccuracy in the measurement of the Roll Index Pulse time, and RADVEL is the current spacecraft radial velocity with respect to Venus. RRAD has been corrected for gross RIP timing errors but a residual error of several milliseconds remains leading to errors in RRAD of the order of 100 meters.

Gross errors in RIP time also affect RRHO because they lead to a miscalculation of the direction in which the radar antenna is pointing. Although only weakly directional (3 db loss at 15 degrees off axis), a large error in RIP determination affects the computation of this loss and therefore affects the analysis of the total echo power.

2. **Ephemeris errors.** These have been estimated by comparing RRAD values of overlaping footprints measured during separate orbits. Of greatest concern is the uncertainty in time of periapsis passage as this affects all RRAD values of a given orbit in the same manner as do RIP errors. This error decreases with altitude, vanishing at periapsis. Errors in other orbital elements have less effect on RRAD. We estimate the residual effect of all ephemeris errors on RRAD as 50 meters at

periapsis, increasing to 150 meters at 4700 km spacecraft altitude.

3. **Anomalous surface properties.** When the composition of the surface footprint differs sufficiently from the 'model' surface used to compute the theoretical radar templates, we expect erroneous results. The three most probable causes of error in our model would come from footprints that contain either A) a large smooth area tilted in the direction of the spacecraft, or B) large changes in relief, or C) very rough material on the meter scale, or some combination of the three. Such a failure of the scattering model can lead to very large errors in RRAD, SLOP, and RRHO. Obvious failures are deleted automatically by the fitting algorithms, and most of the remaining suspect values have been analyzed by hand.

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Pioneer Venus Hypsometry

Peter G Ford
MIT Center for Space Research
December 22, 1986

In 1980, Pioneer Venus altimetry results were published, claiming a mean planetary radius of 6051.5 km. This value was used by USGS when preparing Venus contour maps. A smoothed version of this early data set also found its way to Project Magellan. At the same time, the raw data were re-processed at MIT and the results were delivered to NSSDC, from which center they have been distributed to the scientific community. It has recently been pointed out that the re-processed data have a quite different mean radius of 6051.92 km. A careful review of the data processing history, and of the data sets themselves, show that the NSSDC data set is accurate, and that the previously published radius values were in error. The early error arises from several sources, and cannot be described by a simple algorithm.

Historical Review

Raw Pioneer Venus radar data were delivered to MIT as a set of three data products, one set per S/C orbit:

- **Quick-look data**, received via high-speed RSCS data link. The data stream was split up at MIT into nine files, and written to tape (PVQLxx).
- **Experimental Data Record**, received on CCT (PVExxx). Each tape contained three files: header, uplink commands, and down-link sensor and engineering data.
- **Supplementary Experimental Data Record** (PVSxxx), received on CCT. Each tape contained six files: header, S/C pulse times, attitude, roll period, Sun/star reference, and ephemeris.

To conserve tapes, the nine data files that defined each orbit were merged and written to CCT as a single file. These tapes were originally written at 800 *bpi* (PVBxxx), and were later copied to 6250 *bpi* (PVMxxx).

The raw data contained a mixture of nadir-pointing *altimetry* measurements and side-looking backscatter *images*. In addition, a total of four distinct "levels" of data product were recognized:

0. Quick-look data processed without any spacecraft ephemeris information.
1. Quick-look data processed with a priori orbit elements.
2. EDR/SEDR data processed with a spacecraft ephemeris derived from tracking data.
3. A re-processing of Level 2 data using more accurate algorithms.

Each level of data passed through the following data processing programs:

CYTHERA: A PL/1 program that read an orbit from a "merge tape", reconstructed the 9 original Quick-look or EDR/SEDR files, and processed the ORAD data, roll-by-roll[1]. Three output files were written for each orbit:

- **Archive file** (PVAxxx) containing a full binary record of all intermediate quantities used in the calculations. The Level 0, 1, and 2 archive files were written to 800 *bpi* tapes. The Level 3 files were written to 6250 *bpi* tapes and the previous 800 *bpi* tapes were re-cycled.

- **Composite Data file** (PVCDxx) containing an abbreviated record of each altimetry and imaging measurement. Copies of these files were sent to USGS Flagstaff. The originals were retained for subsequent *cythp* editing (see below), but were later re-cycled.

- **Print file** (PVPxxx) was written to CCT and thence to microfiche. The tapes were then re-cycled.The fiche contains lists of pertinent engineering and ephemeris quantities, and condensed roll-by-roll plots of altimetry and imaging results.

Cythera went through two major revisions (see Appendix). The first was made in the spring of 1979 when it became clear that the Project-derived spacecraft pulse times were seriously in error. *Cythera* was reprogrammed to use the down-link radar data header fields to estimate the timing corrections. The second revision, in the summer of 1981, incorporated a correction associated with atmospheric signal delay and attenuation. It also used a more reliable profile fitting algorithm and an improved treatment of doppler-filter efficiency.

CYTHP: an IBM/BAL program that edited individual altimetric data points. *Cythp* read and wrote composite data files, displaying single- or multi-orbit results on an HP2648A graphics terminal. Each orbit was inspected by this program, often several times, and each apparently anomalous datum was inspected on the corresponding micro-fiche frame. Bad points were then removed or flagged.

CYTFIT: an IBM/BAL program that extracted radius fields from a set of composite data files, grouped them into *cells* according to their footprint altitudes and longitudes, and computed a set of corrections to the periapsis orbital elements of each orbit so as to minimize the variance of radius values within each cell. *Cytfit* was first used in the fall of 1979, at the end of the nominal mission, and then at several times until the end of radar processing. After each use, the set of input composite data files was archived.

GIPS: the General Image Processing System, a set of C-language functions written for the VAX UNIX operating system as part of MIT's SIR-B involvement, was not applied to ORAD data until the spring of 1982. It identified several bad radius values, necessitating further *cytfit* global fitting, and was used extensively in later corrections to Pioneer Venus reflectivity and imaging data.

[1] The ORAD radar was operated once per spacecraft revolution, when its antenna pointed toward the nadir. Hence the term *roll* to denote a discrete radar measurement period.

Hypsometry

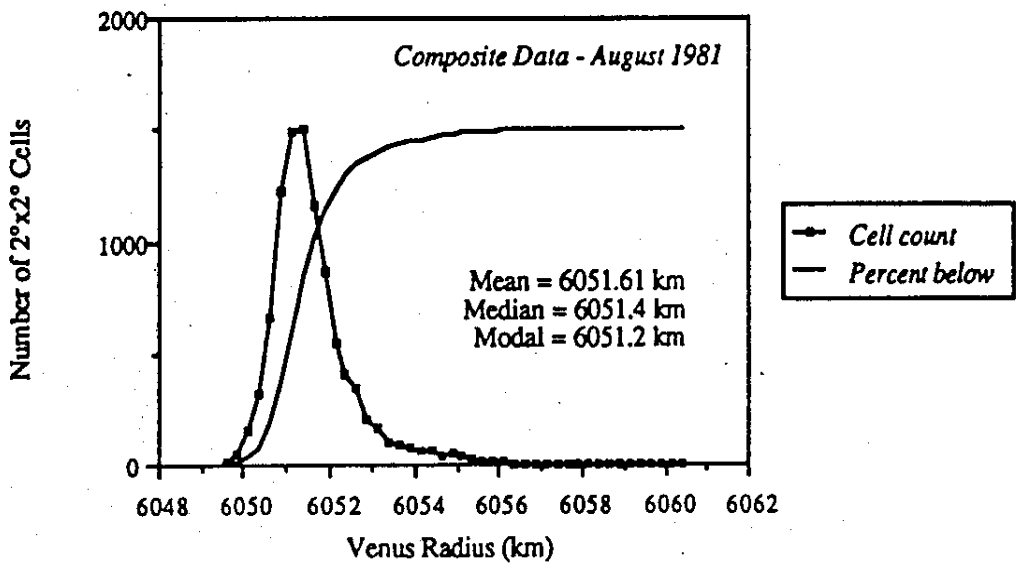
The global radius values reported[2] in 1980 were calculated in October 1979 when the nominal mission was completed. That data set contained two serious gaps: the first between orbits 15 and 47 was the result of an instrumental malfunction; the second, between orbits 249 and 284, was due to telemetry failure during superior conjunction. As we shall see, this led to sizable systematic errors in the values reported in this early paper:

Erroneous values reported in JGR 1980 article

Mean radius	6051.5 km
Median radius	6051.2 km
Modal radius	6051.1 km
Ellipsoid axis A	6051.3 km
Ellipsoid axis B	6051.0 km
Ellipsoid axis C	6051.2 km

During the extended mission, EDRs were processed in weekly batches, and the resulting composite data were edited by *cythp* every few weeks. *Cytfit* was run on several occasions, and the resulting corrected composite data files were sent to USGS Flagstaff. Here a mistake was made—the *cytfit* input consisted of previously corrected composite data files along with freshly edited ones, thereby perpetuating the systematic radius errors inherited from the October 1979 fit. We *should* have used the un-fitted files, but these had already been re-cycled from the nominal mission and it would have been costly to re-create (and re-edit) them from the PVAxxx archive tapes. The last radar data were taken in March 1981, yielding the following global radius distribution:

Level 2 Hypsometric Distribution



[2] G.H. Pettengill, E. Eliason, P.G. Ford, G.B. Loriot, H. Masursky, G.E. McGill, "Pioneer Venus Radar Results: Altimetry and Surface Properties", *J. Geophys. Res.*, 85, 8261 (1980).

This reflects the "Level 2" data set that was used by USGS Flagstaff for all their published Pioneer Venus data products. MIT also distributed copies of this data to the Radar Team members and others:

Walter Brown.....JPL
Don Campbell.....Cornell/Arecibo
Bill Kaula.....UCLA
George McGill.....U. Mass, Amherst
Bob Reasenberg.....MIT

In the spring of 1981, after the radar measurements were terminated,[3] we began working on improvements to the *cythera* reduction program. The following changes were made:

- A correction to the radar echo time, to account for atmospheric delay. Using Pioneer Venus data supplied to us by Kliore *et al.*, we derived the quadratic correction

$$\Delta\tau = 0.8584 - 0.05227h + 0.000938h^2$$

where $\Delta\tau$ is the excess one-way delay associated with the atmosphere (in μsec), and h is the measured altitude (in km) above a reference radius of 6051.2 km.

- A correction to the measured echo power, to account for atmospheric attenuation. This also came from data supplied by Kliore *et al.*

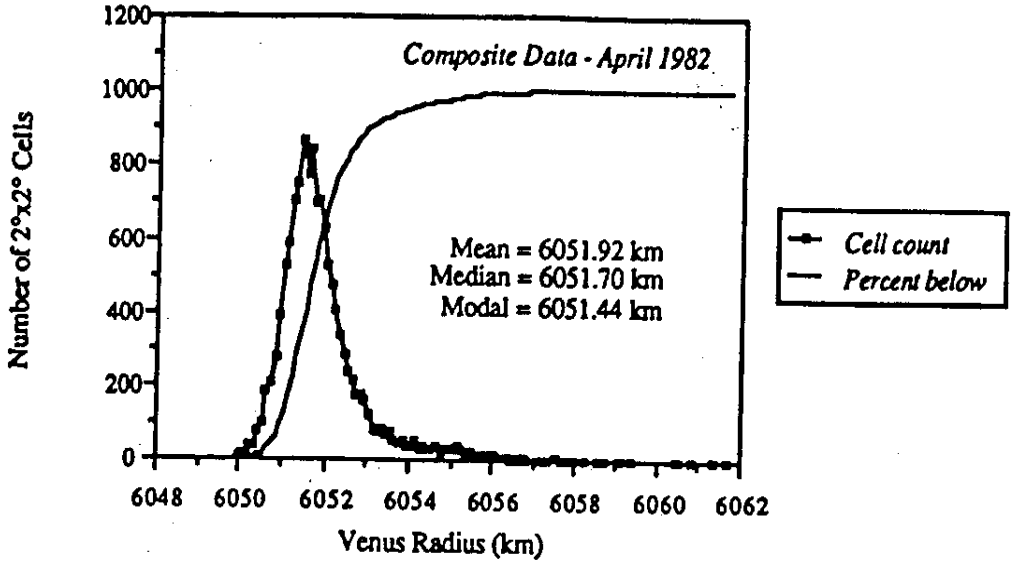
- An improved profile-fitting algorithm. The previous method was occasionally fooled by very rough terrain and by weak signals, when it confused noise with correlator side-lobes, particularly when the altimeter was "squinted" fore and aft.

- A correction to the receiver gain to better account for the effect of the approximations used in the on-board processing of the complex waveform.

In addition, by this time the Project had recalculated all spacecraft pulse times, which often differed from those reported on the original SEDRs by several tenths of a second. These developments argued for a complete re-processing of all data *ab initio*. For this purpose, the *cythera* and *cythp* software were ported to the Harvard computing center. Using a fast computer and high-density tapes, all orbits were re-processed and edited in October 1981. The resulting "Level 3" composite data files were sent to USGS Flagstaff and Eric Eliason and I edited them there in November, after the Palo Alto "Venus" conference. The resulting radius distribution was as follows:

[3] The instrument was still functioning flawlessly, but the spacecraft had run out of propellent with which to control periapsis altitude, which was increasing beyond range of the radar.

Level 3 Hypsometric Distribution



Two further major revisions of this Level 3 data set have proven necessary. Firstly, a total of some 70 orbits (out of a total of 726) still showed severe problems, either in radius, reflectivity, or side-looking back-scatter values. These problems were solved one at a time in the first half of 1982. The corrected data were merged with the previous Level 3 data files and the combination was run through *cyfit* for one last time. This was a similar operation to that performed several times with Level 2 data, but this time we did not permit *cyfit* to alter those orbits that had not been updated since the previous *cyfit* session. The updated composite data files were sent to USGS Flagstaff in April 1982 (see summary above), and the complete revised data set was sent to the following experimenters:

Don Campbell.....Cornell/Arecibo
Jim Head.....Brown U.
Bill Kaula.....UCLA
George McGill.....U. Mass, Amherst
Peter Mouginis-Mark.....U. Hawaii
Irwin Shapiro.....SAO

The second major revision came after much work at MIT to understand the side-looking radar back-scatter data. We estimated what fraction of the surface was acting as a large-angle diffuse scatterer, and did not therefore contribute to quasi-specular scattering. This caused us to increase our reported values of Fresnel reflectivity by an amount that depended on the side-looking back-scatter intensity in the vicinity of each altimeter footprint. The correction increased the average reflectivity by about 10%, but had no effect on the radius or Hagfors RMS slope values.

The corrected reflectivity values were not distributed as composite data files. Instead, they were merged with Pioneer Venus radiometry data[4] and submitted directly to the National Space Sciences Data Center (NSSDC) on January 1, 1985 in a format common to all Pioneer Venus "low frequency" data. We also submitted a tape containing our corrections to the Project's estimates of spacecraft orbital elements. I have also sent copies of the NSSDC submission to the following:

[4] P.G. Ford, G.H. Pettengill, "Venus: Global Surface Radio Emissivity", *Science*, 220, 1379 (1983).

copies of NSSDC data

A.T. Basilevsky.....Vernadsky Institute
Don Campbell.....Cornell/Arecibo
Eric Eliason.....USGS Flagstaff
Jim Head.....Brown U.
Steve Saunders.....JPL
Sean Solomon.....MIT

On the basis of the present analysis, I believe this to be the correct version of the Pioneer Venus radar data, although the composite data files distributed in April 1982 also contain accurate radius values.

↑ This final data set is NSSDC 78-051A-02D, The composite data files distributed in April, 1982 are NSSDC 78-051A-02C

Systematic Radius Errors

When Steve Wall recently asked me to characterize the accuracy of Pioneer Venus radius results for use by the Magellan project, our correspondence went as follows:

```
Date:       Wed, Jul 16 86 05:43:00 EDT
From:       SWALL <SWALL.TELEMAIL>
To:         Pford
CC:         ssdallas mkobrick
Subject:    the error bars on the topo data

We have an action item to answer from MGN Nav team that I would
like your help on.

They have been asked to determine if the "effective pointing
accuracy" of MGN is adequate to allow dead reckoning. They have
responded by requesting us to justify the current error bars on
the topo data we have furnished, saying that the topo uncertainty
is driving the whole "effective pointing" error.

As you know, we have beaten this issue before. The topo data is
limited in accuracy by (1) the actual variations in topography
within a topo "pixel" and (2) the accuracy with which the measur-
ement was made. As I understand it we have told the project that
the total uncertainty (1 + 2) is 1 km 3-sigma.

Could you comment on:

1) the accuracy of the PV measurement and the analysis which leads
you to believe your answer

2) the relative contributions of actual topography and measurement
uncertainty to your answer to 1)

3) the possibility of improving either

Thank you.
```

Date: Thu, Jul 17 86 01:40:00 EDT
From: PFORD <PFORD.TELEMAIL>
To: swall
CC: ssdallas mkobrick pford
Subject: Error bars on PV topo data

To summarize an involved subject, the PV radar topo errors may be grouped into the following categories:

[1] Instrument error. This is the quantity we know best. We wrote software to simulate the radar geometry for a variety of surface scattering models, spacecraft altitudes, and instrumental parameters. We preserved these numbers through the data analysis, and quote these error bars and their correlations in the data set that we submitted to NSSDC. Typical range errors vary with latitude: approx 100m near 17N periapsis, rising to 300m at 74N or 65S.

[2] Scattering-Model Error. Throughout our analysis, we assumed that the surface that contributed to the altimetry echoes was composed of an ensemble of "quasi-specular" scattering regions, all at the same planetary radius. We computed a "suite" of theoretical echo profiles that we would expect to see from such a surface, and we matched each experimental echo to these profiles. We used a series of tests to determine whether the echo matched any of our theoretical profiles. If the match was too poor, we threw out the measurement. These tests eliminated about 20% of our data, particularly in areas of high surface relief, but also at high latitudes (when our SNR was poor). What does it mean if a surface does not scatter according to our quasi-specular (Hagfors law) assumption, but if the measurement still survives our template-recognition tests? The most probable answer is that the surface contains extremes of relief within the footprint area. In general, our analysis will break down if the relief (converted to 2-way light-time) is larger than the 4- or 6-microsec baud length of the PV altimeter. (The Hagfors model will break down before this, but, if we only want to measure range, it's good enough). So this analysis implies that some measurements may be in error by 600 to 900 meters. I doubt that further processing will help to identify more "anomalous" echoes, unless we have some other (a priori) criterion by which to determine the expected scattering behavior of each footprint.

[3] Side-Lobe Confusion. There is yet another, thankfully rarer, error in template fitting: the PV radar echoes contain "side-lobes" caused by the on-board time-compression correlator. When our SNR was particularly low (either at high S/C altitude, or because of intrinsically low-reflective surface material), our template fitting algorithms can confuse an instrumental side-lobe with the peak of a noisy signal! We resorted to hand editing to remove these disasters (the side-lobes are typically 3 or 4 baud away from the peak, i.e. 1.8-3.6km), but some may remain in highland areas.

[4] Sampling error. At periapsis, our radar measurements were made at approx 120km down-track intervals, and our orbits were spaced approx 150km apart. The corresponding footprint size was about 7x23km, so we were really sampling less than 1% of the surface.

Moving away from periapsis, the figures improve: the sampling intervals become shorter and the footprints get larger. 100% sampling is achieved at ca. 55N and 20S. To estimate how much topography we "missed" by under-sampling, we looked at the variance in our results, i.e. we chose a sub-set of the data in which all other errors were relatively small and could be estimated: we attributed the excess variance in our measurements to actual variation in topography. We concluded that the surface could easily "hide" kilometer-deep grooves, provided they were less than about 20km wide and not fortuitously oriented along the S/C ground track.

[5] S/C Timing error. The most difficult part of the data analysis was forced on us by our lack of accurate knowledge of time of data taking. Someone (at HAC) forgot to give the radar an internal clock. Instead, we received readings from a count-down timer that was triggered from a S/C timing pulse that was itself synchronized from the sun or star sensor. Yes, a cheap mission! The sensors frequently became confused, the timing pulse wandered by hundreds of milliseconds (or worse), and we were forced to model this wandering. The bottom line is that our S/C timing errors became large when the S/C crossed the terminator (switch from sun to star sensor), and after telemetry frames had been dropped (insufficient data for pulse modeling). We tried to remove all data with suspected timing errors, but some probably remains. Chris Russell has a magnetometer on the PV spacecraft that is also sensitive to pulse timing. He and I have compared our timing corrections. We generally agree with an rms (1 sigma) of about 10msec (50m), but the distribution is far from gaussian, and there are some periods when we disagree by 100msec (i.e. up to 450m in radius).

[6] Ephemeris error. When footprints of successive orbits overlapped, we expected to measure the same planetary radius. When we didn't, we found that we could account for much of the discrepancy if we assumed that the JPL-supplied S/C ephemeris was in error, often by amounts that were much larger than estimated by the Nav team. We therefore fitted our entire data set to changes in s.m.a, eccentricity, and argument of periapsis of all orbits, minimizing the local variance of radar-derived planetary radii. We derived error estimates for these orbit elements. They are small, so a better estimate of the contribution of systematic S/C tracking errors to our radar radii is still that supplied by the Nav team: of about 300m, 1-sigma.

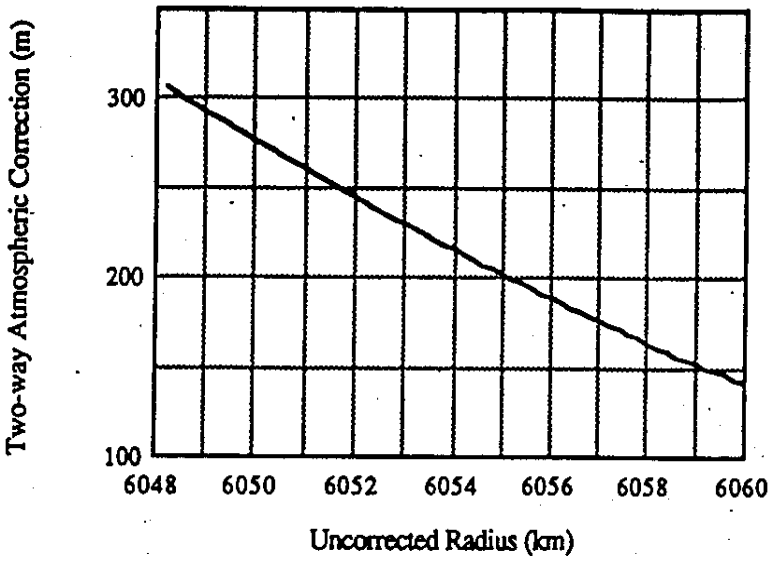
That's the picture in a fair amount of detail. To say that our topo measurements have a 3-sigma error of 1km is a vast oversimplification. Each error source varies with S/C altitude (latitude), some of the systematic errors also vary with longitude. I doubt that further analysis would reduce any of the remaining errors to any useful degree. Even if you could improve some of the systematics, the under-sampling problem is going to remain.

I would recommend that the PV contribution to the Magellan topo model be taken from our NSSDC data submission. It is ordered by time of data-taking (i.e. the counterpart to the MGN-ARCDR data set), and includes values of radius, Hagfors parameter, reflectivity, their statistical errors (item [1] above) and correlations, the footprint size and location, etc. I think that you should

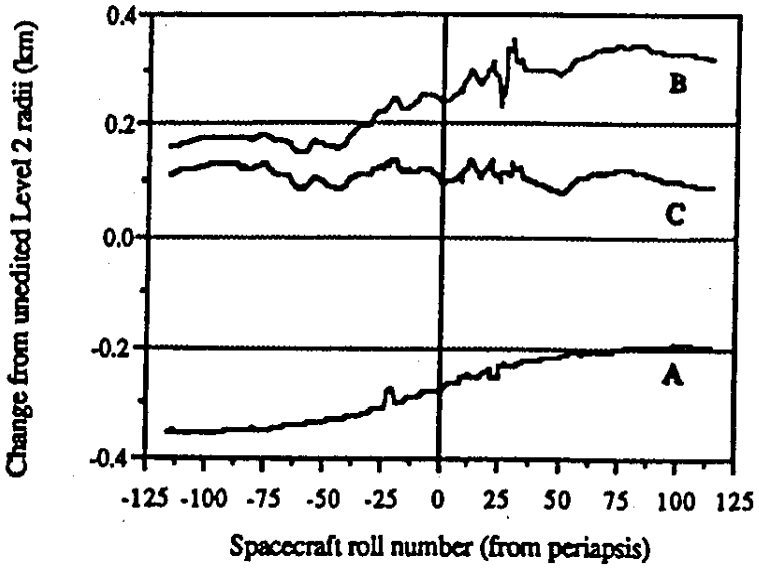
directly fit a polynomial model to this data set, using the quoted radius errors to weight the variances. Optionally, you could first re-sample the data according to the tabulated footprint sizes.

During this correspondence, the Pioneer Venus data I was talking about was, of course, our NSSDC submission, not the Level 2 data that had been used by USGS to create the series of wall charts, culminating in the "VRM Planning Chart" of 1984. I knew that the NSSDC data would be substantially different, if only because of the atmospheric delay correction. The Level 2 data, further smoothed at Flagstaff, had been sent to Mike Kobrick, who has called it a "Pioneer Venus Topography Model". To correct this assumption, I sent him a copy of the NSSDC tape. It was clear that the average radius values had changed dramatically, and I was asked to investigate.

I began by cataloguing all existing Pioneer Venus data sets and by making a calendar of the processing history. As I have described above, some of the intermediate results are missing—the output tapes were re-cycled to save space and money—but the majority are still available. I verified the calculations of mean, median, and modal radii by re-executing the *cytfit* program for the particular sets of composite data input files. Although I was unable to reproduce the precise results that led to the published 1980 JGR figures, I obtained very similar results (mean radius = 6051.61 km) from the 1981 Level 2 files. Similarly, all Level 3 data sets produced mean radii ≈ 6051.92 km. The mean atmospheric delay correction is about 250 meters:



which left 100–200 meters unaccounted for. I found that this change came entirely from the *cytfit* program applied successively to the incomplete Level 2 data sets. Here for example are the cumulative changes that were made to the original Level 2 radius values of orbit 143, firstly as a result of global fitting (curve A, overleaf), then through Level 3 re-processing (curve B), and finally through Level 3 global fitting (curve C).



The discrepancy that I have been asked to explain is that between curves **A** and **C**. Concentrating on the difference at periapsis (roll number 0), the (incorrect) Level 2 global corrections introduced a change of –280 meters to the published USGS data products (curve **A**), the atmospheric correction to level 3 data made a +250 meter change (curve **B**) which was subsequently reduced by about 140 meters by Level 3 global corrections (curve **C**). The differing slopes of the curves is due to the re-estimation of periapsis time at each processing stage. Curves **A** and **B** have nearly the same slopes because Level 3 *cythera* processing began by overriding the project-supplied periapsis times with the "best values" derived from Level 2 global fitting.

Conclusions

(78-051A-02D)

The data submitted to NSSDC in January 1985 represent the most accurate Pioneer Venus radar altimetry data. All other data sets are known to be flawed to some degree. The systematic errors in the USGS topography maps are well understood—in fact, Level 3 *cythera* reprocessing was expressly designed to eliminate those errors.

The question remains whether it is necessary to re-generate the USGS contour maps merely for mission planning purposes. Magellan must use the accurate NSSDC data for its data-processing topography model, but if the zero contour level of the contour maps is re-interpreted relative to the new mean (or median, or modal) radius, the differential change in contours will be small, and the maps may be adequate for Magellan planning purposes. This matter will not be settled until we have more time to make a careful comparison between the existing contour maps and the NSSDC data set.

Appendix: PV Radar Processing Chronology

Date	*Data Processing Task Description*	*Archive Tape*	*Flagstaff Tape*
12/10/78	*Cythera* processing of quick-look data begins on IBM/370 CMS using project-supplied *a priori* orbit elements (Level 1).	PVCDAA	
03/01/79	Quick-look data reprocessed with new orbit elements when *a priori* elements missing or suspect (Level 0).	PVCDAB	
04/12/79	First *cythera* processing of EDR tapes on IBM/360-65 using measured spacecraft ephemeris (Level 2).	PVCDAC	
10/01/79	At end of 243-day nominal mission, global *cytfit* correction applied to all available orbits.	CYTFIT1	
11/01/79	First calculation of hypsometry (mean radius = 6051.5) and fit to tri-axial ellipse. Data were reported in the JGR article.		
01/80 to 01/81	Several *cytfit* global corrections followed by incremental data submissions to USGS.		PVCDxx
03/09/81	Global *cytfit* correction applied to all orbits. Mean radius was 6051.6 km.	CYTFIT2	
03/10/81	Last "complete" Level 2 data submission to USGS of orbits 3–567		PVCDBU PVCDBV
06/01/81	Last incremental Level 2 update sent to USGS, of all available orbits 3 to 834.		
07/01/81	All data processing moved to IBM/4341-II CMS at Harvard.		
08/01/81	Atmospheric refractive index data received from Kliore *et al.* Correction applied to *cythera* computation of radius and ρ.		
10/01/81	*Cythera* Level 3 reprocessing begins, using original EDRs but adjusting periapsis times according to Level 2 *cytfit* results.		
10/20/81	Level 3 *cythera* processing complete. Mean radius (including very many "bad" values) was 6052.02 km.	PVCD02	
10/30/81	Level 3 *cythp* editing complete. Mean radius 6051.89 km.	PVCD03	
10/31/81	Last global fitting of all orbits	CYTFIT7	
10/31/81	Last whole-planet composite data submission to USGS.	PVCD10	PVCDGA PVCDGB PVCDGC
04/26/82	Computation of mean reflectivity and radius (6051.92 km).		

11/03/82	Level 3 data displayed by *GIPS* software, additional data points deleted by hand-editing.	PVA062	
11/04/82	Last global fitting, affecting only those orbits containing updated radius measurements.	CYTFIT8	
11/04/82	Last incremental composite data submission to Flagstaff, Brown, and Arecibo.	PVA070	PVCDGT
08/01/83	Beginning of *GIPS* image processing system on VAX/780 UNIX system at MIT Earth Resources Laboratory.		
07/24/84	Hagfors and reflectivity values edited via *GIPS* display.	PVCD10	
Fall 1984	*Cytim* and *cytim2* programs take average of PV imaging data in neighborhood of each altimetry point, generate updated reflectivity values.	PVCD05	
Fall 1984	*Cytpc* program reads archive tapes, transforms radiometry data to equivalent noise temperature.	CYTPC	
01/01/85	VAX software merges PVCD05 with CYTPC, writes the NSSDC data submission tape.	NSSDC1	

PIONEER VENUS 1

CD TOTAL MAGNETIC FIELD DATA

78-051A-12B

Files 8-22 of the Composite Data (CD) tape contain total magnetic field data for the Pioneer Venus 1 satellite. The data are 32-second averaged magnetic field strength averaged over 2 major telemetry frames. The time parameter (in hour, minutes, and seconds) is for the center of the averaging interval.

PIONEER VENUS 1

MERGED TOTAL MAGNETIC FIELD & PEAK ELECTRIC FIELD DATA

78-051A-12C
78-051A-13B

Files 23-81 of the Composite Data (CD) tape contain merged total magnetic field plus peak electric field data for the Pioneer Venus 1 satellite. Each record contains a time parameter (UT in hours, minutes and seconds), a total magnetic field strength parameter (averaged over 2 major telemetry frames), and 4 peak electric field measurements.

FILE 1

CD

78-078D-01B
78-078E-03B
78-078F-03B
78-078G-03B

Relative Crustal velocity data

12/9/78

```
      1  PV DLBI Experiment
      2    Data format for CD file MITDLB1
      3    A. Formats
      4       Each probe's data are preceded by a record giving the probe
      5         name and number (the number is in column 15) followed
      6         by a column label record. The data for that probe follow
      7         in six columns written with fortran FORMAT(F10.2,5F10.1).
      8
      9    B. Contents:
     10       Col.  1 contains the UTC time of reception of the probe signal
     11             at the Canberra (DSS43) tracking station, expressed as
     12             seconds since zero hours UTC December 9,1978. For altitudes
     13             refer to A.Seiff's LAS/SAS tables of altitude versus UTC
     14             receive time.
     15
     16       Cols. 2, 3, and 4 give Cartesian components of the velocity of the
     17             probe relative to the crust of the planet, in meters per
     18             second. Col. 2 is the positive downward, Col. 3 the positive
     19             westward, and Col. 4 the positive northward component.
     20             These velocity components were determined directly from
     21             the DLBI and Doppler observations.
     22
     23       Cols. 5 and 6    give two of the three Cartesian components
     24             of the velocity of the probe relative to the ambient
     25             atmosphere, also in meters per second. Column 5 is the
     26             positive westward and column 6 the positive northward
     27             component. These relative velocity components were derived
     28             by theoretical calculation involving the aerodynamic drag,
     29             the gravitational, and the inertial forces acting on the
     30             probe. The horizontal velocity components of the wind are
     31             gotten by subtracting columns 5 and 6 from columns 3 and 4
     32             respectively.
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FILE 2

78-078E-03B

	1	2	3	4	5	6
1	PROBE UTC 1	DOWN	WEST	NORTH	COR WEST	COR NORTH
2	TIME					
3	68023.00	93.8	89.2	6.6	3.0	1.7
4	68032.44	89.2	85.1	4.5	2.4	0.8
5	68051.31	81.5	83.4	-1.5	3.0	0.1
6	68070.19	73.9	76.7	-5.8	2.6	0.0
7	68089.06	67.5	71.9	-7.1	2.2	0.0
8	68107.94	62.4	70.4	-7.3	0.4	0.0
9	68126.81	58.7	70.3	-7.1	0.1	0.0
10	68145.69	55.7	69.8	-6.4	0.0	0.0
11	68164.56	52.7	67.5	-3.1	0.0	0.0
12	68183.44	49.6	63.3	-0.1	0.0	0.0
13	68202.31	47.0	60.1	0.3	0.0	0.0
14	68221.19	45.5	58.9	-1.3	0.0	0.0
15	68240.06	43.9	57.0	-1.8	0.0	0.0
16	68258.94	41.7	54.2	-0.7	0.0	0.0
17	68277.87	39.7	51.3	0.7	0.0	0.0
18	68296.75	38.3	47.4	1.5	0.0	0.0
19	68315.62	37.0	43.2	2.1	0.0	0.0
20	68334.50	35.6	41.1	1.0	0.0	0.0
21	68353.37	34.6	40.4	0.3	0.0	0.0
22	68372.25	33.6	39.1	-1.5	0.0	0.0
23	68391.12	32.2	38.2	-1.5	0.0	0.0
24	68410.00	31.7	38.1	-1.2	0.0	0.0
25	68428.87	31.6	37.4	-0.9	0.0	0.0
26	68447.75	30.8	36.8	0.1	0.0	0.0
27	68466.62	29.8	36.7	0.7	0.0	0.0
28	68485.50	28.5	35.3	0.7	0.0	0.0
29	68504.37	27.5	33.3	0.2	0.0	0.0
30	68523.25	27.3	33.0	-0.4	0.0	0.0
31	68542.12	27.0	33.1	-1.0	0.0	0.0
32	68561.00	26.8	32.2	-1.8	0.0	0.0
33	68579.94	26.1	30.8	-2.6	0.0	0.0
34	68598.81	25.5	30.0	-2.7	0.0	0.0
35	68617.69	25.1	29.4	-2.0	0.0	0.0
36	68636.56	24.7	28.4	-1.2	0.0	0.0
37	68655.44	24.0	27.7	-0.9	0.0	0.0
38	68674.31	23.4	26.6	-0.9	0.0	0.0
39	68693.19	23.1	25.2	-0.8	0.0	0.0
40	68712.06	22.6	25.2	-0.4	0.0	0.0
41	68730.94	22.0	25.9	0.0	0.0	0.0
42	68749.81	21.5	25.9	-0.2	0.0	0.0
43	68768.69	21.2	25.1	-1.1	0.0	0.0
44	68787.56	20.8	24.0	-2.3	0.0	0.0
45	68806.44	20.6	22.7	-3.7	0.0	0.0
46	68825.31	20.7	21.7	-4.7	0.0	0.0
47	68844.19	20.7	21.6	-4.3	0.0	0.0
48	68863.06	20.1	20.7	-3.9	0.0	0.0
49	68882.00	19.5	19.2	-2.9	0.0	0.0
50	68900.87	19.3	18.1	-2.1	0.0	0.0
51	68919.75	18.8	17.0	-1.5	0.0	0.0
52	68938.62	18.3	16.5	-1.1	0.0	0.0
53	68957.50	18.2	16.4	-0.9	0.0	0.0
54	68976.37	18.3	16.2	-1.0	0.0	0.0
55	68995.25	18.4	16.1	-1.3	0.0	0.0
56	69014.12	18.1	15.6	-1.3	0.0	0.0
57	69033.00	17.4	15.2	-1.1	0.0	0.0
58	69051.87	17.1	14.6	-0.7	0.0	0.0

*B MODCOMP SOURCE EDITOR DATE 01/26/82 12:02:09 PAGE 1

FILE 3

```
    1  ******** ******** ******** ******** ******** ********
    2  BULLETIN CIRCD CREATED: 06/06/79 16:44:00 BY JPLALL
    3  ******** ******** ******** ******** ******** ********
    4  *
    5  A ZONAL AND TIME AVERAGE OF TEMPERATURE VERSUS LATITUDE FOR ORBITS 4,6,7,10-14,
    6  17-19,33-36 AND 38-40 HAS BEEN ENTERED IN THE CD DATA BASE AS CIRTEMP. THE FOR-
    7  MAT IS AS FOLLOWS: LATITUDE, CHANNEL 2 TEMPERATURE, CHANNEL 3 TEMPERATURE, CHAN-
    8  NEL 4 TEMPERATURE, AND THE SEQUENCE REPEATS. EACH PHYSICAL RECORD OF 80 BYTES
    9  CONTAINS 5 OF THESE SEQUENCES AND THERE ARE A TOTAL OF 36 PHYSICAL RECORDS. ALL
   10  NUMBERS ARE 32 BIT (4 BYTE) INTEGERS AND HAVE BEEN MULTIPLIED BY 100. CHANNEL 2
   11  IS REPRESENTATIVE OF THE TEMPERATURE AT 90 KM, CHANNEL 3 AT 80 KM AND CHANNEL 4
   12  AT 70 KM.
   13
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CIR

78-51A-16C

Zonal av. Temp vs Lat.

12/8/78 – 1/13/79

*R MODCOMP SOURCE EDITOR DATE 01/26/82 14:21:12 PAGE 1

FILE 8

	Time	
1	H M S	
2	19: 8: 6.0	8.66
3		
4	19: 8:38.0	9.85
5	19: 9:10.0	8.93
6	19: 9:42.0	8.83
7	19:10:14.0	9.79
8	19:10:46.0	9.88
9	19:11:18.0	9.35
10	19:11:50.0	8.97
11	19:12:22.0	9.21
12	19:12:54.0	9.26
13	19:13:26.0	9.74
14	19:13:58.0	8.35
15	19:14:30.0	8.69
16	19:15: 2.0	9.41
17	19:15:34.0	9.57
18	19:16: 6.0	9.39
19	19:16:38.0	10.10
20	19:17:10.0	10.70
21	19:17:42.0	9.94
22	19:18:14.0	9.10
23	19:18:46.0	9.12
24	19:19:18.0	8.91
25	19:19:50.0	9.01
26	19:20:22.0	7.71
27	19:20:54.0	8.24
28	19:21:26.0	9.91
29	19:21:58.0	9.85
30	19:22:30.0	9.93
31	19:23: 2.0	9.08
32	19:23:34.0	9.06
33	19:24: 6.0	9.04
34	19:24:38.0	8.98
35	19:25:10.0	8.85
36	19:25:42.0	8.30
37	19:26:14.0	8.34
38	19:26:46.0	8.20
39	19:27:18.0	8.56
40	19:27:50.0	8.74
41	19:28:22.0	8.69
42	19:28:54.0	9.14
43	19:29:26.0	9.58
44	19:29:58.0	9.51
45	19:30:30.0	9.60
46	19:31: 2.0	9.43
47	19:31:34.0	9.40
48	19:32: 6.0	9.44
49	19:32:38.0	9.91
50	19:33:10.0	9.98
51	19:33:42.0	10.98
52	19:34:14.0	9.60
53	19:34:46.0	10.64
54	19:35:18.0	10.72
55	19:35:50.0	8.94
56	19:36:22.0	9.61
57	19:36:54.0	11.47
58	19:37:26.0	10.47

ORBIT 121

78-051A-12B → 4/4/79 - 6/3/79

1900 - 2300

*B MODCOMP SOURCE EDITOR DATE 01/26/82 11:53:37 PAGE 1

FILE 23 — 79

5/29/79 - 6/8/79

			ORBIT 203			
	tED					
	TIME	BMAG	100 HZ	730 HZ	5.4K HZ	30K HZ
	20:46:35.9	11.23	-1.0E+32	-1.0E+32	-1.0E+32	-1.0E+32
	20:48:43.9	11.37	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	20:50:51.9	11.72	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	20:52:59.9	12.07	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	20:55: 7.9	12.73	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	20:57:15.9	12.68	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	20:59:23.9	13.15	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	21: 1:31.9	13.79	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	21: 3:39.9	14.22	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	21: 5:47.9	13.89	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	21: 7:55.9	14.09	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	21:10: 3.9	14.04	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	21:12:11.9	14.37	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	21:14:19.9	14.15	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	21:16:27.9	13.28	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	21:18:35.9	13.64	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	21:20:43.9	15.26	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	21:22:51.9	15.67	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	21:24:59.9	15.96	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	21:27: 7.9	16.21	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	21:28: 9.9	17.85	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	21:28:41.9	17.25	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	21:29:13.9	17.20	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	21:29:45.9	17.35	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	21:30:17.9	17.26	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	21:30:49.9	17.36	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	21:31:21.9	17.37	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	21:31:53.9	17.64	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	21:32:25.9	17.49	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	21:32:57.9	17.51	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	21:33:29.9	18.23	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	21:34: 1.9	17.94	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	21:34:33.9	18.49	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	21:35: 5.9	18.24	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	21:35:37.9	18.51	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	21:36: 9.9	18.93	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	21:41:45.9	20.28	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	21:42:17.9	20.24	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	21:42:49.9	20.77	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	21:43:21.9	20.67	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	21:43:53.9	22.43	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	21:44:25.9	22.07	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	21:44:57.9	21.15	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	21:45:29.9	21.64	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	21:46: 1.9	23.66	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	21:46:33.9	23.83	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	21:47: 5.9	22.48	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	21:47:37.9	22.68	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	21:48: 9.9	23.45	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	21:48:41.9	23.47	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	21:49:13.9	24.36	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	21:49:45.9	25.11	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	21:50:17.9	26.19	0.00E+00	0.00E+00	0.00E+00	0.00E+00

PRINT

File 1 CD 002

78-051A-01B ?

OETP Observed Ionopause locations

File 83

ORBIT	DATE	PERIAPSIS OUTBOUND CROSSING				INBOUND CROSSING						Solar zenith Angle
		HH:MM:SS	LAT	LST	ALT	SECS	HH:MM:SS	LAT	LST	ALT	SZA	D/RV
SECS												
1	78339	15:11:12				54398	15: 6:38	40.6	15.5	619.	63.5	0.005
4901		15:15: 1	0.1	16.4	546.		66.5	-0.013				
2	78340	14:21:42				51276	14:14:36	52.1	15.2	832.	66.4	0.035
2130		14:28:50	-15.8	16.8	834.		72.9	0.023				
3	78341	14:31:46				51971	14:26:11	45.9	15.6	579.	66.2	-0.007
2690		14:38:10	-13.0	16.9	687.		73.7	-0.002				
4	78342	14:40:12				52272	14:31:12	59.6	14.9	1110.	65.5	0.075
3271		14:47:51	-18.7	17.1	867.		77.1	0.021				
5	78343	14:48:14				52724	14:38:44	61.3	14.9	1206.	70.6	0.089
0		0: 0: 0	0.0	0.0	0.		0.0	0.000				
7	78345	15: 4:10				53897	14:58:17	47.4	16.0	592.	71.1	-0.013
4627		15:10:27	-12.9	17.3	645.		79.6	-0.021				
8	78346	15:11:51				54307	15: 5: 7	51.0	15.9	714.	71.9	0.006
5204		15:20: 4	-21.1	17.6	956.		83.8	0.022				
9	78347	15:19:28				54912	15:15:12	39.9	16.5	386.	74.1	-0.053
5530		15:25:30	-12.3	17.5	600.		82.1	-0.034				
10	78348	15:28:58				55333	15:22:13	51.1	16.1	708.	74.0	0.000
6157		15:35:57	-16.0	17.7	742.		85.3	-0.017				
11	78349	15:38:23				56025	15:33:45	41.8	16.6	423.	75.5	-0.050
6592		15:43:12	-6.0	17.6	441.		84.3	-0.064				
12	78350	15:47:36				56335	15:38:55	58.7	15.9	1032.	75.6	0.051
7290		15:54:50	-17.1	17.9	778.		88.7	-0.017				
13	78351	15:56:41				57098	15:51:38	43.7	16.7	469.	77.7	-0.046
7776		16: 2:56	-12.7	18.0	628.		89.1	-0.043				
14	78352	16: 5:40				57567	15:59:27	48.9	16.6	623.	78.2	-0.022
8333		16:12:13	-14.1	18.1	672.		91.0	-0.039				
16	78354	16:23:22				58526	16:15:26	56.0	16.5	896.	79.1	0.021
9532		16:32:12	-23.6	18.5	1052.		96.3	0.015				
17	78355	16:31:58				0	0: 0: 0	0.0	0.0	0.	0.0	0.000
0045		16:40:45	-23.5	18.6	1044.		97.6	0.012				
18	78356	16:40:26				59684	16:34:44	46.7	17.2	549.	83.1	-0.044
0525		16:48:45	-21.7	18.7	959.		98.7	-0.003				
19	78357	16:48:46				59988	16:39:48	59.8	16.5	1080.	81.2	0.047
1082		16:58: 2	-25.4	18.9	1137.		100.9	0.024				
20	78358	16:57: 1				60552	16:49:12	55.6	17.0	873.	83.1	0.009
1585		17: 6:25	-26.0	19.0	1162.		102.4	0.027				
21	78359	17: 5:12				61012	16:56:52	57.6	16.9	967.	83.5	0.024
2079		17:14:39	-26.1	19.1	1170.		103.8	0.027				
22	78360	17:13:23				61587	17: 6:27	52.0	17.4	729.	86.1	-0.020
2471		17:21:11	-19.5	19.1	869.		104.3	-0.023				
23	78361	17:21:31				62123	17:15:23	48.7	17.6	611.	88.3	-0.044
2981		17:29:41	-21.0	19.2	932.		106.0	-0.014				
24	78362	17:29:37				62502	17:21:42	56.0	17.4	893.	86.9	0.005
3532		17:38:52	-25.3	19.4	1133.		108.0	0.018				
25	78363	17:37:40				63060	17:31: 0	51.0	17.7	690.	89.6	-0.034
3752		17:42:32	-6.2	19.2	444.		106.9	-0.055				
26	78364	17:45:41				63395	17:36:35	60.3	17.3	1109.	86.9	0.041
4448		17:54: 8	-22.1	19.6	985.		110.6	-0.006				
27	78365	17:53:40				63925	17:45:25	57.2	17.6	953.	89.1	0.011
5005		18: 3:25	-27.2	19.8	1233.		112.3	0.035				
28	79001	18: 1:37				64388	17:53: 8	58.1	17.6	996.	89.6	0.017
5151		18: 5:51	-3.1	19.4	377.		111.1	-0.107				
30	79003	18:17:24				65228	18: 7: 8	64.1	17.3	1330.	88.2	0.075
6402		18:26:42	-25.7	20.1	1136.		116.4	0.021				

ORBITS 1-975
12/5/78 – 8/7/81

31	79004	18:22:26			0	0: 0: 0	0.0	0.0	0.	0.0	0.000
6662	18:31: 2	-22.7	20.1	1009.	117.9	0.001					
32	79005	18:27:21		65790	18:16:30		65.8	17.3	1461.	88.5	0.096
7222	18:40:22	-38.3	20.6	1938.	117.8	0.154					
33	79006	18:32:15			0	0: 0: 0	0.0	0.0	0.	0.0	0.000
7275	18:41:15	-24.2	20.4	1087.	120.7	0.016					
34	79007	18:37: 9		66215	18:23:35		71.9	16.2	2073.	85.0	0.204
7741	18:49: 1	-34.6	20.8	1681.	120.7	0.115					
35	79008	18:42: 2		66859	18:34:19		55.1	18.6	863.	97.6	-0.018
8149	18:55:49	-40.6	21.0	2122.	120.4	0.187					
36	79009	18:46:54		66896	18:34:56		68.6	17.3	1711.	89.0	0.136
8476	19: 1:16	-42.2	21.2	2261.	120.8	0.211					
37	79010	18:51:47			0	0: 0: 0	0.0	0.0	0.	0.0	0.000
8654	19: 4:14	-36.4	21.1	1815.	123.7	0.140					
38	79011	18:56:33		67732	18:48:52		55.0	18.9	853.	100.4	-0.023
8812	19: 6:52	-29.2	21.1	1344.	126.7	0.067					
39	79012	19: 0:55		68175	18:56:15		42.0	19.6	424.	110.0	-0.099
9272	19:14:32	-40.1	21.5	2081.	124.4	0.185					
41	79014	19: 9:34		68451	19: 0:51		58.7	19.0	1042.	100.3	0.009
9650	19:20:50	-32.5	21.5	1551.	129.3	0.105					
42	79015	19:13:53		69090	19:11:30		30.8	20.3	236.	120.5	-0.124
9532	19:18:52	-6.6	21.0	468.	134.3	-0.064					
43	79016	19:18:12		69283	19:14:43		36.3	20.2	320.	118.4	-0.113
0157	19:29:17	-31.8	21.7	1515.	131.7	0.104					
44	79017	19:22:23		69232	19:13:52		58.0	19.3	995.	103.3	-0.002
0302	19:31:42	-25.5	21.6	1145.	135.1	0.049					
45	79018	19:25:56			0	0: 0: 0	0.0	0.0	0.	0.0	0.000
1028	19:43:48	-51.1	22.6	3134.	122.6	0.357					
46	79019	19:29:28		69716	19:21:56		54.2	19.8	831.	108.2	-0.031
0854	19:40:54	-33.1	22.0	1584.	134.1	0.120					
48	79021	19:36:30		70311	19:31:51		41.8	20.6	433.	120.3	-0.092
1040	19:44: 0	-17.9	21.9	828.	142.4	0.010					
49	79022	19:40: 2		70241	19:30:41		60.7	19.6	1167.	104.8	0.026
1325	19:48:45	-23.0	22.1	1046.	141.9	0.046					
50	79023	19:43:34		70940	19:42:20		24.8	21.3	192.	135.1	-0.109
1609	19:53:29	-27.5	22.3	1280.	140.9	0.082					

File 83 p.2

File 83 p.3

ORBIT	DATE	PERIAPSIS OUTBOUND CROSSING				INBOUND CROSSING						
SECS	HH:MM:SS	HH:MM:SS	LAT	LST	ALT	SECS	HH:MM:SS	SZA	LAT	LST	ALT	SZA	D/RV
951	81195	1:57:38			6629		1:50:29		43.9	21.1	1284.	123.8	0.053
7750		2: 9:10	-32.8	22.8	1996.		139.9		0.199				
952	81196	1:57:39			6585		1:49:45		46.6	21.1	1391.	122.3	0.069
7834		2:10:34	-37.0	23.0	2270.		137.3		0.239				
953	81197	1:57:40			6856		1:54:16		28.6	21.7	906.	138.8	0.017
8007		2:13:27	-44.9	23.4	2879.		131.1		0.328				
955	81199	1:57:44			6525		1:48:45		50.4	21.2	1567.	121.2	0.096
8061		2:14:21	-46.9	23.7	3070.		129.7		0.357				
956	81200	1:57:47			0		0: 0: 0		0.0	0.0	0.	0.0	0.000
7811		2:10:11	-35.3	23.4	2178.		140.5		0.230				
957	81201	1:57:50			6454		1:47:34		54.5	21.2	1787.	118.4	0.130
7791		2: 9:51	-34.1	23.5	2106.		141.9		0.221				
958	81202	1:57:54			6694		1:51:34		40.5	21.9	1204.	133.3	0.055
7774		2: 9:34	-33.0	23.6	2043.		143.2		0.213				
959	81203	1:57:57			6707		1:51:47		39.8	22.0	1189.	134.8	0.055
8318		2:18:38	-55.5	0.6	4028.		120.9		0.503				
960	81204	1:58: 2			6619		1:50:19		45.6	21.9	1392.	129.7	0.080
8040		2:14: 0	-45.1	0.2	2935.		131.7		0.338				
961	81205	1:58: 7			6531		1:48:51		51.0	21.8	1630.	124.7	0.111
7612		2: 6:52	-23.0	23.6	1547.		153.3		0.148				
962	81206	1:58:12			6758		1:52:38		37.3	22.5	1131.	139.6	0.055
7791		2: 9:51	-32.9	24.0	2049.		144.1		0.215				
963	81207	1:58:17			6731		1:52:11		39.4	22.5	1194.	138.2	0.063
7831		2:10:31	-34.7	0.1	2162.		142.3		0.231				
964	81208	1:58:23			6552		1:49:12		50.6	22.2	1625.	126.9	0.114
7909		2:11:49	-38.2	0.4	2405.		138.5		0.264				
965	81209	1:58:28			6447		1:47:27		56.4	21.9	1943.	121.0	0.158
8145		2:15:45	-48.2	0.8	3238.		127.8		0.382				
966	81210	1:58:34			6659		1:50:59		44.9	22.6	1393.	134.1	0.088
7935		2:12:15	-38.9	0.6	2458.		137.5		0.270				
967	81211	1:58:40			6477		1:47:57		55.4	22.2	1894.	123.0	0.153
7624		2: 7: 4	-21.7	0.3	1510.		155.3		0.145				
968	81212	1:58:46			6605		1:50: 5		48.8	22.7	1560.	130.9	0.110
7797		2: 9:57	-31.2	0.6	1976.		145.0		0.205				
969	81213	1:58:53			6642		1:50:42		46.9	22.9	1486.	133.3	0.102
8019		2:13:39	-41.8	1.0	2692.		133.4		0.301				
970	81214	1:58:59			6288		1:44:48		64.6	21.7	2573.	113.2	0.257
8019		2:13:39	-41.5	1.1	2671.		133.3		0.298				
971	81215	1:59: 5			6568		1:49:28		51.8	22.8	1715.	128.6	0.131
7982		2:13: 2	-39.6	1.2	2522.		135.0		0.276				
972	81216	1:59:12			6409		1:46:49		60.0	22.4	2213.	119.6	0.201
7844		2:10:44	-32.4	1.0	2051.		142.1		0.212				
973	81217	1:59:18			6605		1:50: 5		50.4	23.1	1654.	130.8	0.125
7905		2:11:45	-35.2	1.2	2226.		138.6		0.234				
974	81218	1:59:24			6686		1:51:26		46.0	23.4	1467.	135.7	0.103
8070		2:14:30	-42.7	1.6	2770.		130.1		0.308				
975	81219	1:59:30			7080		1:58: 0		19.8	0.3	889.	162.0	0.051

File 84

See file 5

78-05/A-02C

ORBITER RADAR MAPPER COMPOSITE DATA FILES

Composite data CDFILEs have been entered into the CD database since mid-December. Because the software that produces them has gone through several changes and improvements, we have replaced each CDFILE at least once since then. At present, data for orbits 3-14, 47, and 49-53 is available. The gap is, of course, due to the instrument hardware problems that beset us between orbits 14 and 33, when CRAD was shut off for 10 days.

Our CD files are written in a mixture of IBM binary and EBCDIC code. The precise format is detailed in file 'CDDESC' which has itself been stored on the CDFILE disk. Our CDFILEs have the standard nomenclature CRAxnnn where 'x' is an alphabetic character showing the update level of the data and processing program, and 'nnn' represents the orbit number.

When CDFILEs belonging to a new update level are entered into the CDFILE database, we will accompany them with a short file containing details of the updates that have been applied. These files will be named 'CRAxDSC' where 'x' will be the same letter as used in the CDFILE names themselves.

Experimenters who require additional information concerning our CDFILEs, or who want 'back numbers' should MAILIN a message to MITALL.

CRAD Software Processing Group, MIT 54-426 Cambridge, Mass 02138
(617) 253 6485 2/13/79

File 85

IBM 360
Double precision
floating point
words

DUMP OF TAPE CD-002

INPUT TAPE CD-002 ON TU1
DATA INPUT FS DF 3 SR 3 1 2

FILE	INPUT RECS.	DATA RECORDS INPUT	MAX. SIZE	READ ERROR SUMMARY PERM	ZERO B	SHORT	UNDEF.	INPUT RETRIES #RECS.	TOTAL#
1	179	179	800	0	0	0	0	0	0

FILE 3 RECORD 1 LENGTH 800BYTES

(0)	0001DF80	00000000	00000000	00000000	496DF36A	3C800000	496E464C	55FFFFFF	496E5927	B3500000
(40)	496EEC02	ABE00000	496F3EDC	810FFFFF	496F91B2	D66FFFFF	496FE487	C4300000	49703778	F6EFFFFF
(80)	49708A68	E6E00000	4970DD55	7F2FFFFF	49713040	39B00000	00000000	00000000	00000000	00000000
(120)	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
(160)	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
(200)	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
(240)	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
(280)	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
(320)	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
(360)	00000000	00000000	48683118	DE000000	00000000	00000000	48758443	6B000000	487AADDA	D9000000
(400)	487FD740	580C0000	4884FFDA	180C0000	488A286F	6C000000	488FE1CC	09000000	48954798	E5C00000
(440)	00000000	00000000	489ECAB1	70000000	48A3F3CB	64000000	00000000	00000000	48AE4171	9E000000
(480)	48B36893	65000000	48B88FB4	59000000	48BDB6D6	3AFFFFFF	48C2DDF8	B0000000	48C804E3	24000000
(520)	48CD2AF9	FAC00000	48D2510C	57C00000	48D77718	44CC0000	48DC9D22	55000000	48E1C32D	45000000
(560)	48E6E937	80000000	00000000	00000000	00000000	C0000000	48F65520	2F000000	00000000	00000000
(600)	49100A31	F4200000	49105C81	B5B00000	00000000	00000000	4911011E	38100000	4911535F	51300000
(640)	4911A59F	FC700000	4911F7E0	1CE00000	49124A1F	E4000000	49129C5F	81400000	4912EE9D	0FD00000
(680)	491340D2	AF400000	49139307	856FFFFF	4913E53B	ECCC0000	00000000	00000000	49148SA1	18800000
(720)	4914DBD3	5EA00000	49152E05	62C00000	49158037	28B00000	4915D268	A2200000	49162495	EC200000
(760)	491676CB	02F00000	4916C8FB	E5500000	49171B2C	8F700000	49176D5C	F4FFFFFF	4917C006	ACB00000

FILE 3 RECORD 2 LENGTH 800BYTES

(0)	491812B0	1C500000	49186559	57900000	4918B802	5F800000	4919CAAB	4C000000	49195D53	F1800000
(40)	4919AFFC	6F100000	491A02A4	C3100000	491A554C	C8100000	491AA7F4	A7400000	00000000	00000000
(80)	491B4D43	84A00000	491B9FEA	95700000	491BF291	6B700000	491C4538	0B200000	491C97DE	72A00000
(120)	491CEA84	68FC0000	491D3D2A	28400000	491D8FCF	99200000	491DE274	B04FFFFF	491E3519	518FFFFF
(160)	491E87BD	8B000000	491EDAE1	3B7FFFFF	491F2D04	87200000	491F7FA7	19AFFFFF	491FD248	E3E00000
(200)	492024E9	B73FFFFF	49207789	B8300000	4920CA28	C1F00000	49211CC6	EDB00000	49216F64	32600000
(240)	4921C200	117FFFFF	4922149A	058FFFFF	49226732	489FFFFF	4922B9C8	668FFFFF	49230C5C	183FFFFF
(280)	49235EED	91AFFFFF	4923B17C	E47FFFFF	492404CA	E30FFFFF	49245696	A4200000	4924A521	08300000
(320)	4924FBA9	E08FFFFF	49254E30	6DCFFFFF	4925A0AE	2E6FFFFF	4925F328	4C2FFFFF	492645SF	73E00000
(360)	00000000	00000000	00000000	00000000	49273CEC	F8A00000	49278F50	62200000	4927E1B0	F5900000
(400)	492834OF	A4500000	4928866C	D25C0000	4928D8C9	1C5FFFFF	49292B25	32A00000	49297D7C	FA100000
(440)	4929CFC6	3F5C0000	492A220A	7AA00000	492A744B	DED00000	492AC68B	B7000000	492B18CA	82A00000
(480)	492B6B08	89D00000	492BBD46	0EF00000	492C0F80	89500000	492C61AE	43800000	492CB3D9	5F800000
(520)	492D0602	F35FFFFF	492D582B	82F00000	492DAA53	6EA00000	00000000	00000000	492E4EA2	26700000
(560)	492EA0C5	08300000	492EF2D3	D10FFFFF	492F44DE	DED00000	492F96E7	FB400000	492FE8F0	03300000
(600)	49303AF4	EDA00000	49308CEB	BE800000	4930DEDF	7C9FFFFF	493131BD	72800000	4931849A	30600000
(640)	4931D776	41700000	49322A51	DBE00000	49327D2D	28D00000	4932D004	0D600000	493322C7	E3300000
(680)	49337587	A2500000	4933C845	34C00000	49341B01	2CA00000	4934EDBB	F4B00000	4934CC7E	EF200000
(720)	4935132F	55600000	493565E4	A7BFFFFF	00000000	00000000	4936CB25	5F700000	49365DBF	CF900000
(760)	00000000	00000000	493702EE	31EFFFFF	49375583	3B200000	00000000	00000000	4937FAA8	27EFFFFF

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