APPENDIX A: ORBITER MISSION DATABOOK

Go to TOC

A.1 Orbiter Mission Database

Orbiter Mission Database

10/24/96

Departure Coord. System: Hyperbolic Asymptote Earth equator and equinox of J2000 WRT: Earth
Iorb = 152
all times Ephemeris Time unless otherwise indicated

Day in Launch Period	Injection Date	Injection Time	Cartesian X [km]	Cartesian Y [km]	Cartesian Z [km]	Cartesian Xdot [km/s]	Cartesian Ydot [km/s]	Cartesian Zdot [km/s]	Depart C3 [km^2/s^2]	Depart Dec.Vinf [deg.]	Depart RA.Vinf [deg.]
1	**12/10/98**	**20:12:07.2**	1483.362	5711.844	-2908.145	-11.049	2.319	-2.213	**11.189**	**14.404**	**217.881**
2	12/11/98								11.101	14.141	217.727
3	12/12/98								10.941	14.849	218.044
4	12/13/98								10.781	15.550	218.249
5	12/14/98								10.636	16.161	218.421
6	12/15/98								10.508	16.754	218.641
7	12/16/98								10.393	17.377	218.880
8	**12/17/98**	**19:11:51.4**	1505.555	5624.569	-3040.162	-11.106	2.515	-1.407	**10.287**	**18.860**	**219.530**
9	12/18/98								10.193	18.693	219.325
10	12/19/98								10.109	19.368	219.518
11	12/20/98								10.036	20.046	219.691
12	12/21/98								9.974	20.723	219.845
13	12/22/98								9.924	21.392	219.983
14	**12/23/98**								**9.885**	**22.051**	**220.106**

Maximum 11.189

MacDAC Injection Data [from 5/31/96]

Launch Date	Launch Time [UTC]	3rd Stage Burnout [UTC]	C3 km^2/s^2	Decl Vinf [deg.]	RA Vinf [deg.]
12/10/98	19:30:44	20:11:06	11.2628	13.496	217.357
12/17/98	18:28:37	19:10:50	10.288	18.027	219.111
12/25/98	17:00:40	17:46:25	9.841	23.322	220.322

Orbiter 10/24/96

Arrival

Coord System: Hyperbolic Asymptote equator and node of epoch [IAU] WRT: Mars

Iorb = -11073

all times Ephemeris Time unless otherwise indicated

Day in Launch Period	Flight Time [days]	Arrival Date	Arrival Time	Arrival Peri.Rad* [km]	Incl. [deg.]	Arrival T.wrt.Peri [sec.]	Arrival Vinf [km/s]	Arrival Dec.Vinf [deg.]	Arrival RA.Vinf [deg.]
1	**286.451**	**9/23/99**	**07:01:37.9**	**3557.200**	**92.930**	**0.000**	**3.344**	**-29.727**	**173.327**
2	288.065	9/25/99	01:33:22.5	3557.200	92.930	0.000	3.341	-29.817	172.451
3	287.734	9/25/99	17:36:23.0	3557.200	92.930	0.000	3.343	-30.229	172.606
4	287.445	9/26/99	10:40:08.3	3557.200	92.930	0.000	3.345	-30.652	172.734
5	287.179	9/27/99	04:18:12.1	3557.200	92.930	0.000	3.348	-31.087	172.845
6	286.921	9/27/99	22:06:50.1	3557.200	92.930	0.000	3.352	-31.530	172.949
7	286.685	9/28/99	16:26:17.5	3557.200	92.930	0.000	3.356	-31.980	173.036
8	**285.242**	**9/29/99**	**01:00:03.6**	**3557.200**	**92.930**	**0.000**	**3.365**	**-32.870**	**173.728**
9	286.293	9/30/99	07:01:54.1	3557.200	92.930	0.000	3.367	-32.897	173.156
10	286.139	10/1/99	03:19:39.4	3557.200	92.930	0.000	3.374	-33.362	173.188
11	286.012	10/2/99	00:17:49.6	3557.200	92.930	0.000	3.382	-33.831	173.202
12	285.914	10/2/99	21:56:26.7	3557.200	92.930	0.000	3.391	-34.301	173.198
13	285.844	10/3/99	20:15:23.6	3557.200	92.930	0.000	3.400	-34.772	173.177
14	**285.802**	**10/4/99**	**19:15:12.8**	**3557.200**	**92.930**	**0.000**	**3.411**	**-35.241**	**173.138**

Maximum 3.411

* does not include effects of altitude loss during MOI finite burn

Orbiter 10/24/96

Capture Orbit*

Coord System: Classical (Keplerian) equator and node of epoch [IAU] WRT: Mars

Iorb = -71

all times Ephemeris Time unless otherwise indicated

Day in Launch Period	Capture Semi-M.Ax [km]	Capture eccen.	Capture Incl [deg.]	Capture Node [deg.]	Capture Arg.Peri [deg.]	Capture Mean.An [deg.]	Local Mean Solar Time of DN [hh:mm:ss PM]	Days to Lander Arrival	Capture Period [hrs]
1	**21473.888**	**0.83434765**	**92.93**	**-4.998**	**151.00**	**0**	**6:15:29 PM**	**71.6**	**26.5**
2	21329.956	0.83322985	92.93	-5.868	151.12	0	6:08:17 PM	69.8	26.3
3	21420.244	0.83393279	92.93	-5.685	151.51	0	6:07:37 PM	69.1	26.4
4	21539.985	0.83485597	92.93	-5.528	151.92	0	6:06:45 PM	68.4	26.7
5	21713.530	0.83617587	92.93	-5.386	152.32	0	6:05:47 PM	67.7	27.0
6	21925.739	0.83776146	92.93	-5.252	152.73	0	6:04:45 PM	67.0	27.4
7	22185.047	0.83965777	92.93	-5.132	153.14	0	6:03:38 PM	66.2	27.9
8	**22781.944**	**0.8438588**	**92.93**	**-4.377**	**153.94**	**0**	**6:05:55 PM**	**65.8**	**29.0**
9	22891.985	0.84460937	92.93	-4.947	153.95	0	6:01:00 PM	64.6	29.2
10	23344.949	0.84762443	92.93	-4.881	154.34	0	5:59:30 PM	63.7	30.1
11	23895.555	0.85113549	92.93	-4.832	154.74	0	5:57:52 PM	62.9	31.2
12	24542.069	0.85505705	92.93	-4.801	155.12	0	5:56:06 PM	62.0	32.4
13	25306.845	0.85943724	92.93	-4.787	155.50	0	5:54:12 PM	61.0	34.0
14	**26227.260**	**0.86437012**	**92.93**	**-4.790**	**155.86**	**0**	**5:52:11 PM**	**60.1**	**35.8**

* Data are approximate, based on 29 hr orbit at end of Primary period, impulsive maneuvers.

Lander Arrival
12/3/99 20:56:51

A.2 Orbiter DSN and Air Force Tracking Initial Acquisition Geometry

ORBITER

JET PROPULSION LABORATORY INTEROFFICE MEMORANDUM

312/96.2-2010

Aug 21, 1996

TO: Phil Knocke

FROM: Steve Williams SW

SUBJECT: Mars 98 Tracking Station Initial Acquisition Geometry Update

This memo provides Mars 98 Initial acquisition geometries for a 2 hour period following stage 3 burnout for the 3 DSN stations and the 12 Air Force tracking stations given below. The burnout states used here were provided by you in a personal communication. The data is arranged in seven groups:

1) day 1 lander trajectories launching on 3 Jan 99 (short coast)
2) day 8 lander trajectories launching on 10 Jan 99 (short coast)
3) day 16 lander trajectories launching on 16 Jan 99 (short coast)
4) day 25 lander trajectories launching on 27 Jan 99 (short coast)
5) day 1 orbiter trajectories launching on 10 Dec 98 (short coast)
6) day 8 orbiter trajectories launching on 17 Dec 98 (short coast)
7) day 16 orbiter trajectories launching on 25 Dec 98 (short coast)

As before, four parameters are plotted for each station: range, range rate, elevation angle, and aspect angle between the S/C z-axis and the vector to the station (z-axis is assumed to be the S/C velocity vector at burnout as we discussed).

Stations shown in this memo are :

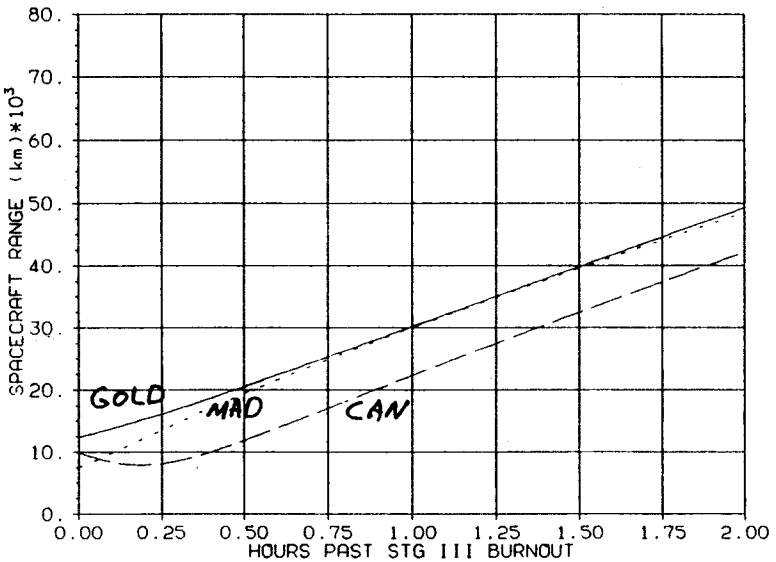
GOLD : Goldstone
MAD : Madrid
CAN : Canberra
ANT : Antigua
ASC : Ascension Island
DGS : Diego Garcia
LBV : Libreville, Gabon
IOS : Indian Ocean
KWAJ : Ennylabegan
HTS : Hawaii
GTS : Guam
HBK : Hartebeesthoek, South Africa
TEL4 : Tel-4
VTS : Vandenberg
PRTH : Perth

Distribution
D. Murrow
R. Roncoli

ORBITER DAY 1 (12/10/98) SHORT COAST

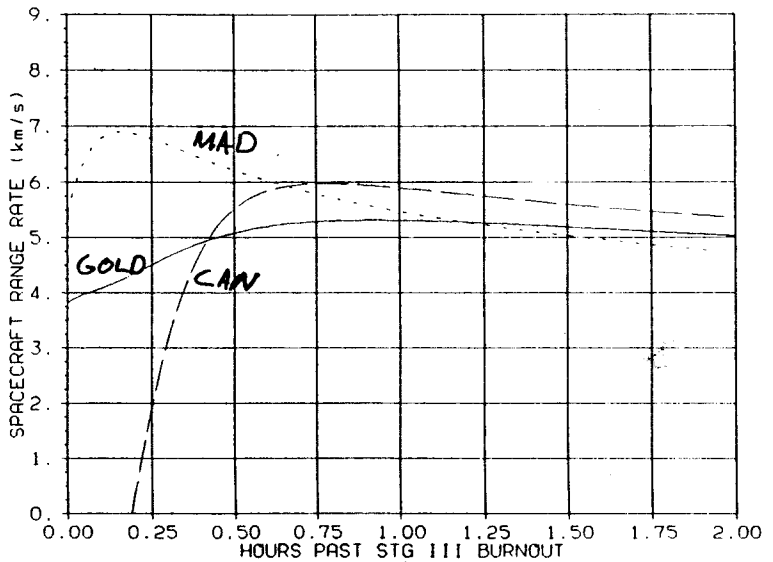
TRACKING STATION GEOMETRY (ORBITER): DAY 1 SHORT COAST

SPACECRAFT RANGE



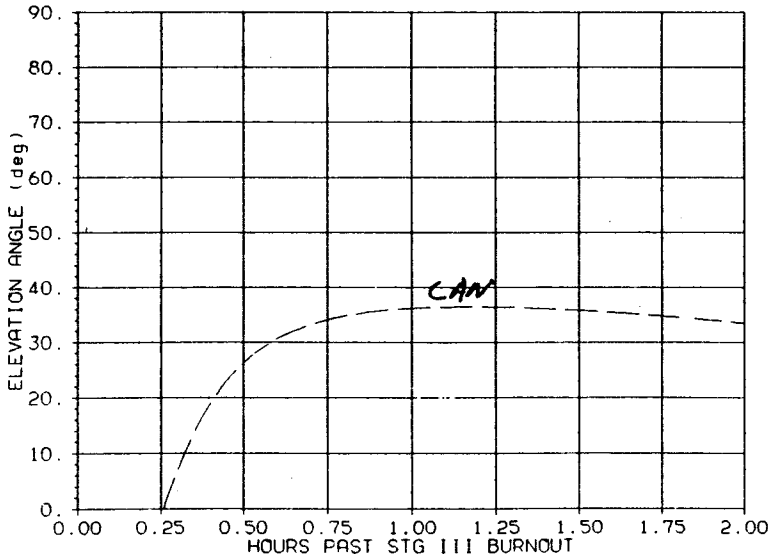
STAGE III BURNOUT : 981210.22107793 UTC

SPACECRAFT RANGE RATE



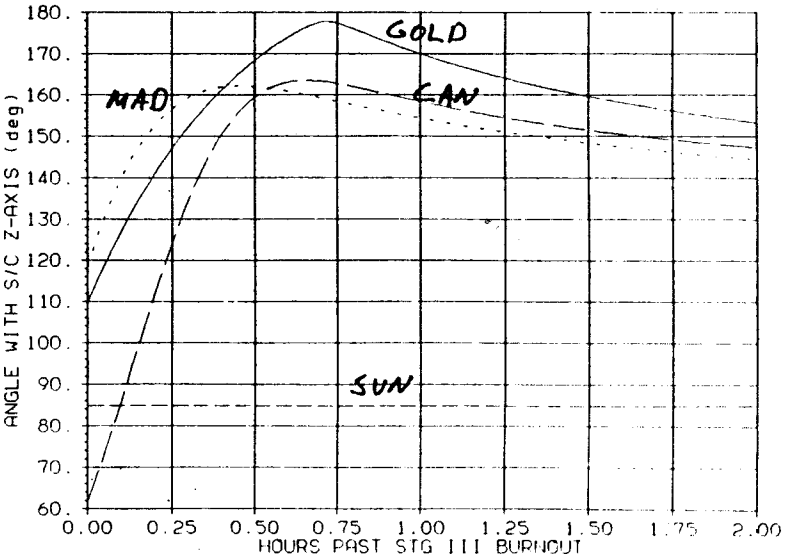
STAGE III BURNOUT : 981210.22107793 UTC

SPACECRAFT ELEVATION ANGLE



STAGE III BURNOUT : 981210.22107793 UTC

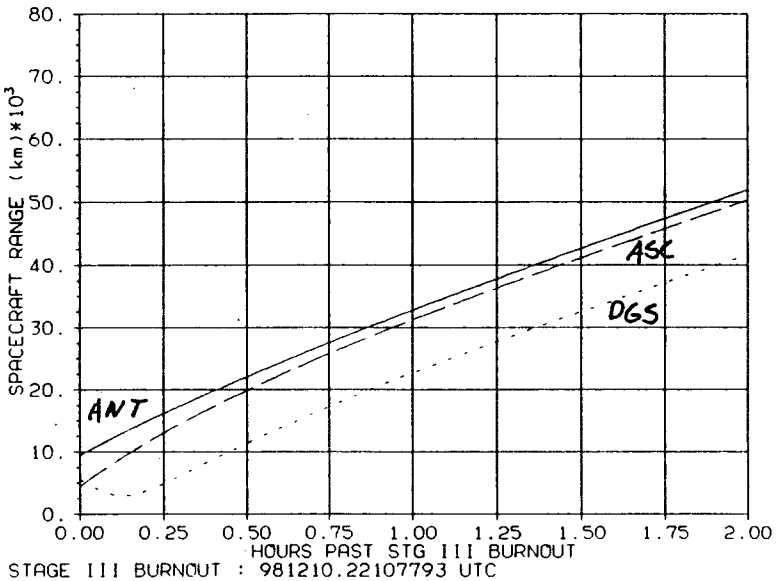
ASPECT ANGLE WITH S/C Z-AXIS



STAGE III BURNOUT : 981210.22107793 UTC

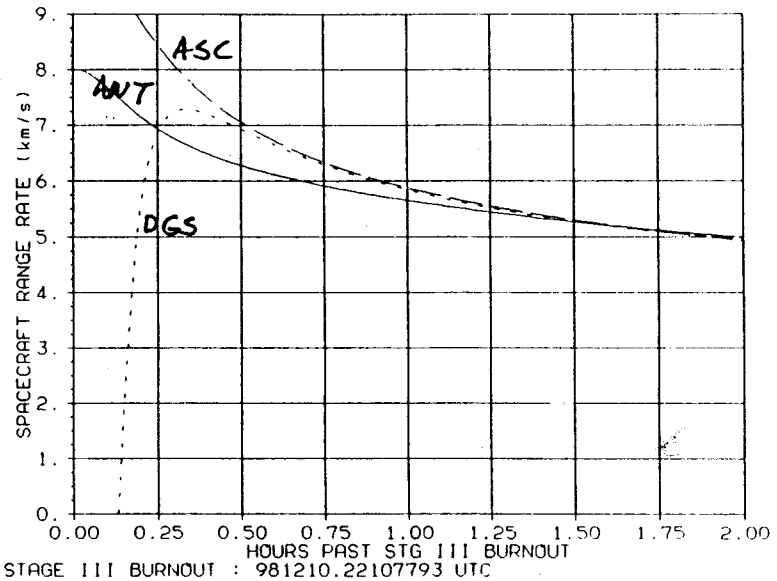
TRACKING STATION GEOMETRY (ORBITER): DAY 1 SHORT COAST

SPACECRAFT RANGE



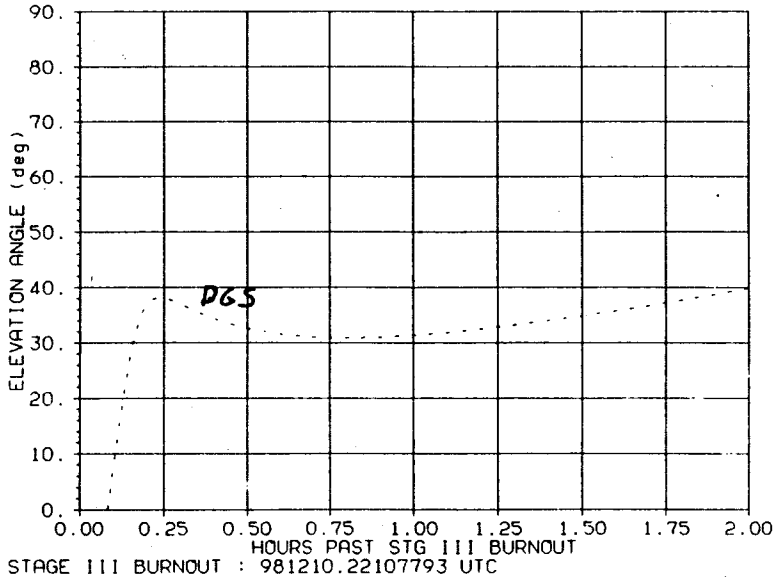
STAGE III BURNOUT : 981210.22107793 UTC

SPACECRAFT RANGE RATE



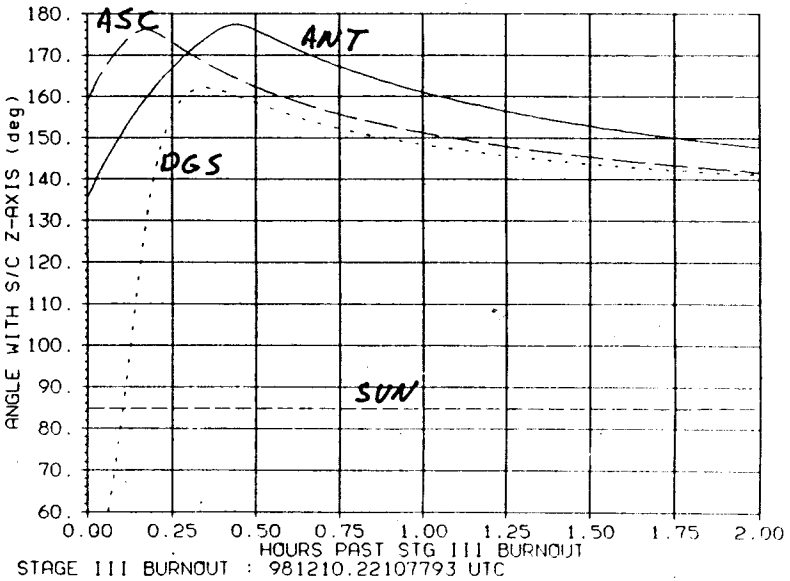
STAGE III BURNOUT : 981210.22107793 UTC

SPACECRAFT ELEVATION ANGLE



STAGE III BURNOUT : 981210.22107793 UTC

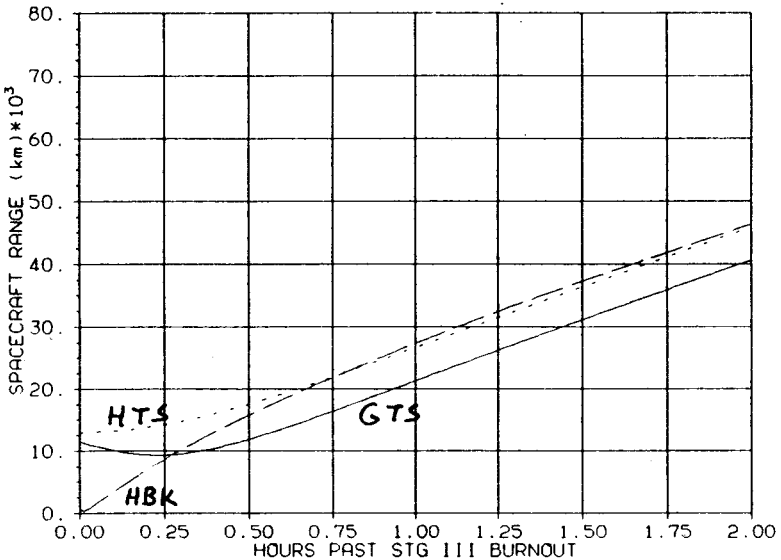
ASPECT ANGLE WITH S/C Z-AXIS



STAGE III BURNOUT : 981210.22107793 UTC

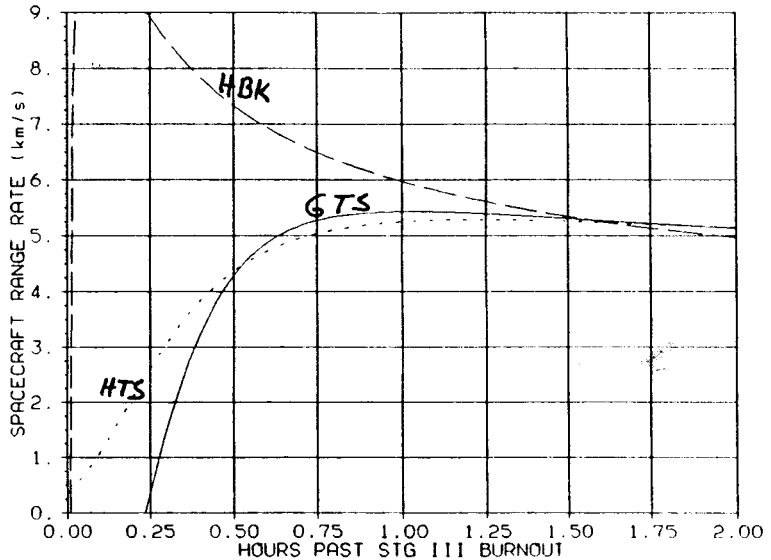
TRACKING STATION GEOMETRY (ORBITER): DAY 1 SHORT COAST

SPACECRAFT RANGE



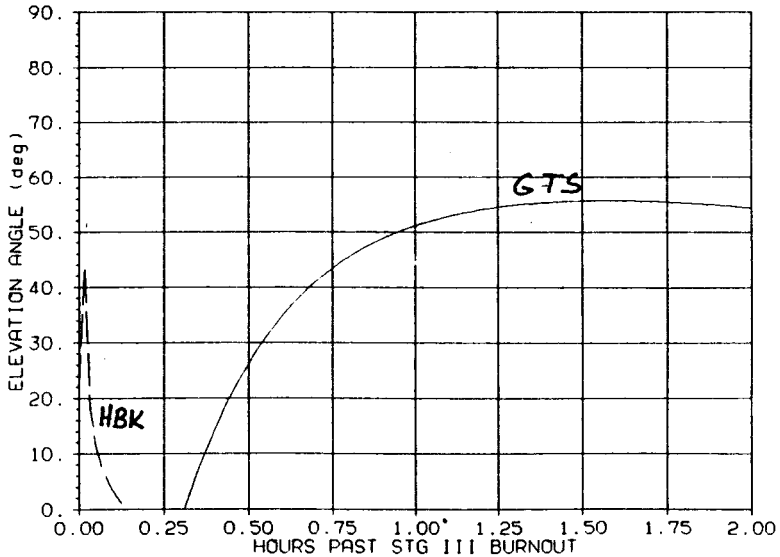
STAGE III BURNOUT : 981210.22107793 UTC

SPACECRAFT RANGE RATE



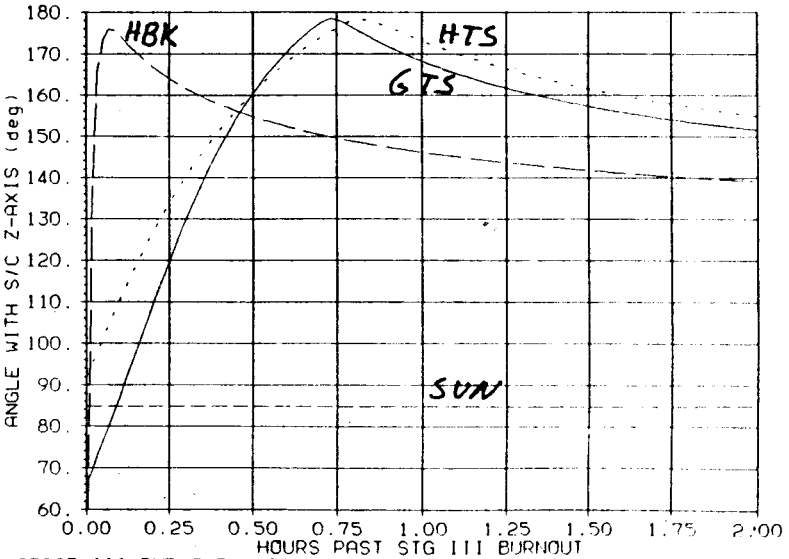
STAGE III BURNOUT : 981210.22107793 UTC

SPACECRAFT ELEVATION ANGLE



STAGE III BURNOUT : 981210.22107793 UTC

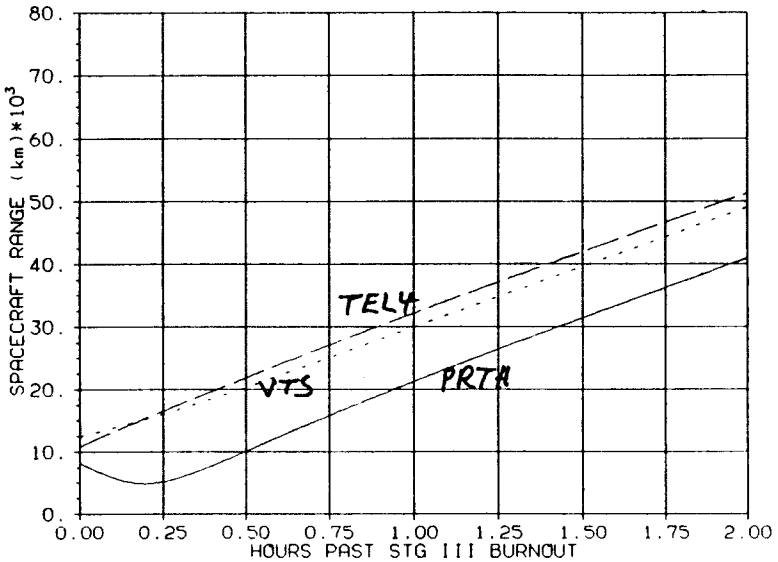
ASPECT ANGLE WITH S/C Z-AXIS



STAGE III BURNOUT : 981210.22107793 UTC

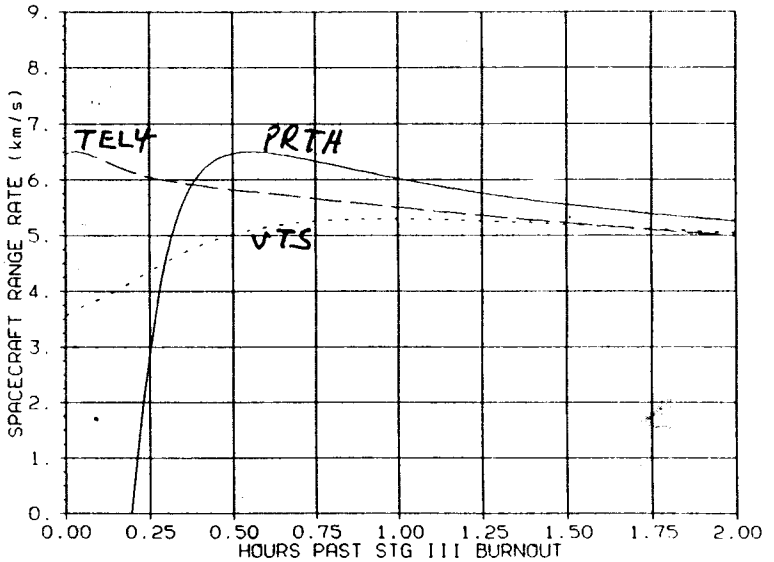
TRACKING STATION GEOMETRY (ORBITER): DAY 1 SHORT COAST

SPACECRAFT RANGE



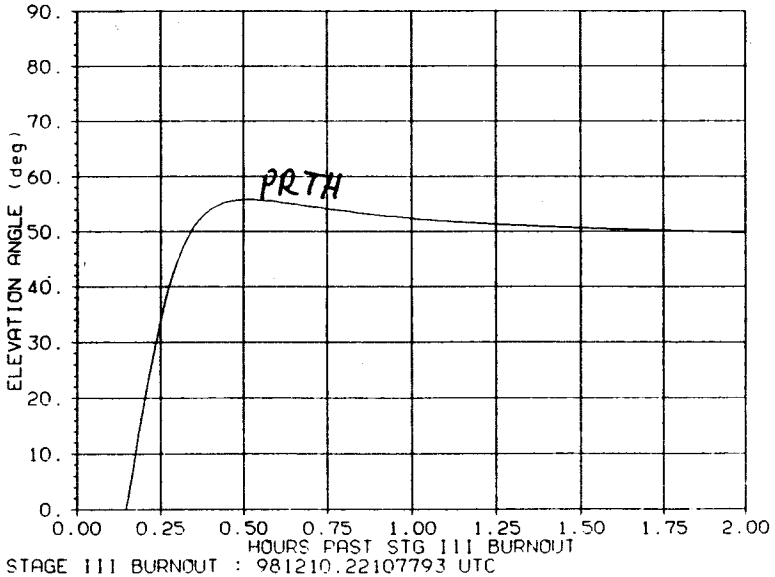
STAGE III BURNOUT : 981210.22107793 UTC

SPACECRAFT RANGE RATE



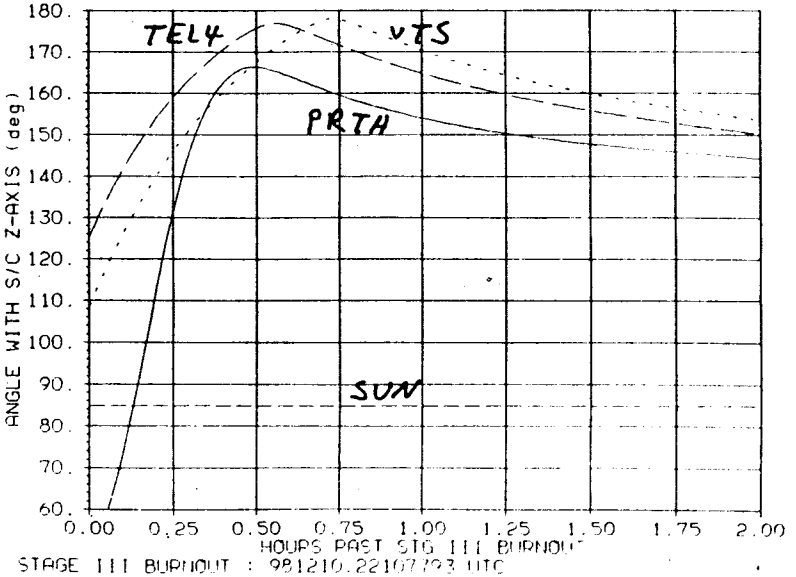
STAGE III BURNOUT : 981210.22107793 UTC

SPACECRAFT ELEVATION ANGLE



STAGE III BURNOUT : 981210.22107793 UTC

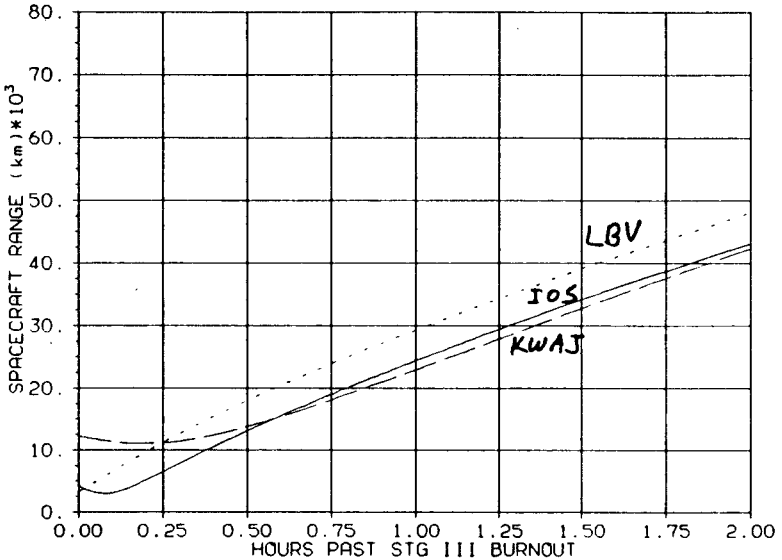
ASPECT ANGLE WITH S/C Z-AXIS



STAGE III BURNOUT : 981210.22107793 UTC

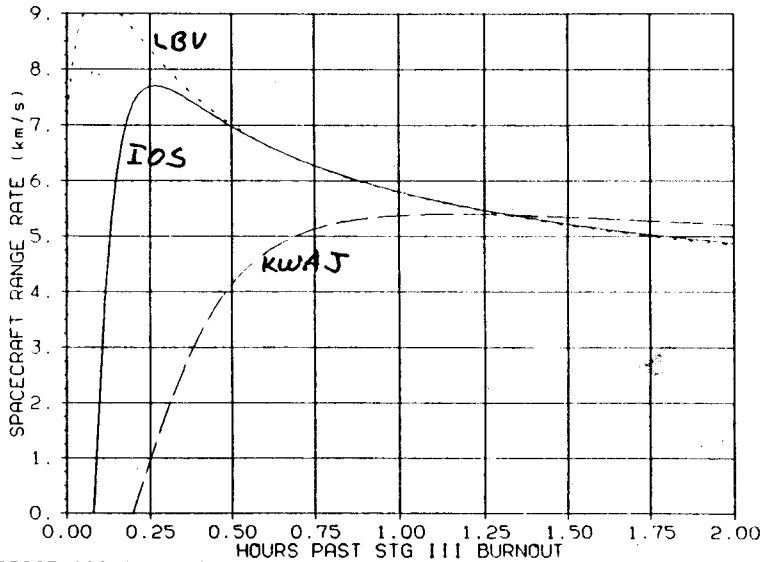
TRACKING STATION GEOMETRY (ORBITER): DAY 1 SHORT COAST

SPACECRAFT RANGE



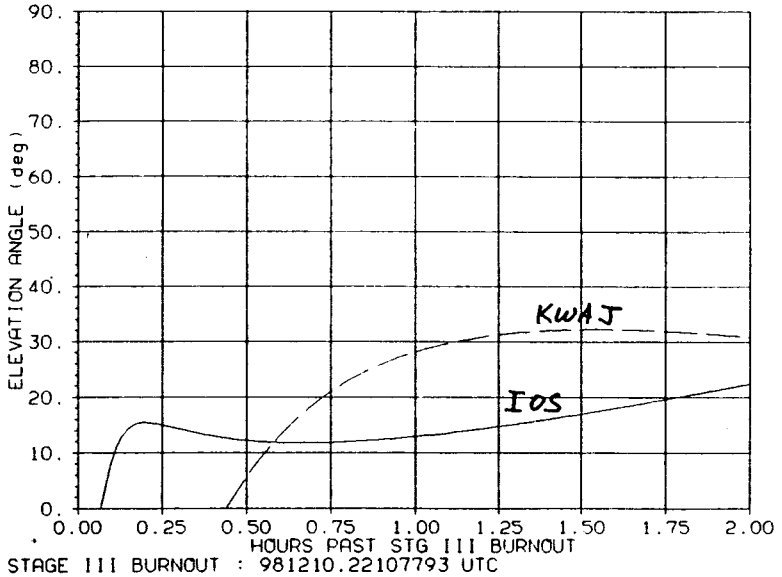
STAGE III BURNOUT : 981210.22107793 UTC

SPACECRAFT RANGE RATE



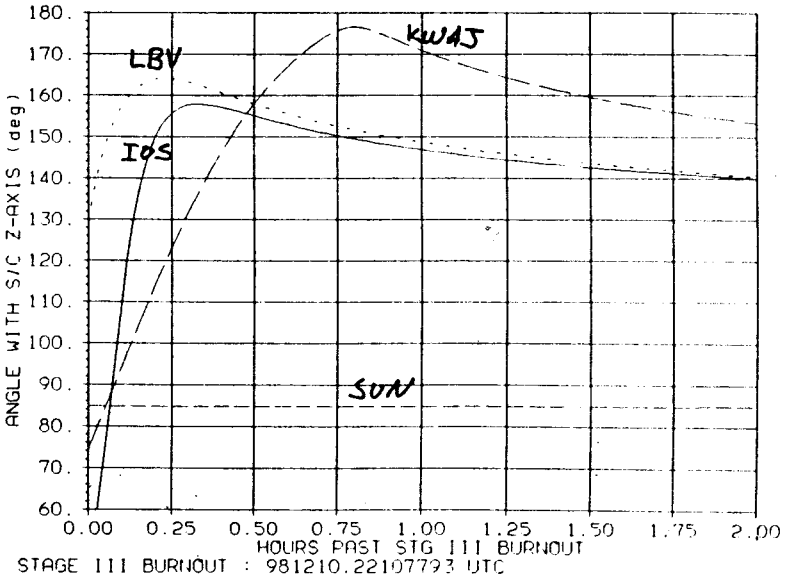
STAGE III BURNOUT : 981210.22107793 UTC

SPACECRAFT ELEVATION ANGLE



STAGE III BURNOUT : 981210.22107793 UTC

ASPECT ANGLE WITH S/C Z-AXIS

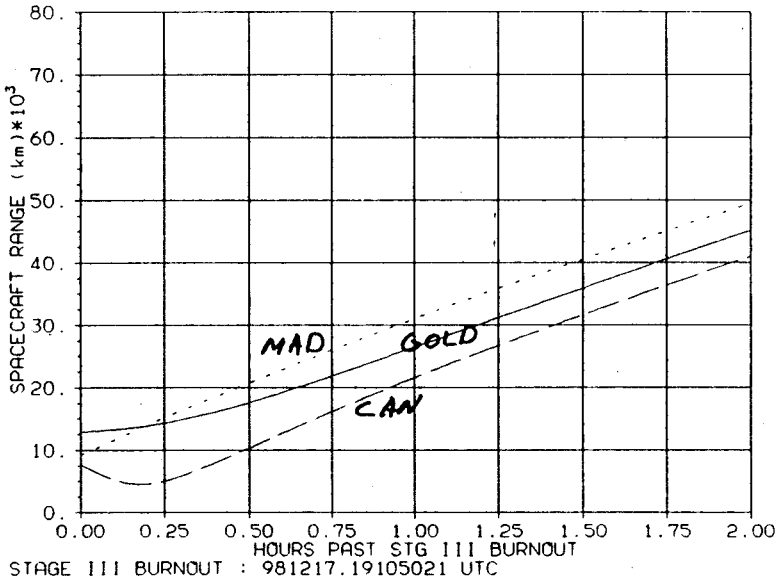


STAGE III BURNOUT : 981210.22107793 UTC

ORBITER DAY 8 (12/17/98) SHORT COAST

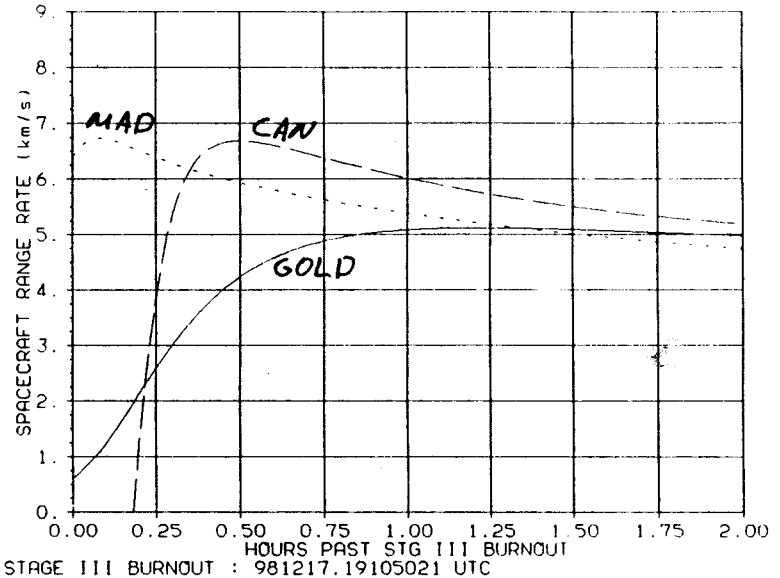
TRACKING STATION GEOMETRY (ORBITER): DAY 8 SHORT COAST

SPACECRAFT RANGE



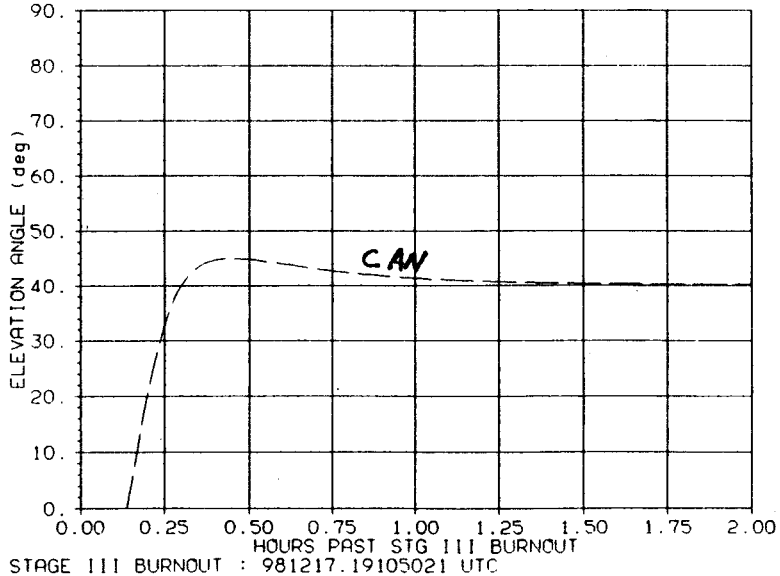
STAGE III BURNOUT : 981217.19105021 UTC

SPACECRAFT RANGE RATE



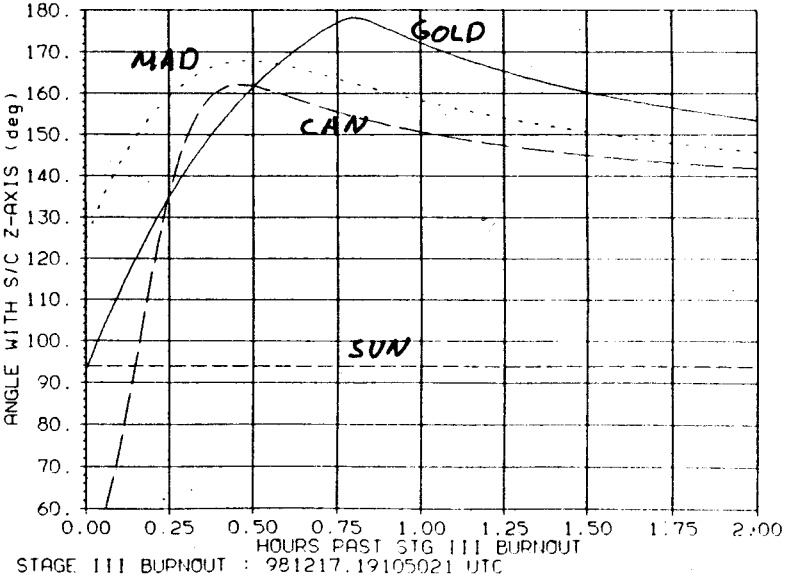
STAGE III BURNOUT : 981217.19105021 UTC

SPACECRAFT ELEVATION ANGLE



STAGE III BURNOUT : 981217.19105021 UTC

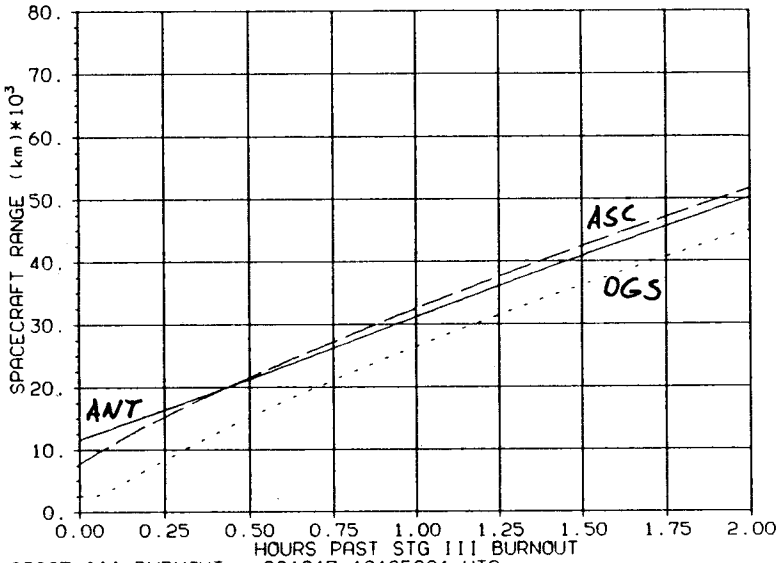
ASPECT ANGLE WITH S/C Z-AXIS



STAGE III BURNOUT : 981217.19105021 UTC

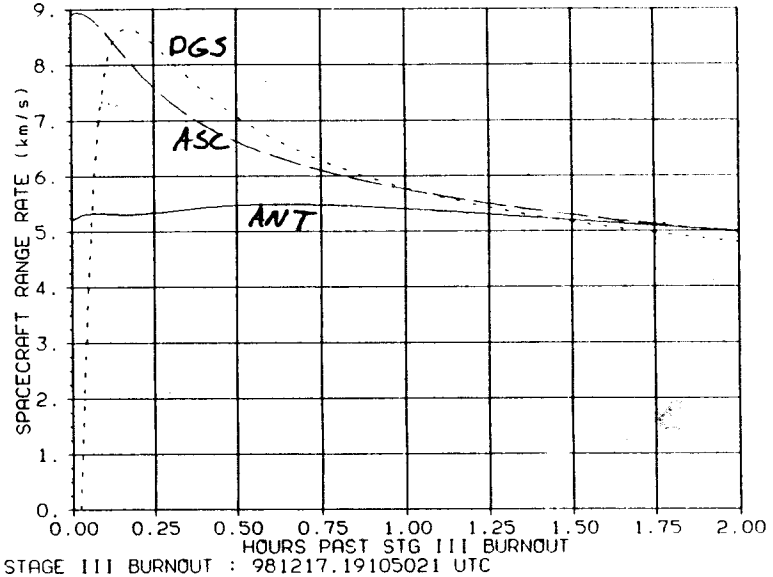
TRACKING STATION GEOMETRY (ORBITER): DAY 8 SHORT COAST

SPACECRAFT RANGE



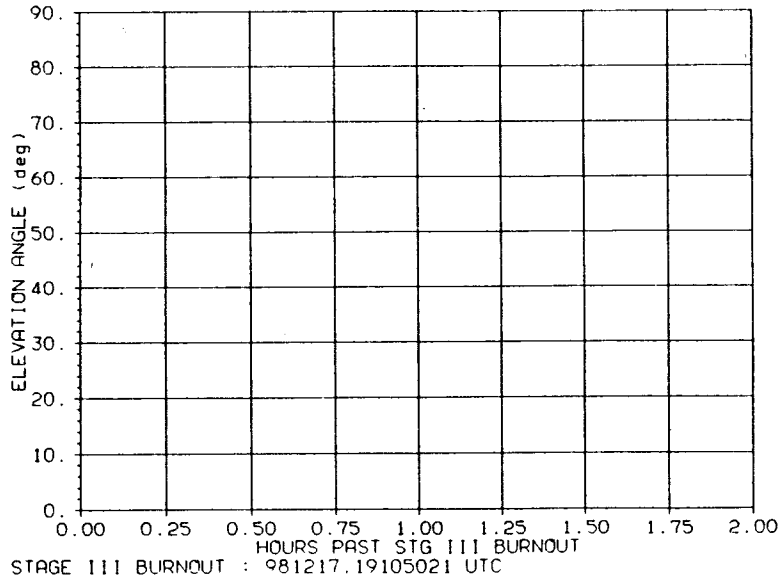
STAGE III BURNOUT : 981217.19105021 UTC

SPACECRAFT RANGE RATE



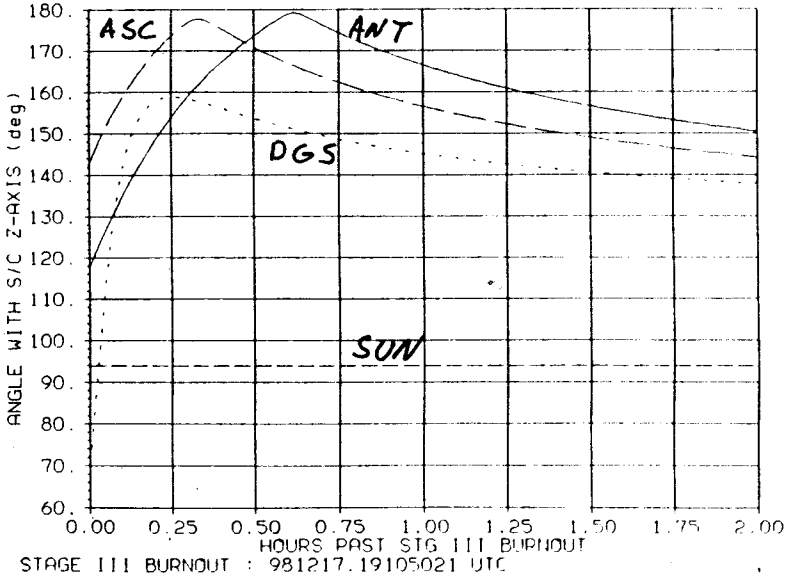
STAGE III BURNOUT : 981217.19105021 UTC

SPACECRAFT ELEVATION ANGLE



STAGE III BURNOUT : 981217.19105021 UTC

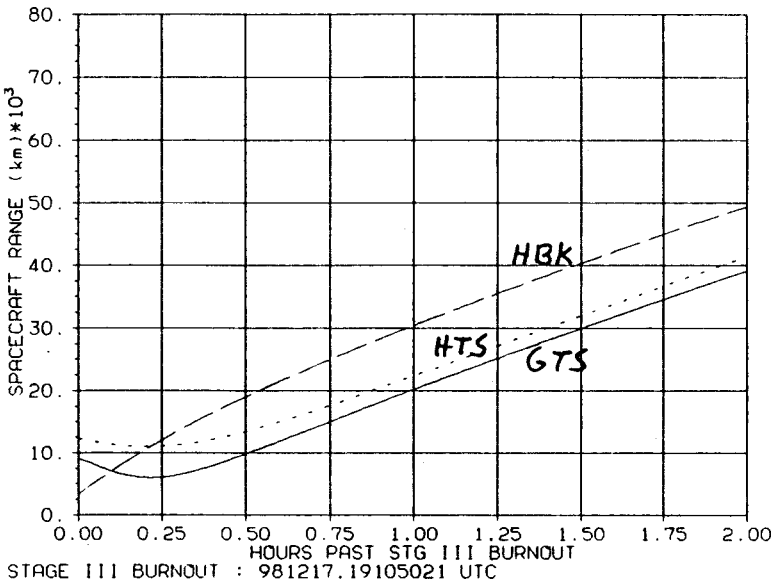
ASPECT ANGLE WITH S/C Z-AXIS



STAGE III BURNOUT : 981217.19105021 UTC

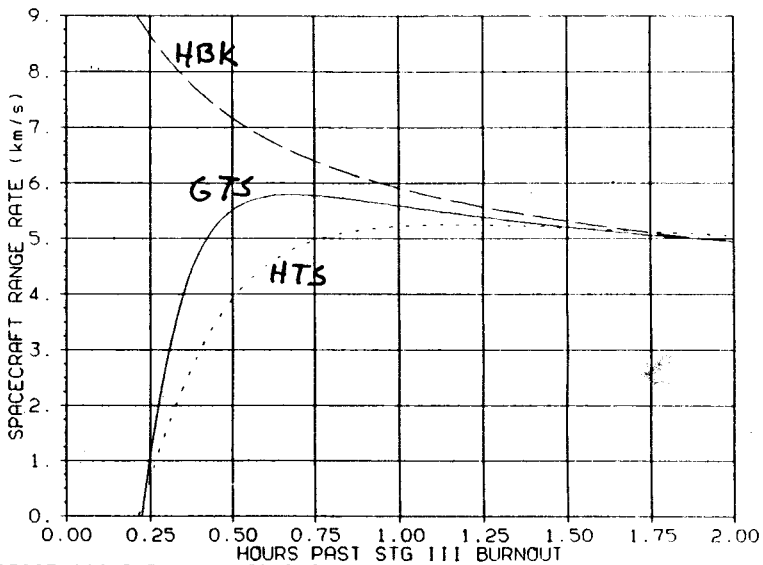
TRACKING STATION GEOMETRY (ORBITER): DAY 8 SHORT COAST

SPACECRAFT RANGE



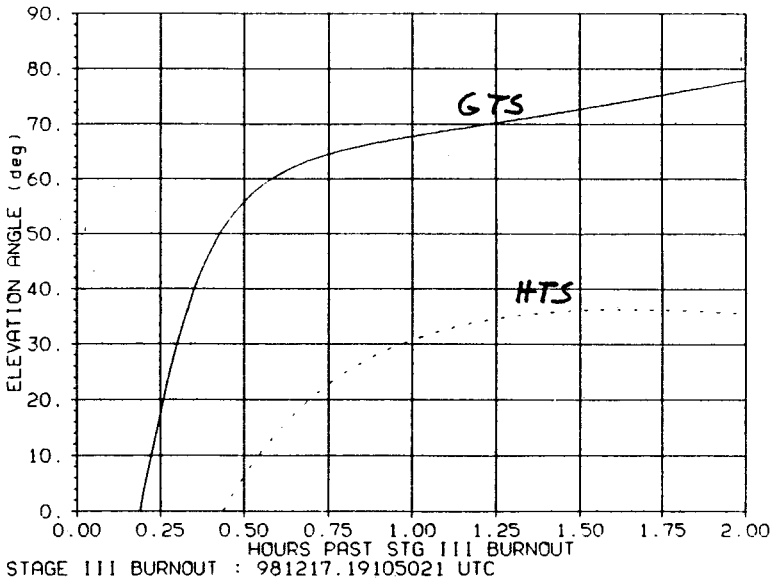
STAGE III BURNOUT : 981217.19105021 UTC

SPACECRAFT RANGE RATE



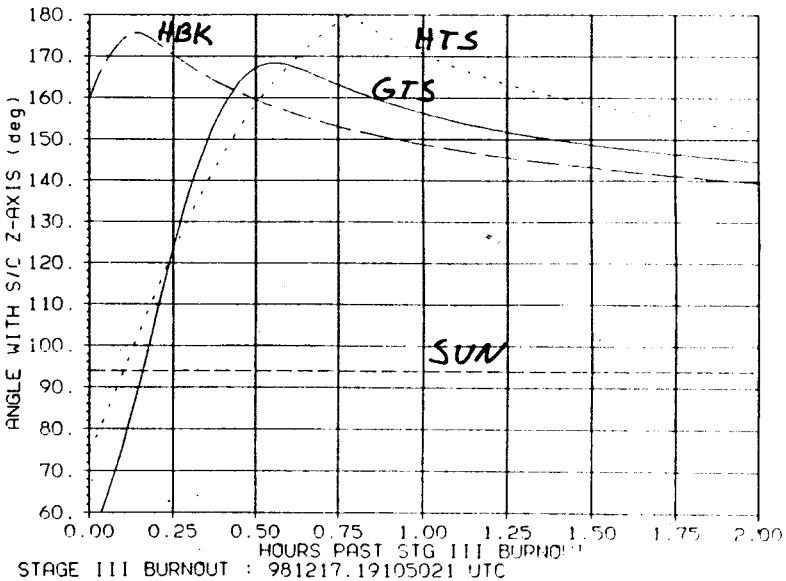
STAGE III BURNOUT : 981217.19105021 UTC

SPACECRAFT ELEVATION ANGLE



STAGE III BURNOUT : 981217.19105021 UTC

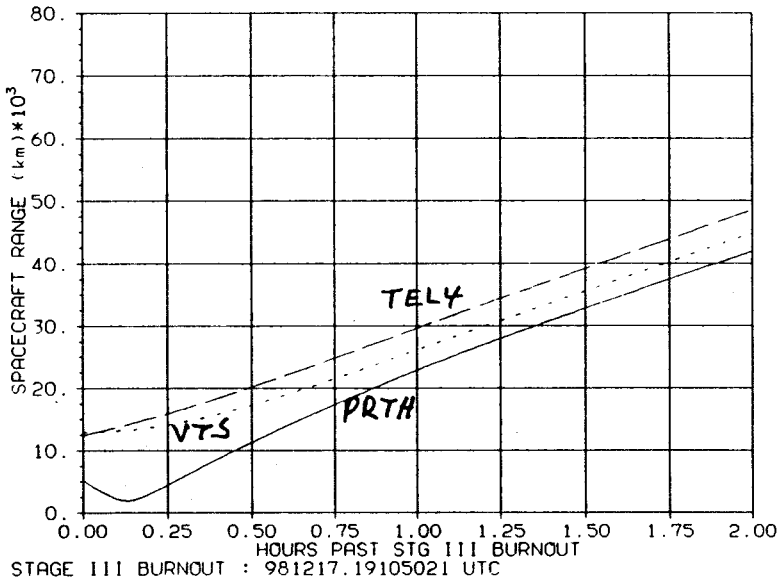
ASPECT ANGLE WITH S/C Z-AXIS



STAGE III BURNOUT : 981217.19105021 UTC

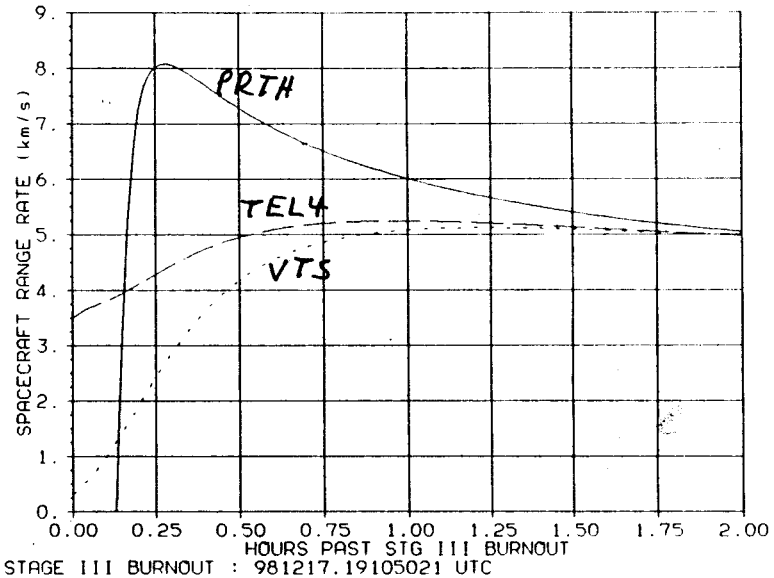
TRACKING STATION GEOMETRY (ORBITER): DAY 8 SHORT COAST

SPACECRAFT RANGE



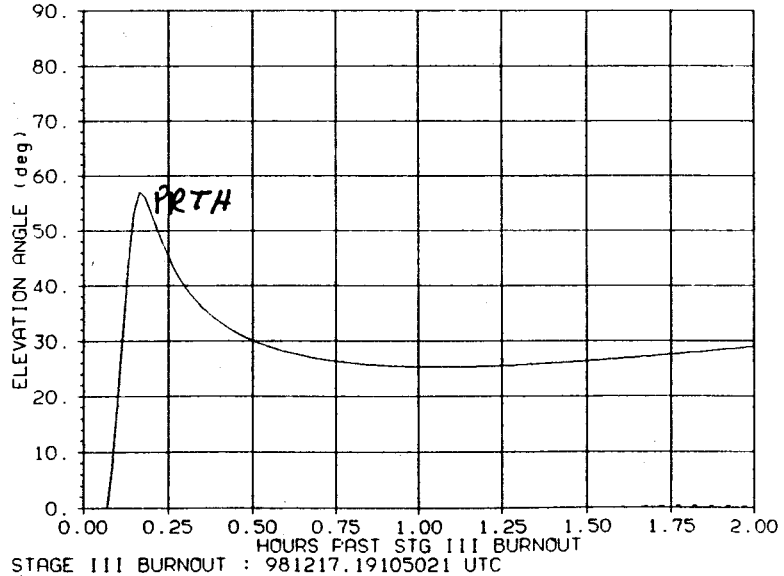
STAGE III BURNOUT : 981217.19105021 UTC

SPACECRAFT RANGE RATE



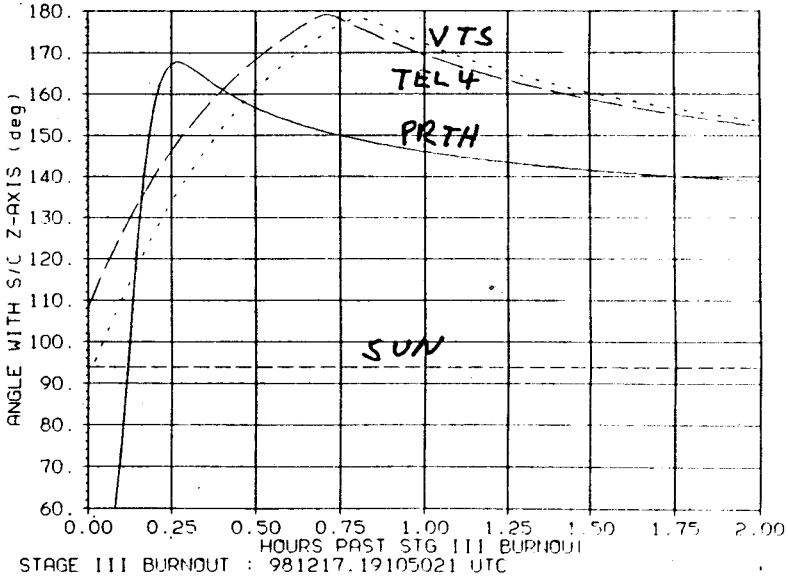
STAGE III BURNOUT : 981217.19105021 UTC

SPACECRAFT ELEVATION ANGLE



STAGE III BURNOUT : 981217.19105021 UTC

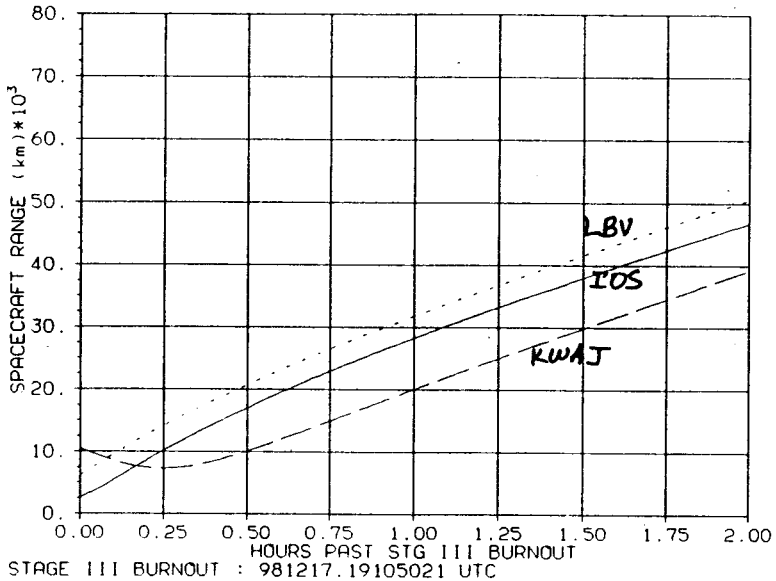
ASPECT ANGLE WITH S/C Z-AXIS



STAGE III BURNOUT : 981217.19105021 UTC

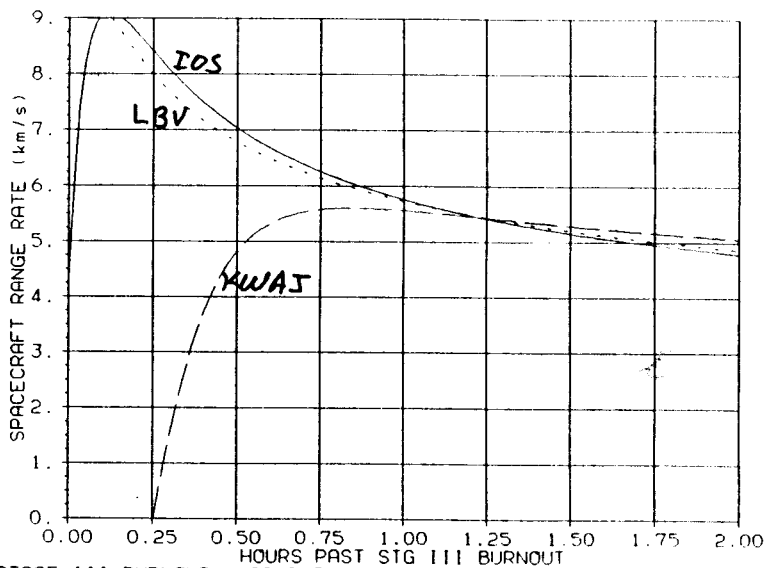
TRACKING STATION GEOMETRY (ORBITER): DAY 8 SHORT COAST

SPACECRAFT RANGE



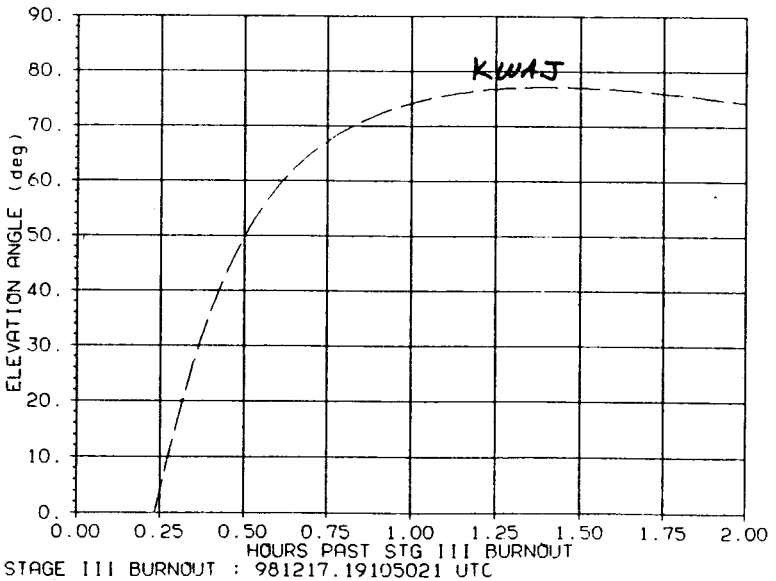
STAGE III BURNOUT : 981217.19105021 UTC

SPACECRAFT RANGE RATE



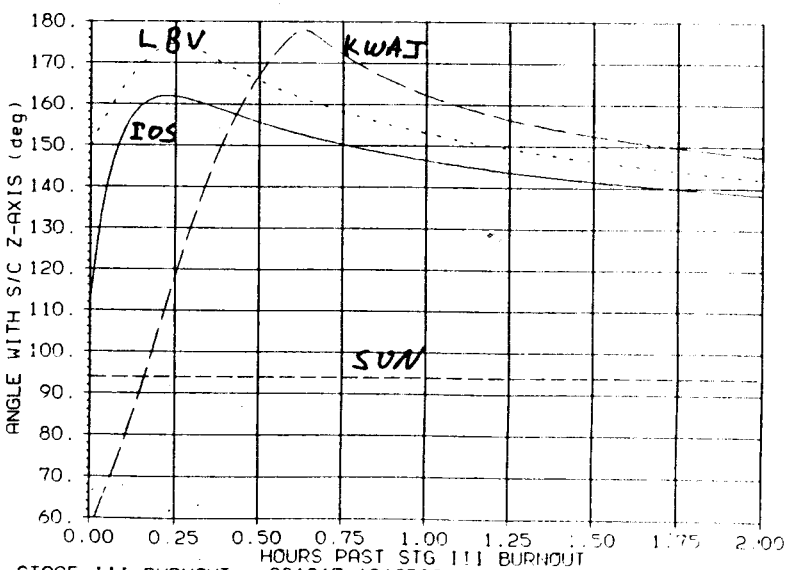
STAGE III BURNOUT : 981217.19105021 UTC

SPACECRAFT ELEVATION ANGLE



STAGE III BURNOUT : 981217.19105021 UTC

ASPECT ANGLE WITH S/C Z-AXIS

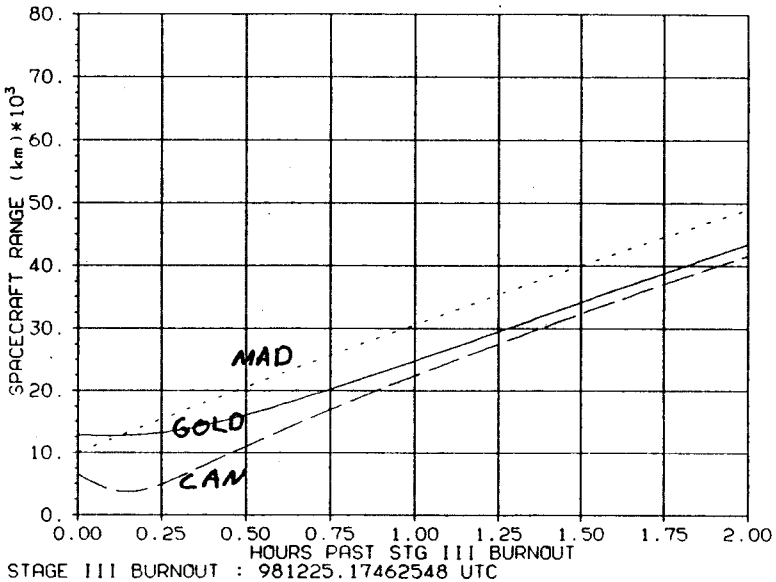


STAGE III BURNOUT : 981217.19105021 UTC

ORBITER DAY 16 (12/25/98) SHORT COAST

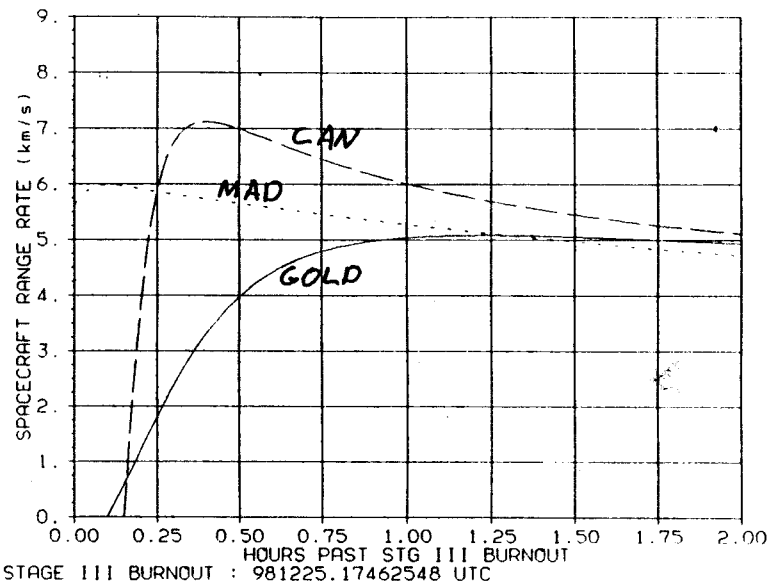
TRACKING STATION GEOMETRY (ORBITER): DAY 16 SHORT CONST

SPACECRAFT RANGE



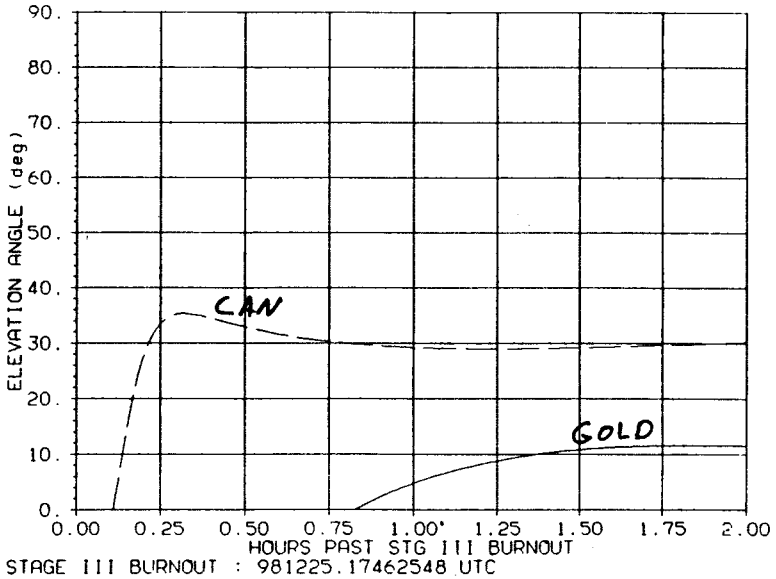
STAGE III BURNOUT : 981225.17462548 UTC

SPACECRAFT RANGE RATE



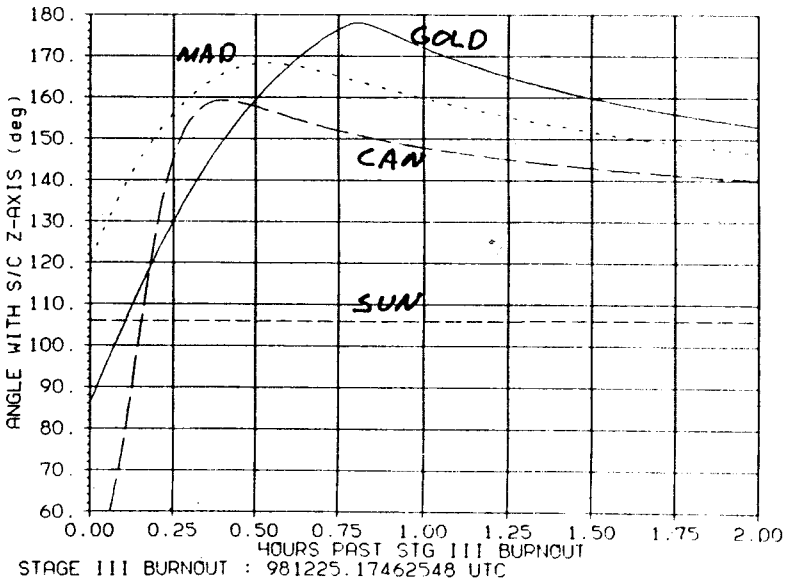
STAGE III BURNOUT : 981225.17462548 UTC

SPACECRAFT ELEVATION ANGLE



STAGE III BURNOUT : 981225.17462548 UTC

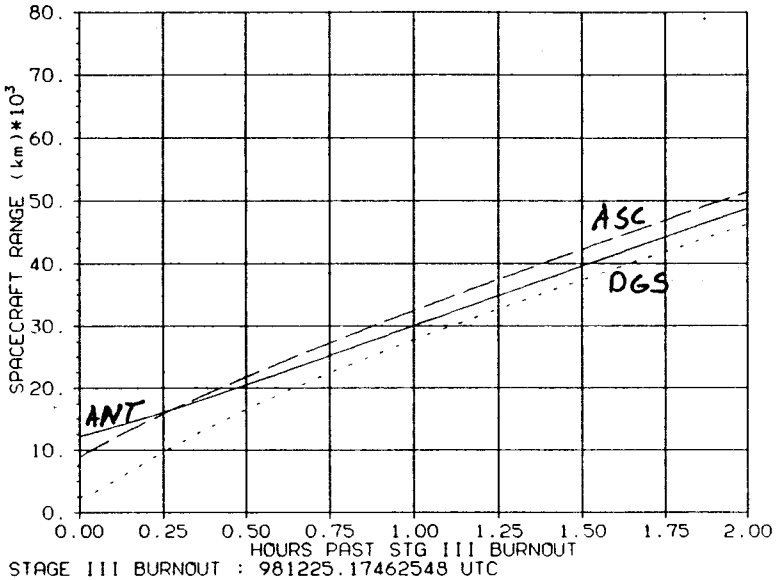
ASPECT ANGLE WITH S/C Z-AXIS



STAGE III BURNOUT : 981225.17462548 UTC

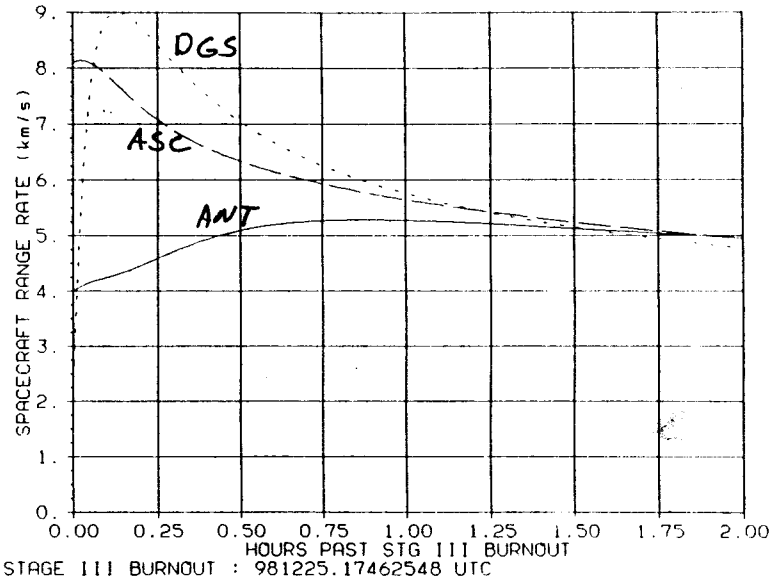
TRACKING STATION GEOMETRY (ORBITER): DAY 16 SHORT COAST

SPACECRAFT RANGE



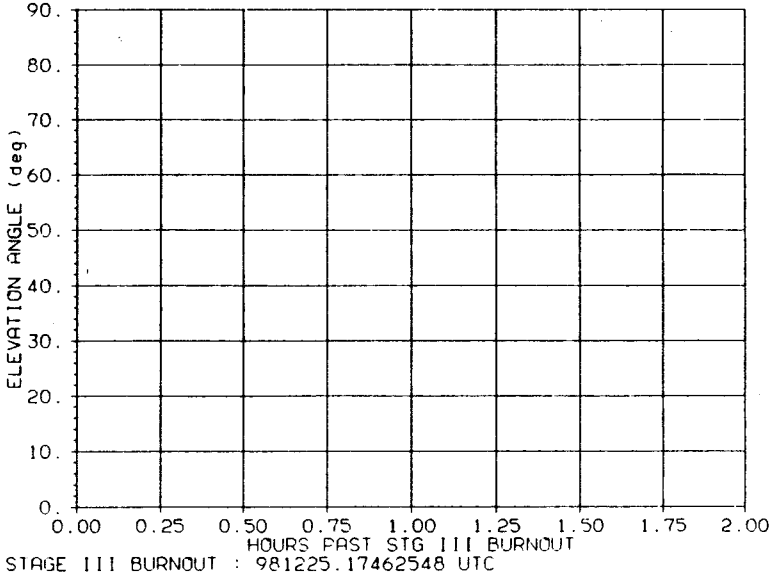
STAGE III BURNOUT : 981225.17462548 UTC

SPACECRAFT RANGE RATE



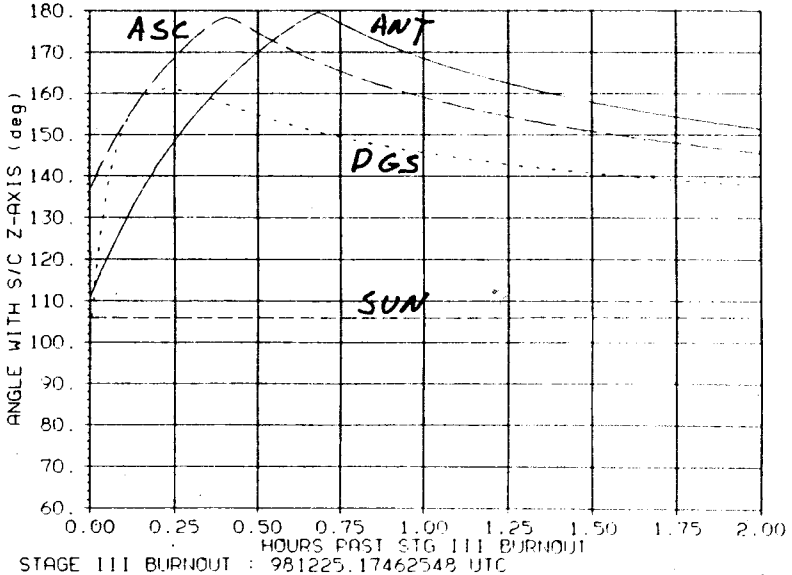
STAGE III BURNOUT : 981225.17462548 UTC

SPACECRAFT ELEVATION ANGLE



STAGE III BURNOUT : 981225.17462548 UTC

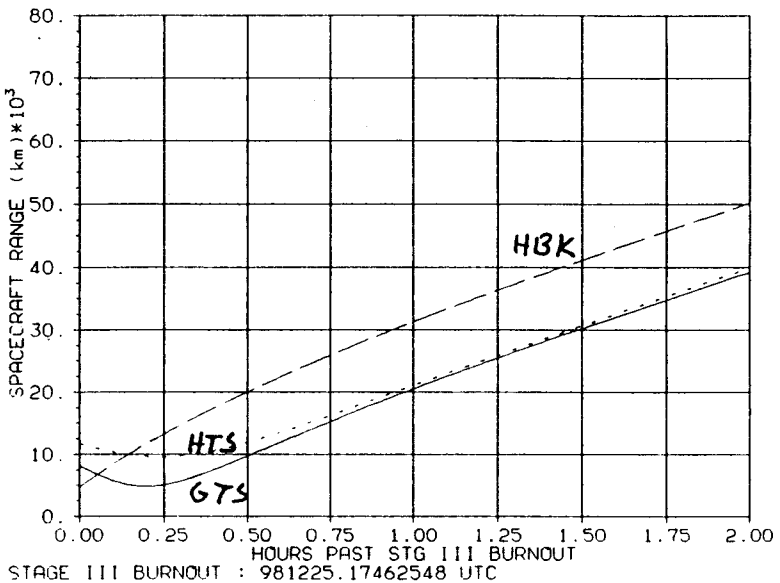
ASPECT ANGLE WITH S/C Z-AXIS



STAGE III BURNOUT : 981225.17462548 UTC

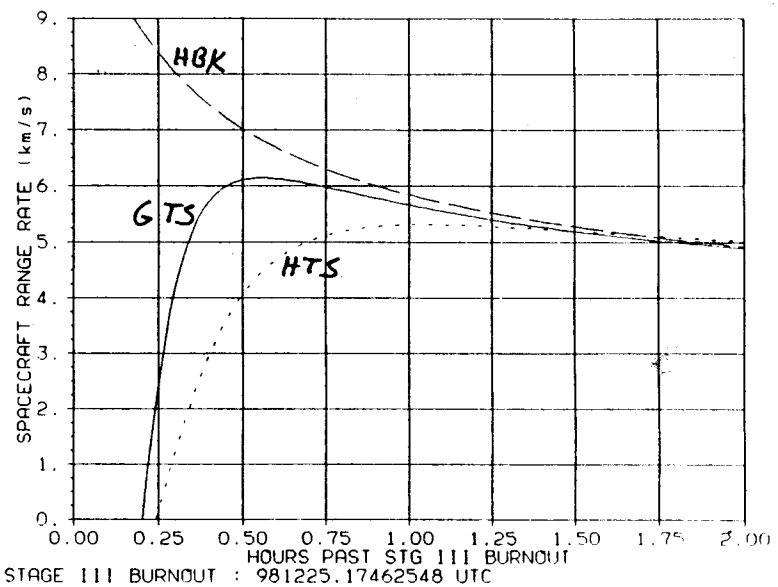
TRACKING STATION GEOMETRY (ORBITER): DAY 16 SHORT COAST

SPACECRAFT RANGE



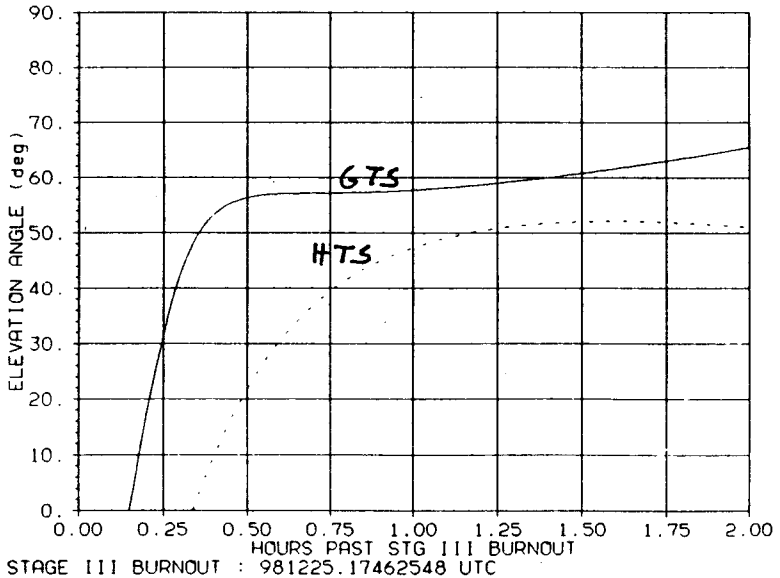
STAGE III BURNOUT : 981225.17462548 UTC

SPACECRAFT RANGE RATE



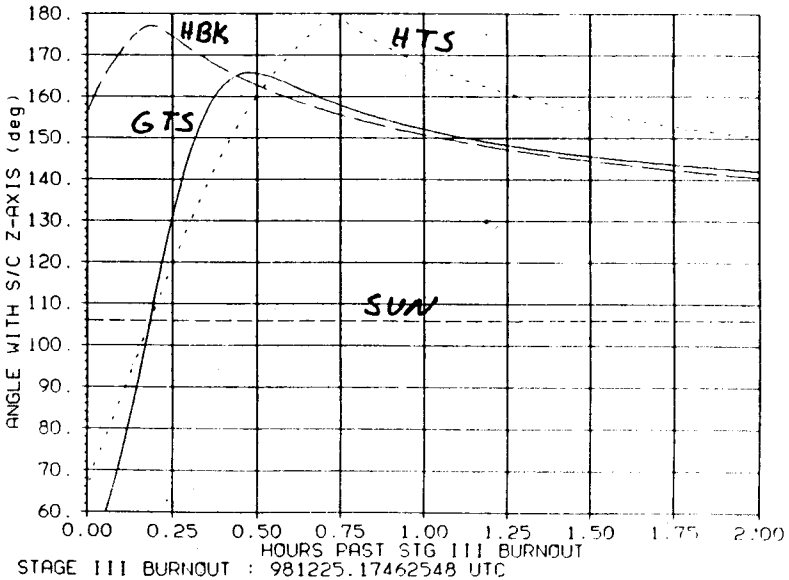
STAGE III BURNOUT : 981225.17462548 UTC

SPACECRAFT ELEVATION ANGLE



STAGE III BURNOUT : 981225.17462548 UTC

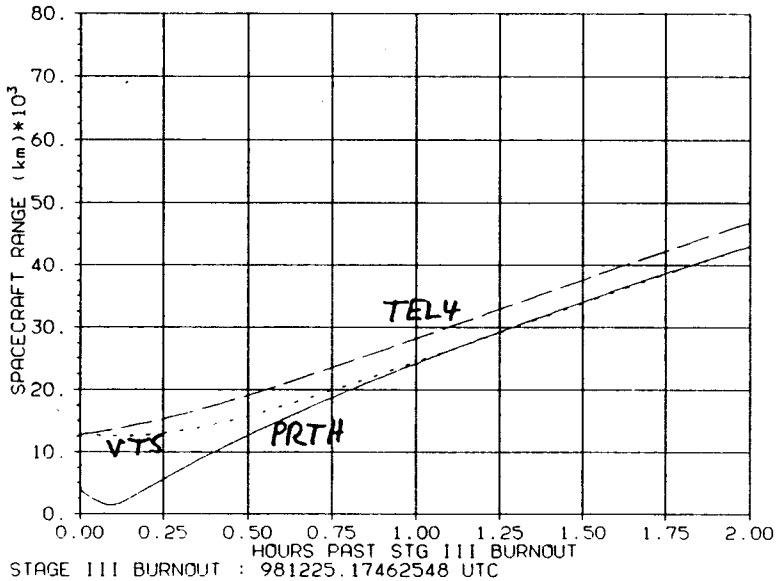
ASPECT ANGLE WITH S/C Z-AXIS



STAGE III BURNOUT : 981225.17462548 UTC

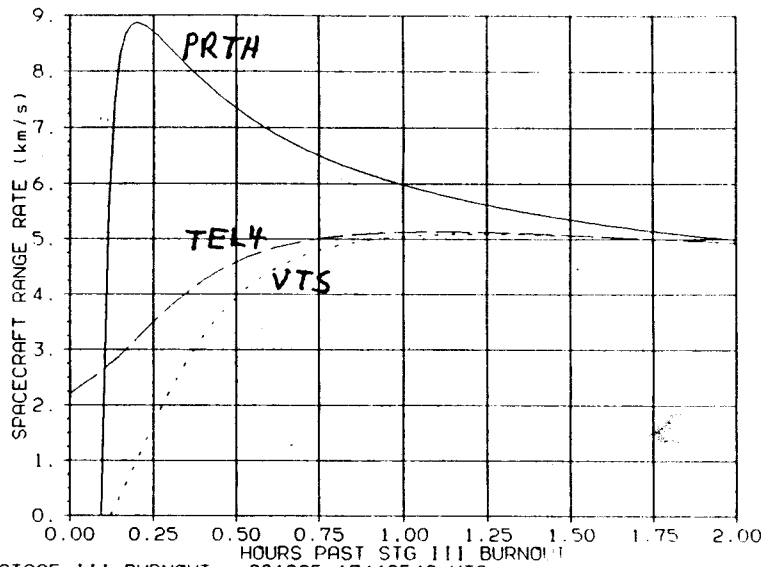
TRACKING STATION GEOMETRY (ORBITER): DAY 16 SHORT COAST

SPACECRAFT RANGE



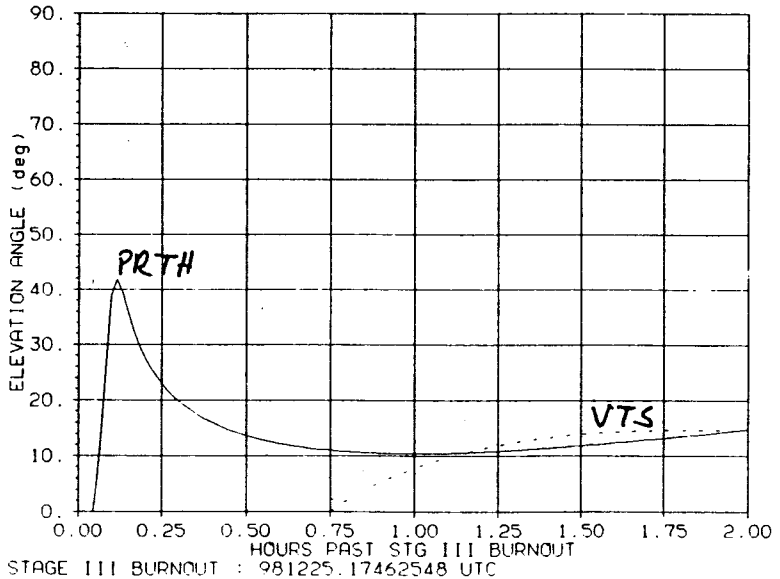
STAGE III BURNOUT : 981225.17462548 UTC

SPACECRAFT RANGE RATE



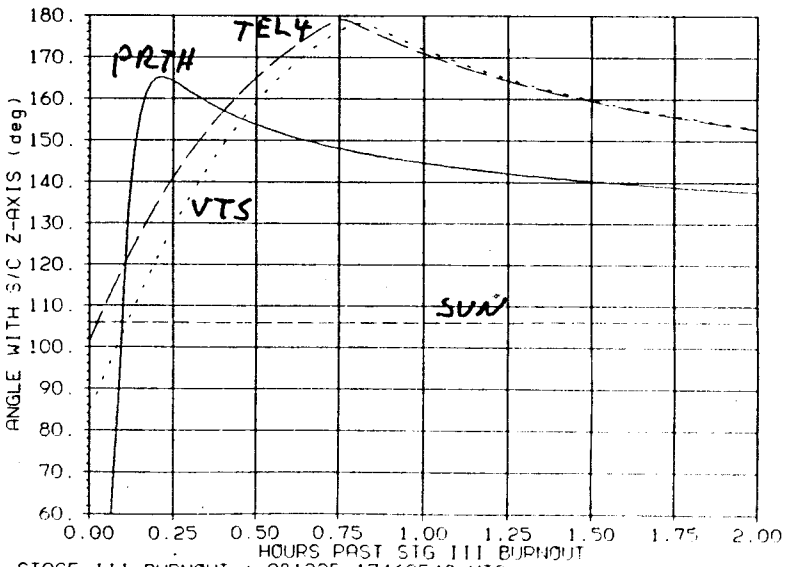
STAGE III BURNOUT : 981225.17462548 UTC

SPACECRAFT ELEVATION ANGLE



STAGE III BURNOUT : 981225.17462548 UTC

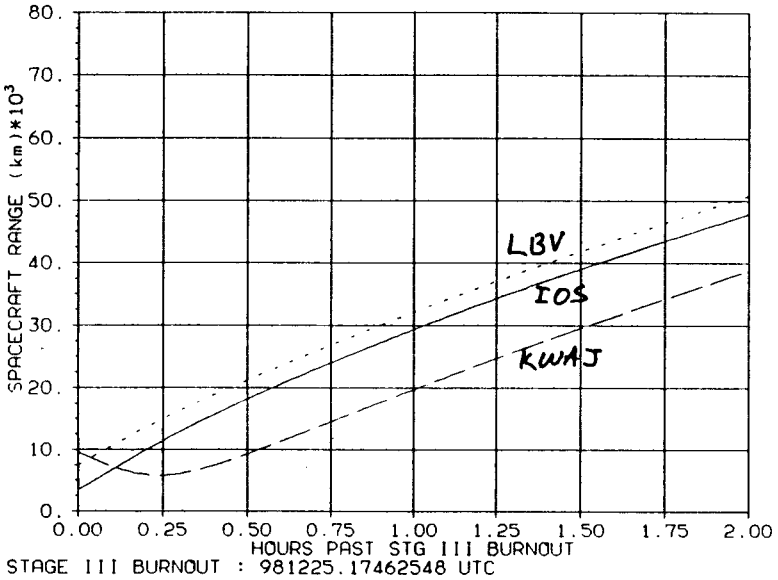
ASPECT ANGLE WITH S/C Z-AXIS



STAGE III BURNOUT : 981225.17462548 UTC

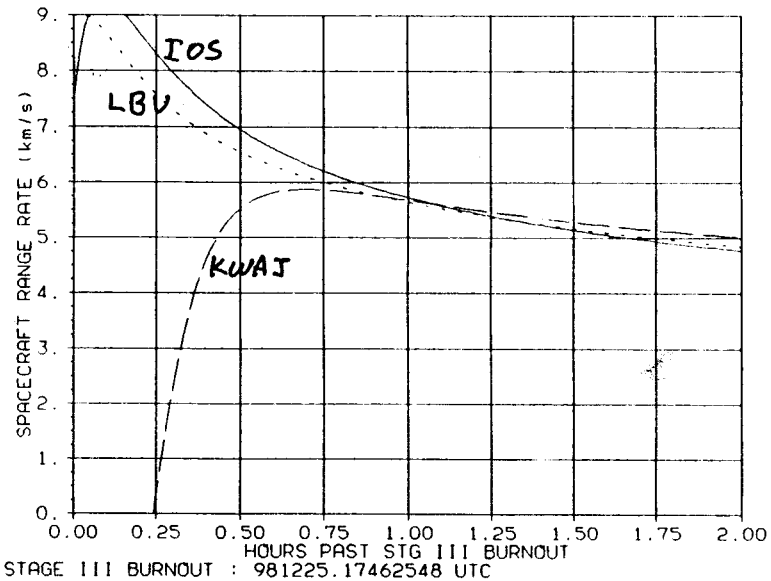
TRACKING STATION GEOMETRY (ORBITER): DAY 16 SHORT COAST

SPACECRAFT RANGE



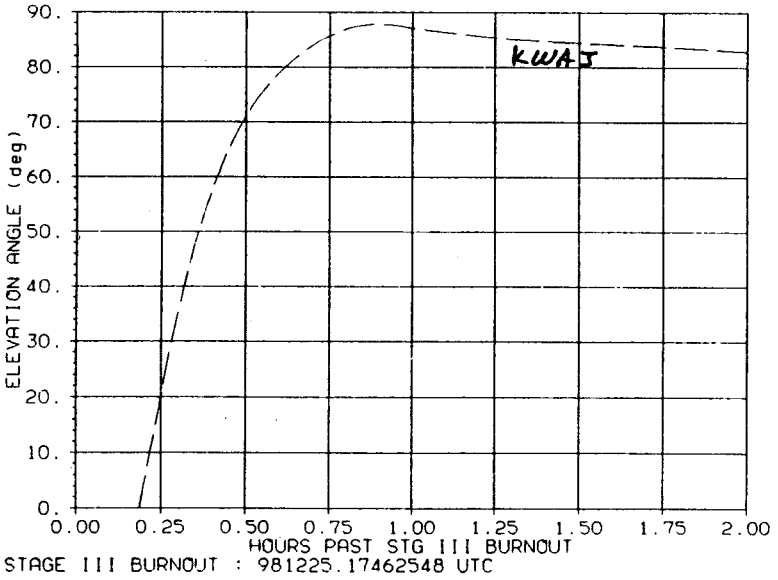
STAGE III BURNOUT : 981225.17462548 UTC

SPACECRAFT RANGE RATE



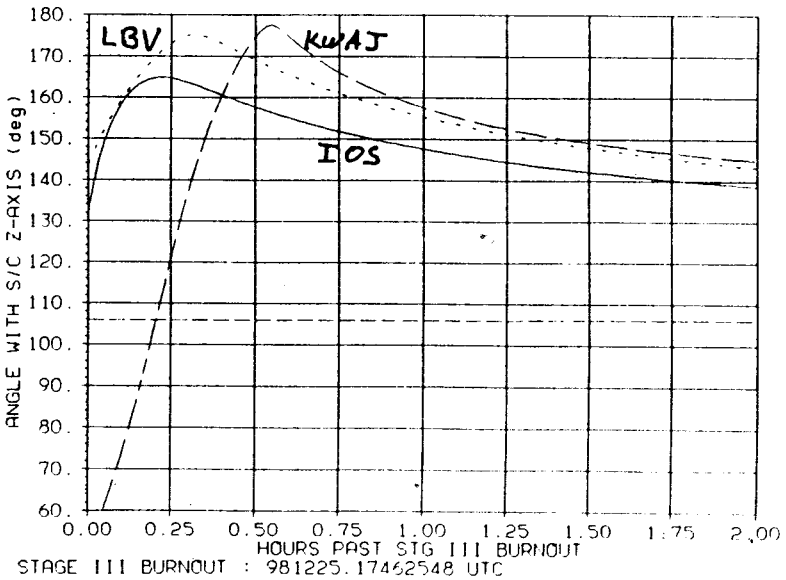
STAGE III BURNOUT : 981225.17462548 UTC

SPACECRAFT ELEVATION ANGLE



STAGE III BURNOUT : 981225.17462548 UTC

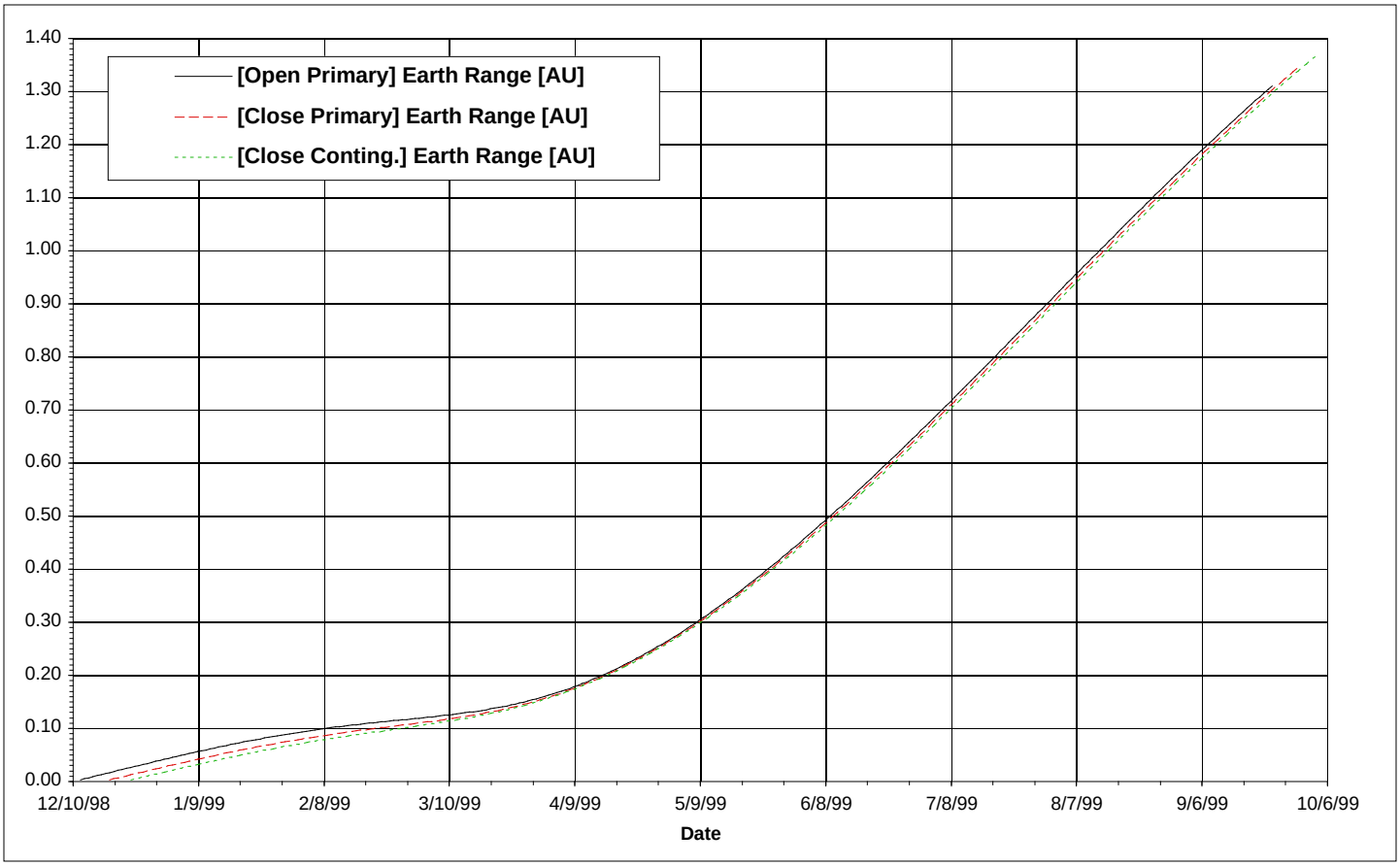
ASPECT ANGLE WITH S/C Z-AXIS

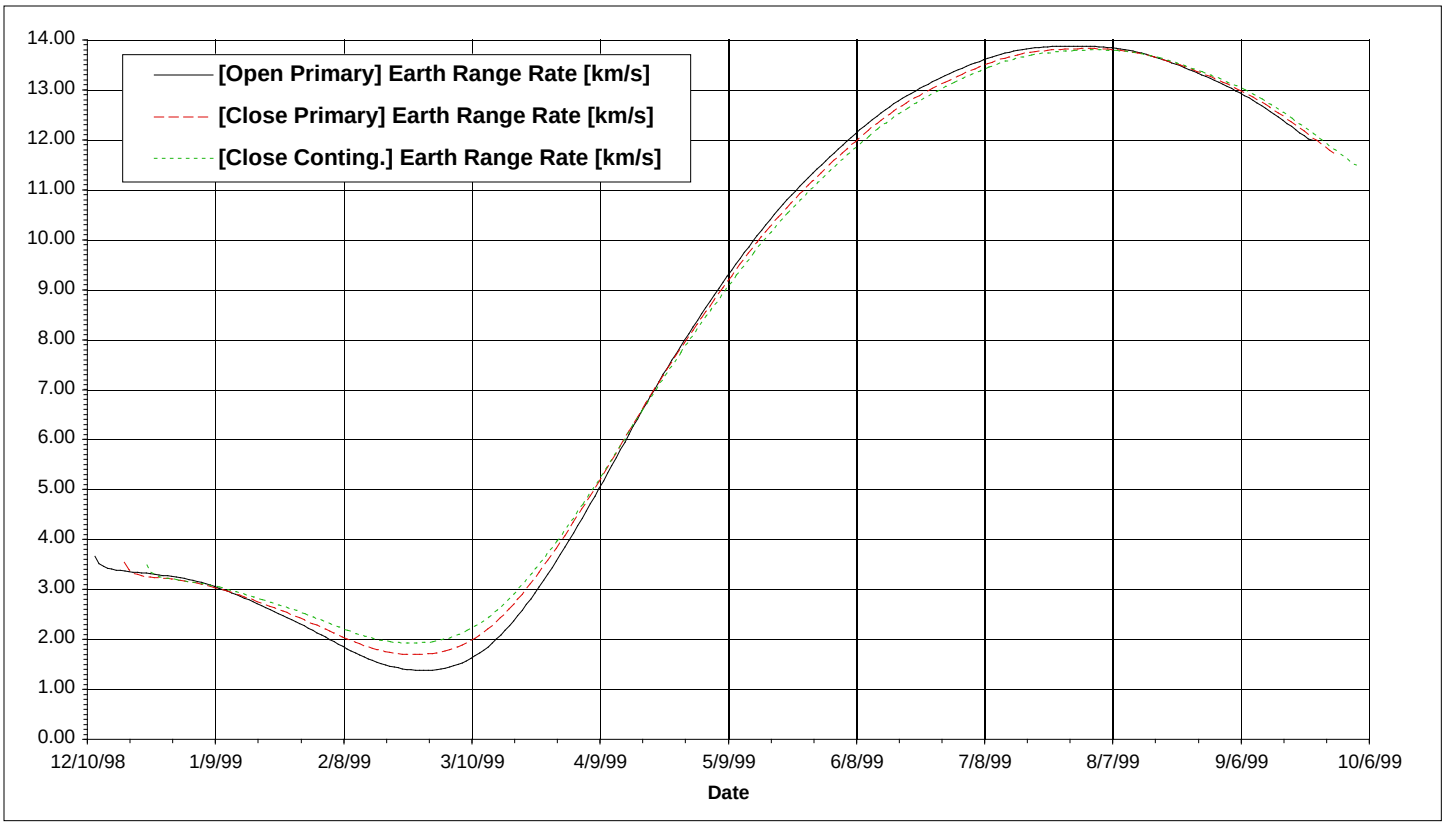


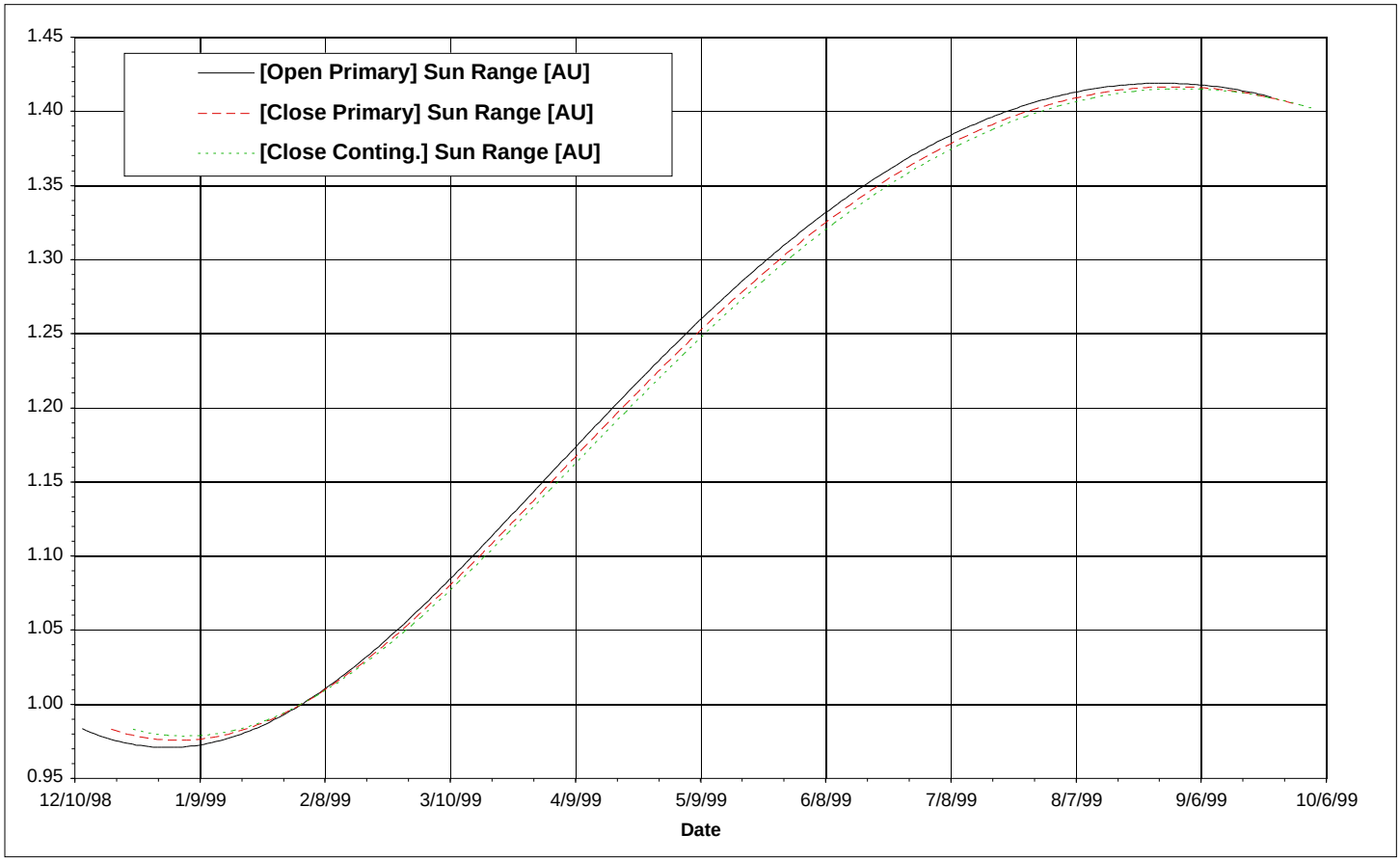
STAGE III BURNOUT : 981225.17462548 UTC

A.3 Orbiter Cruise Trajectory Characteristics

Orbiter TCD 11/25/96



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[Close Primary] Sun Range [AU]
[Close Conting.] Sun Range [AU]
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1.35
1.30
1.25
1.20
1.15
1.10
1.05
1.00
0.95
12/10/98
1/9/99
2/8/99
3/10/99
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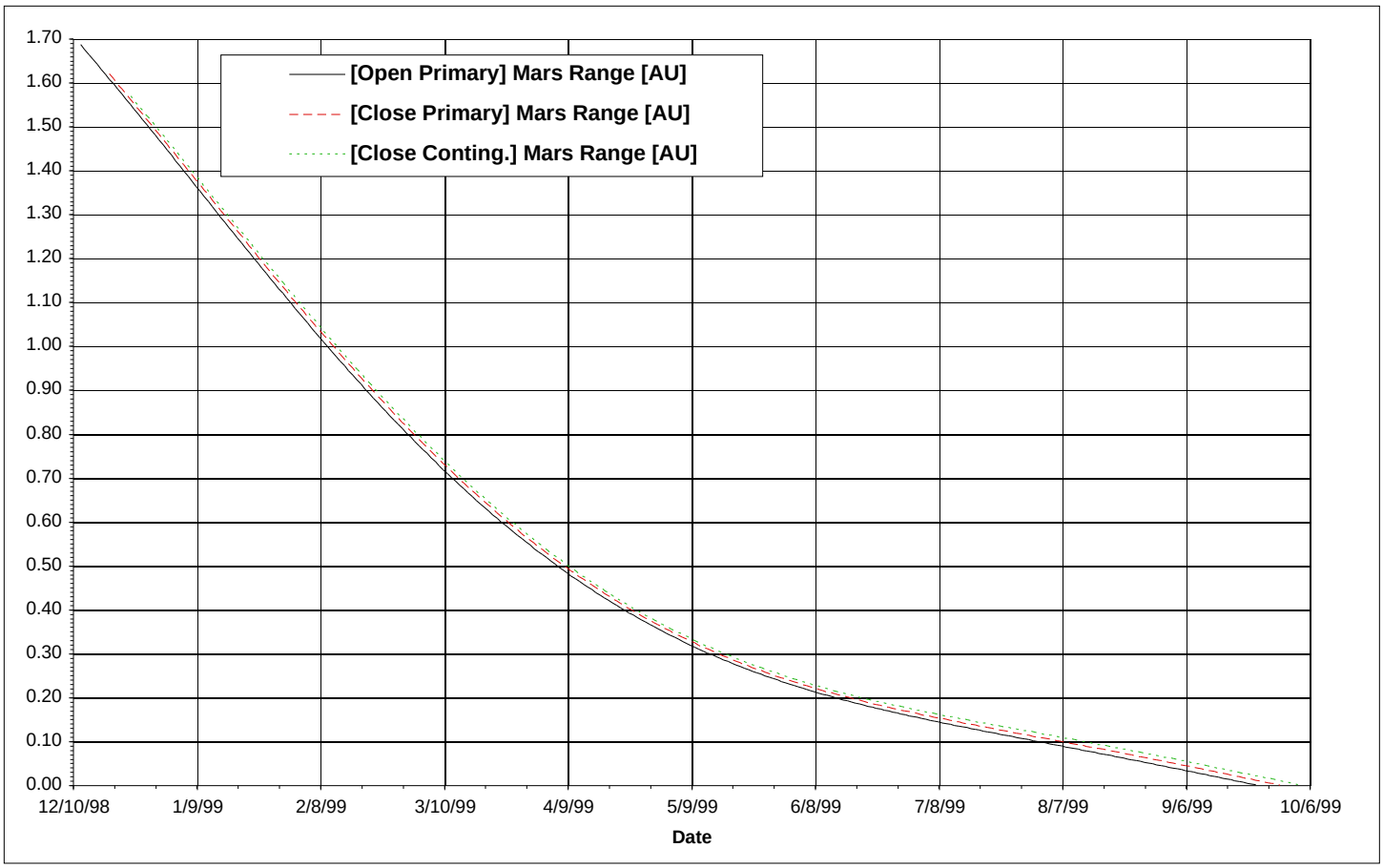
6/8/99
7/8/99
8/7/99
9/6/99
10/6/99
Date


[Open Primary] Mars Range [AU]
[Close Primary] Mars Range [AU]
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1.40
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1.10
1.00
0.90
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0.00
12/10/98
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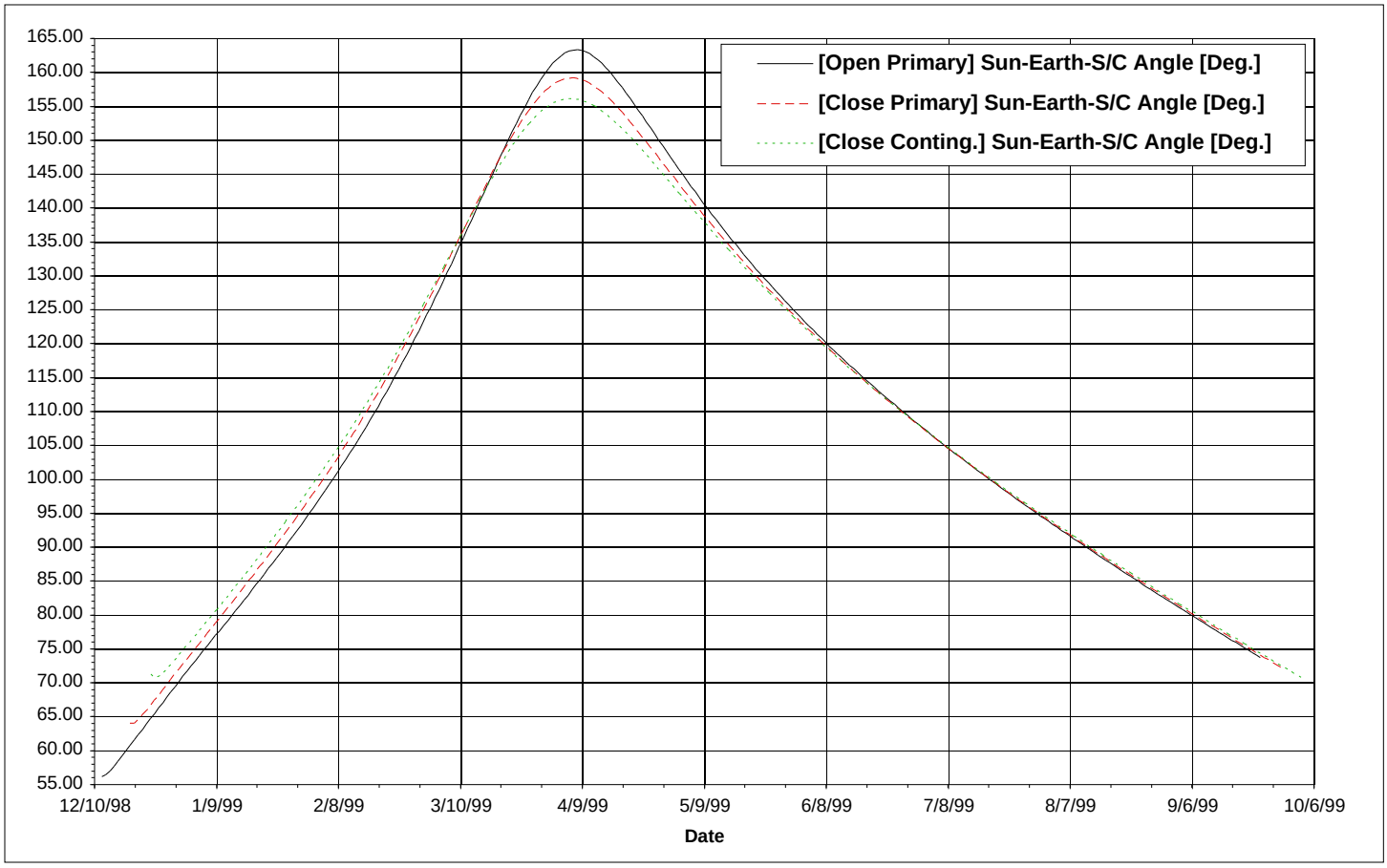
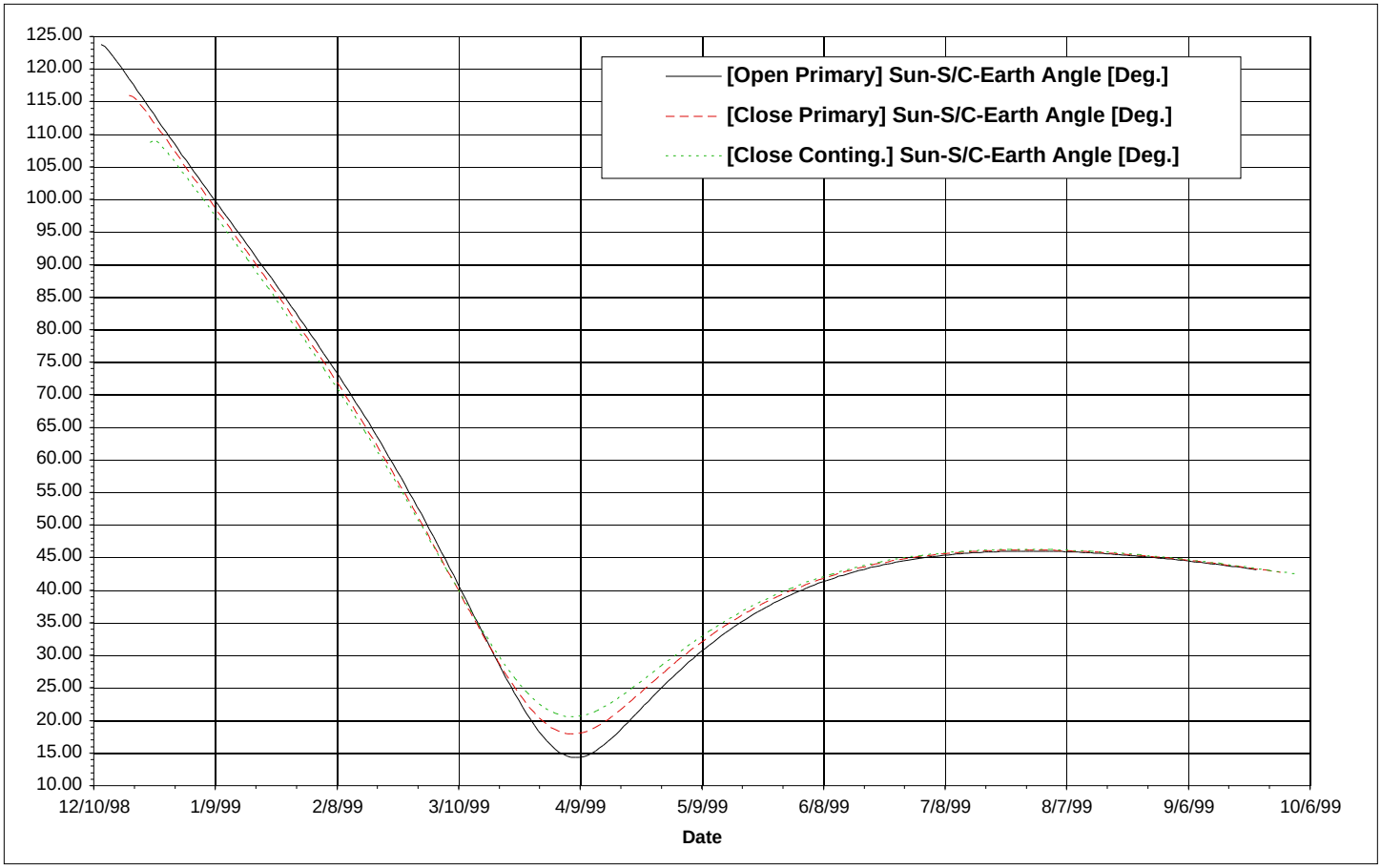
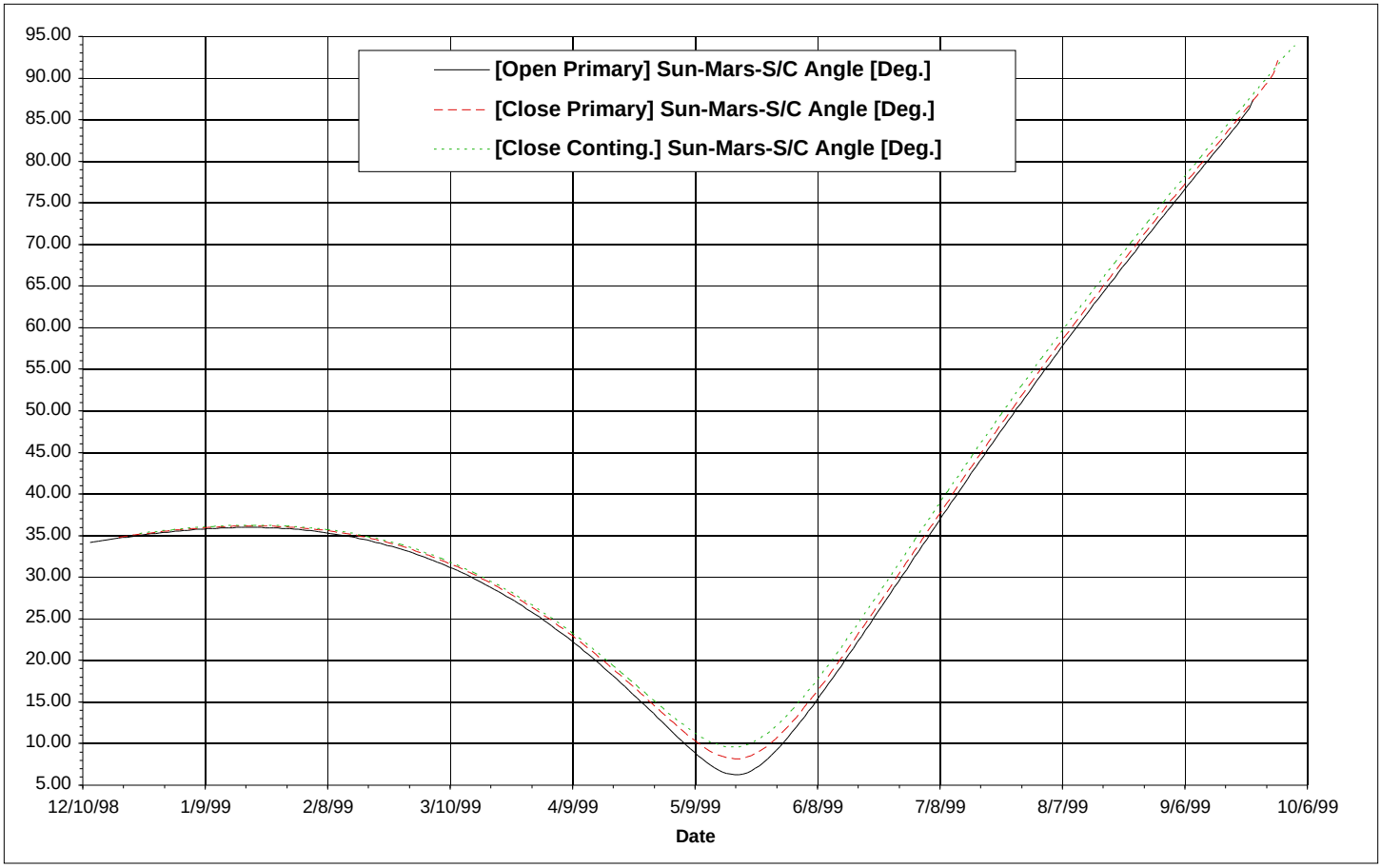
Date

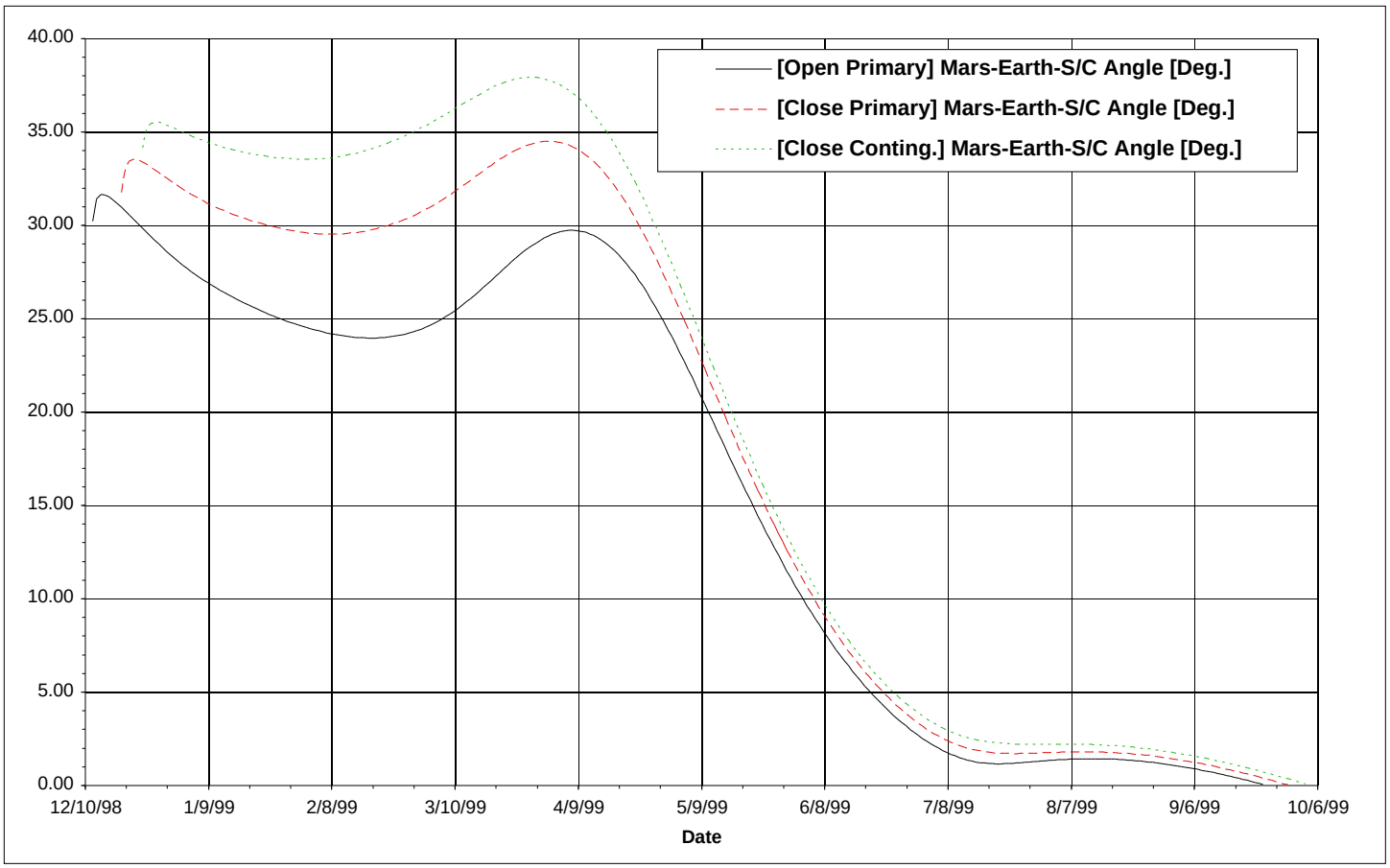
Orbiter TCD 11/25/96



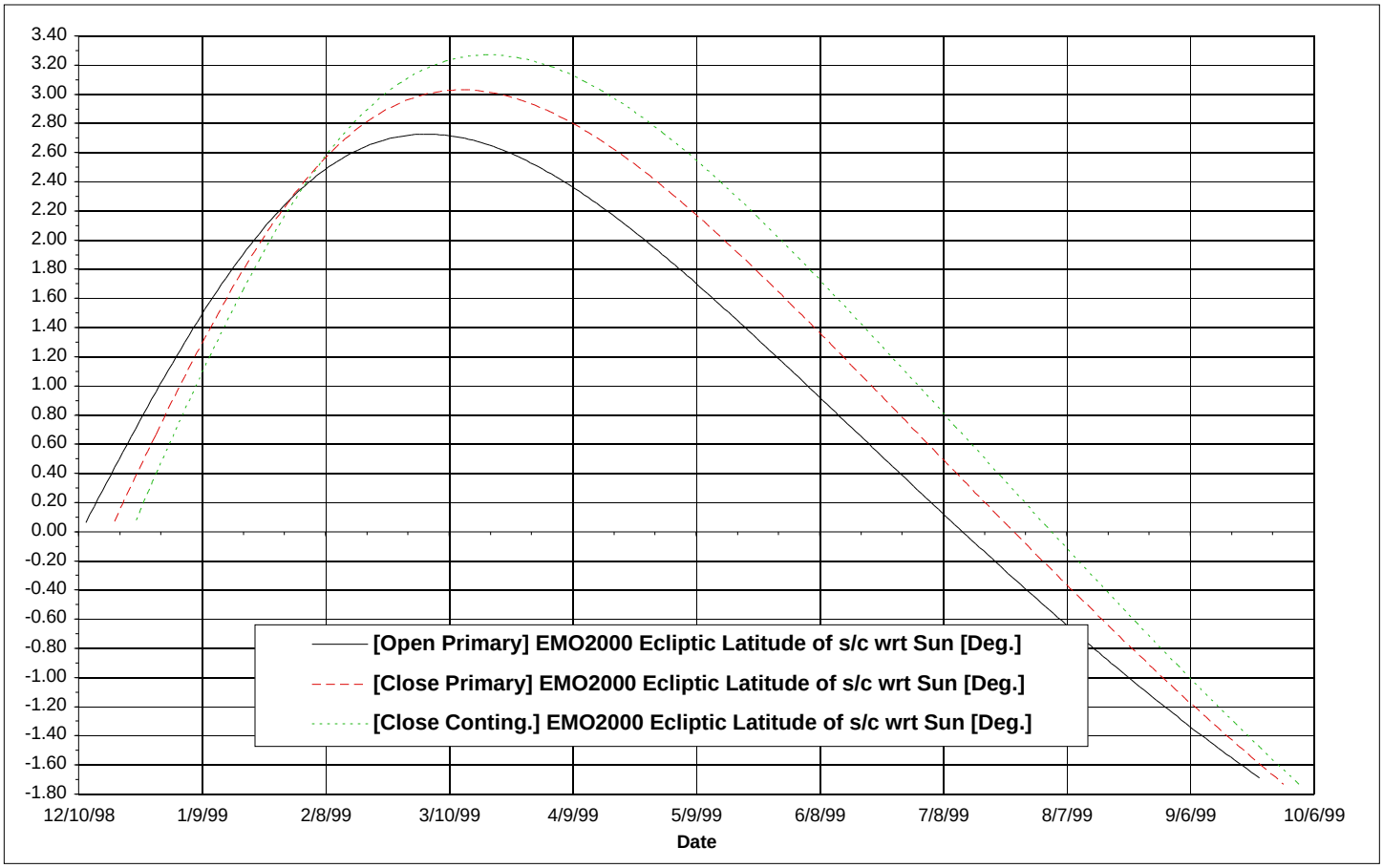


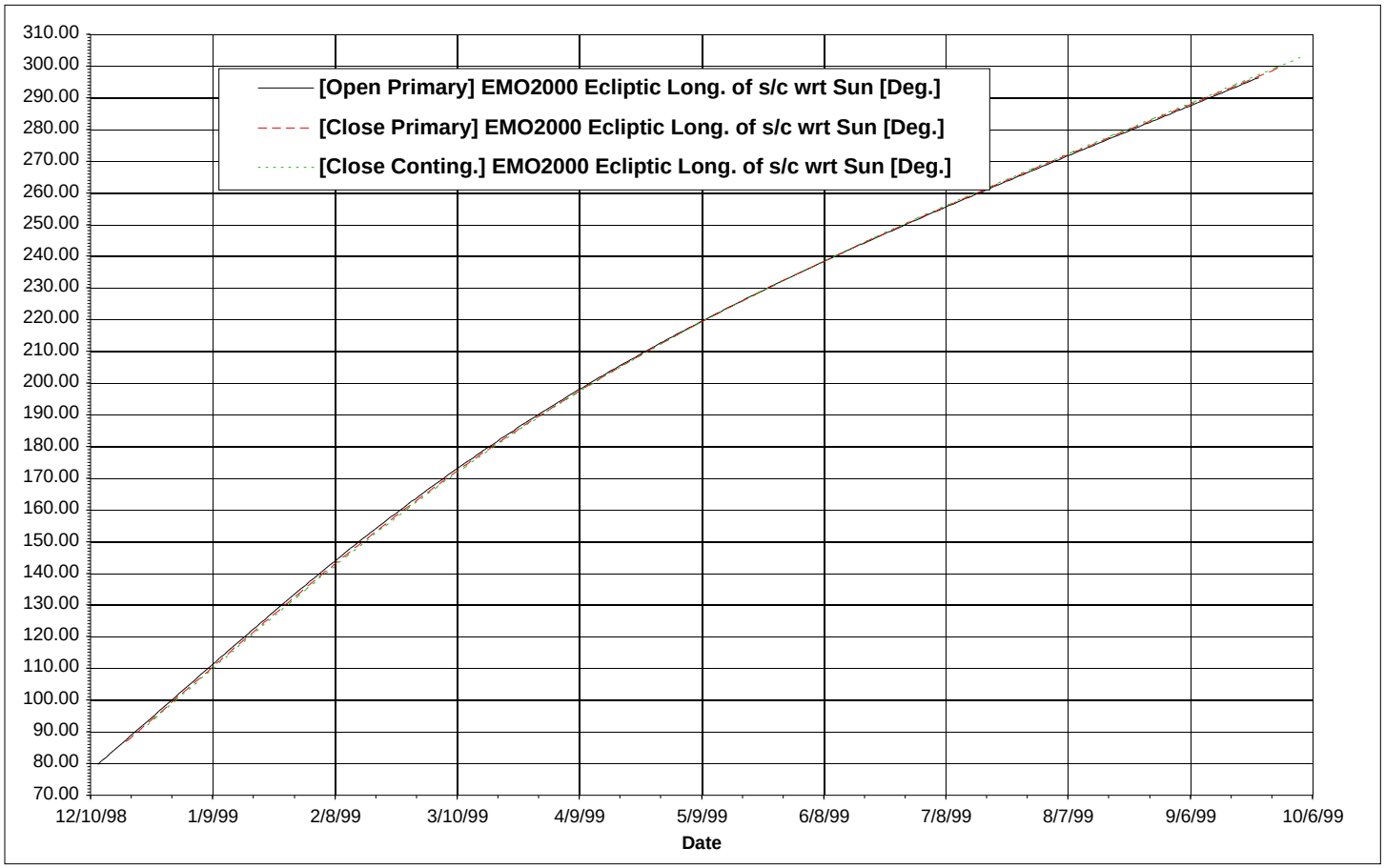
Orbiter TCD 11/25/96



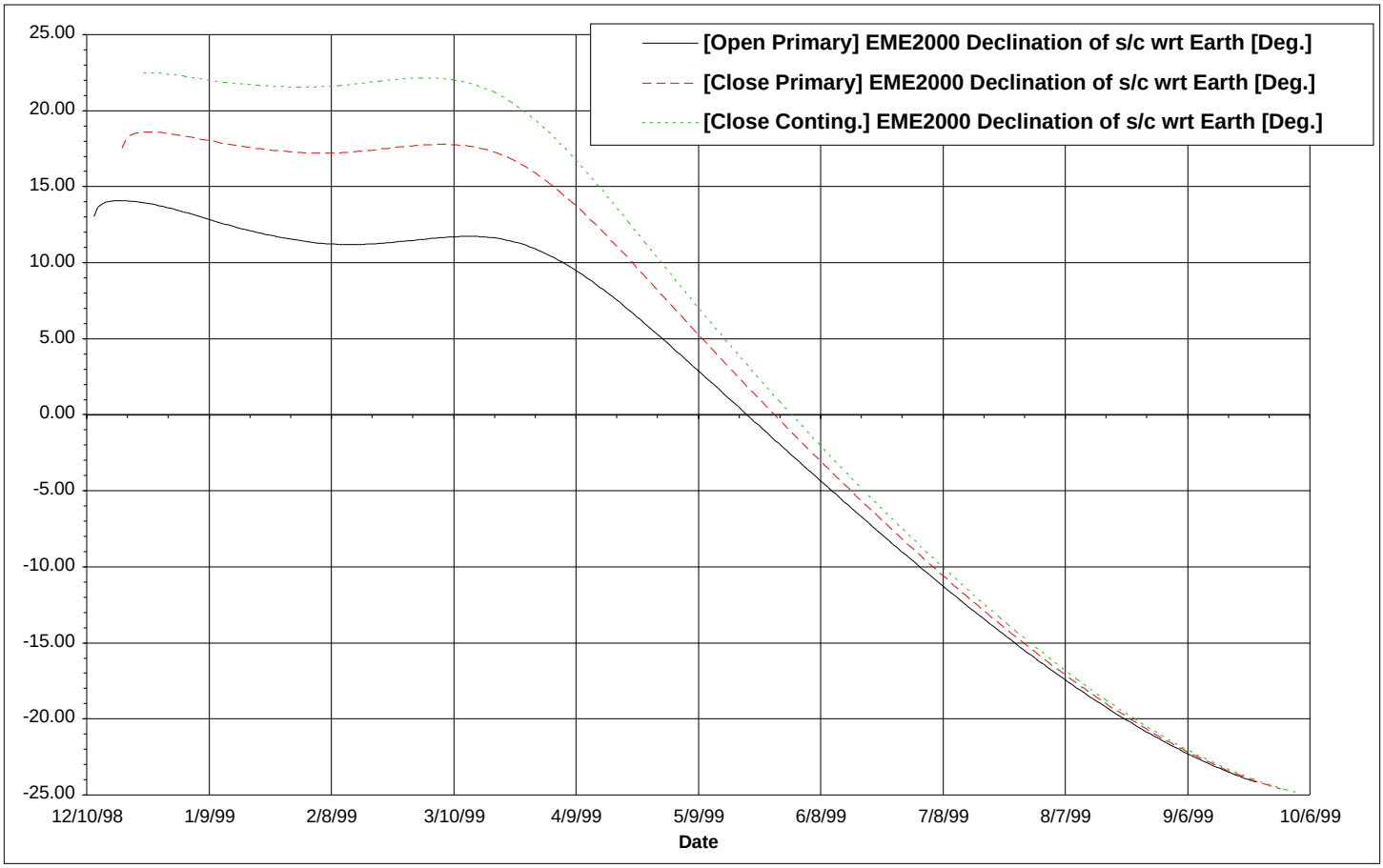


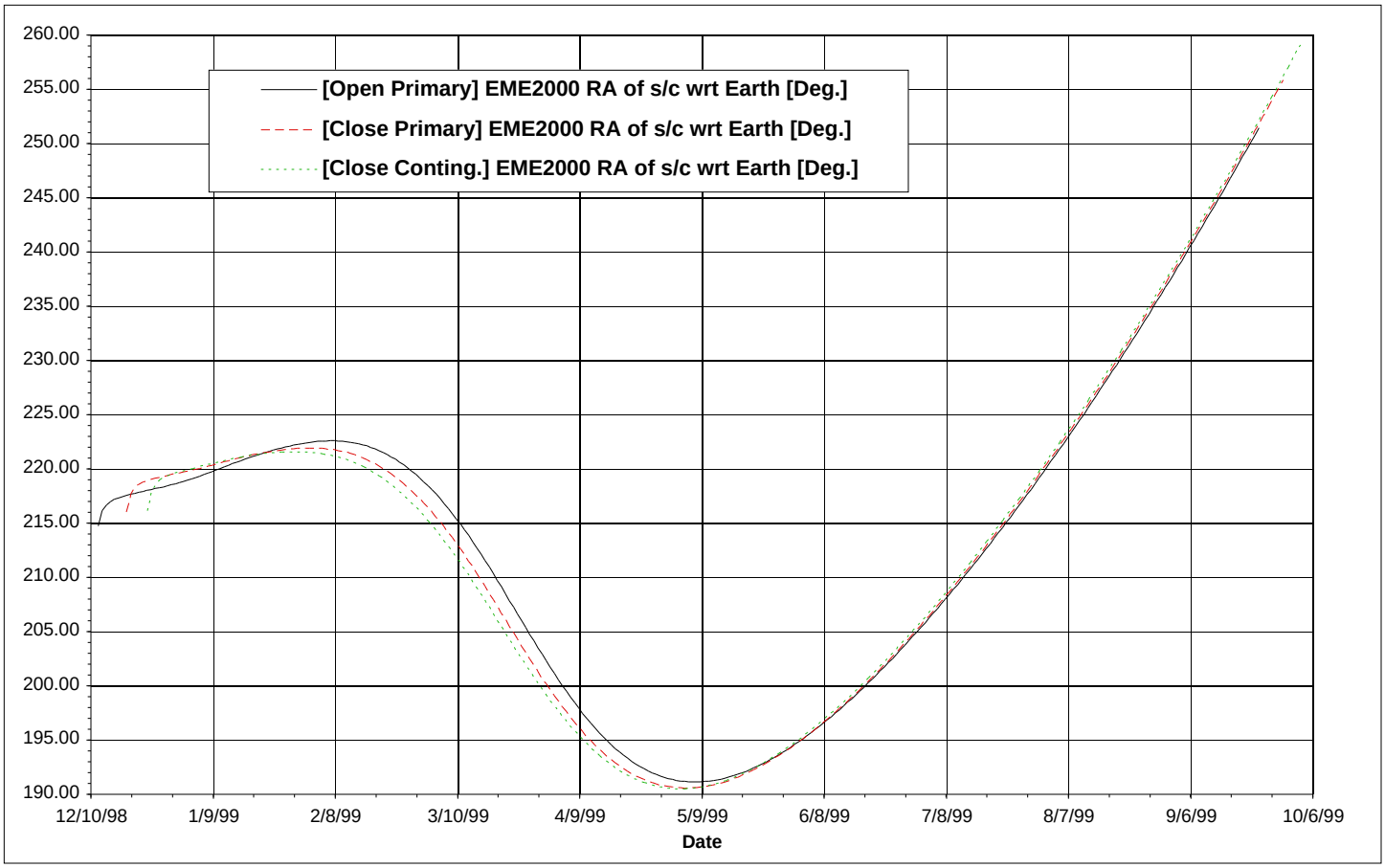
Orbiter TCD 11/25/96





Orbiter TCD 11/25/96





A.4 MOI Illustrations

MOI 9/24/99: View From N. Trajectory Pole

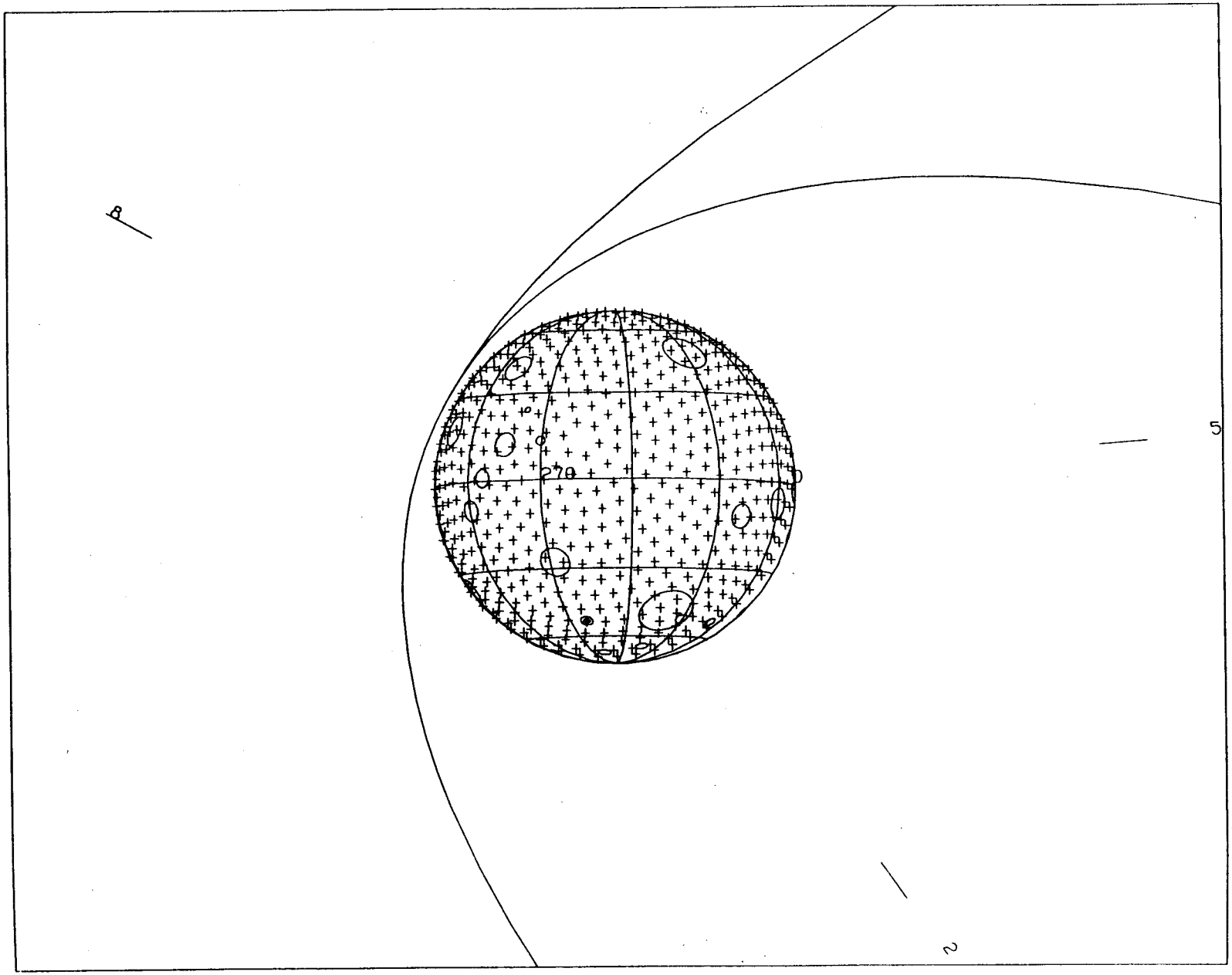


Fig 1

MOI 9/24/99: View From S. Trajectory Pole

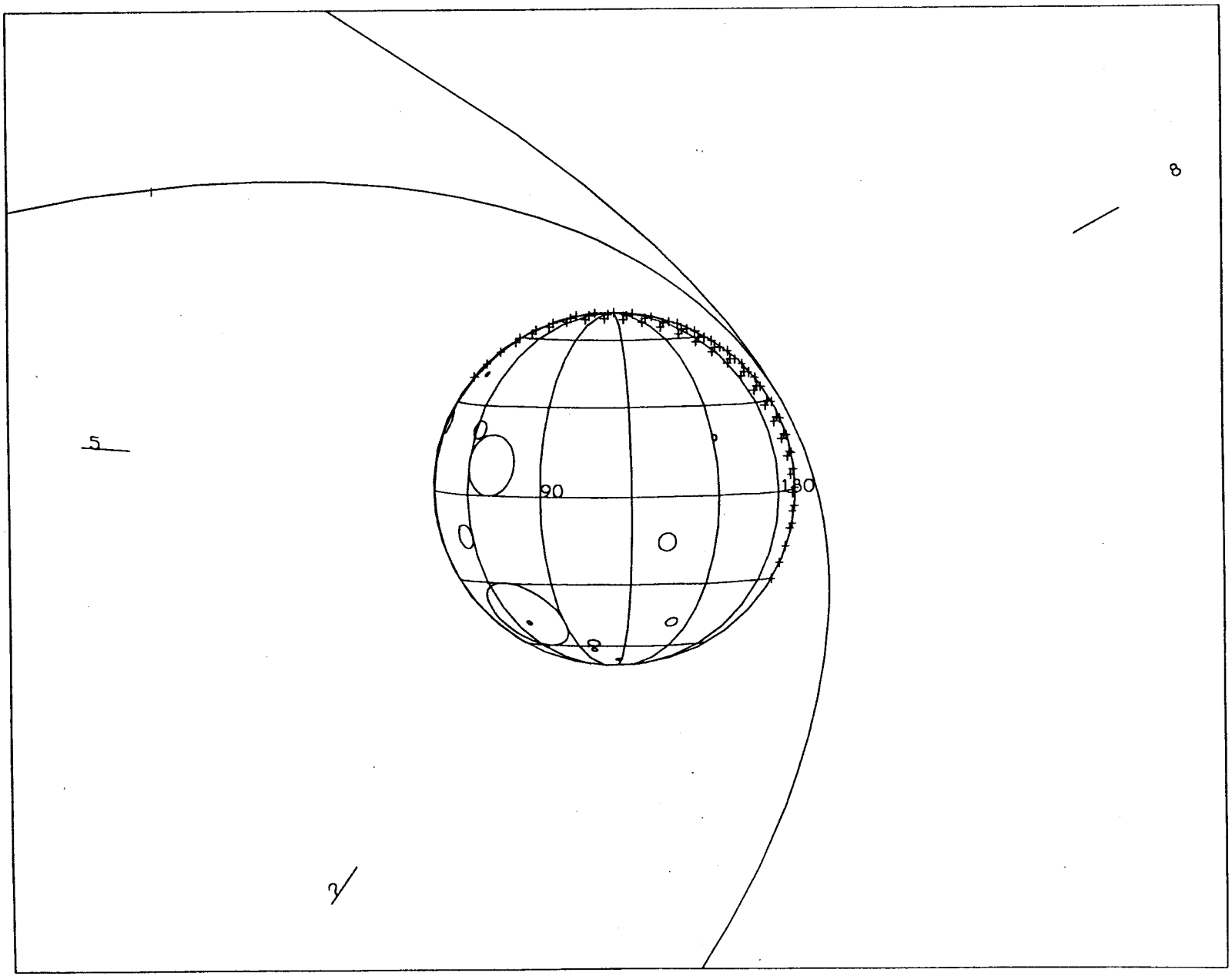


Fig 2

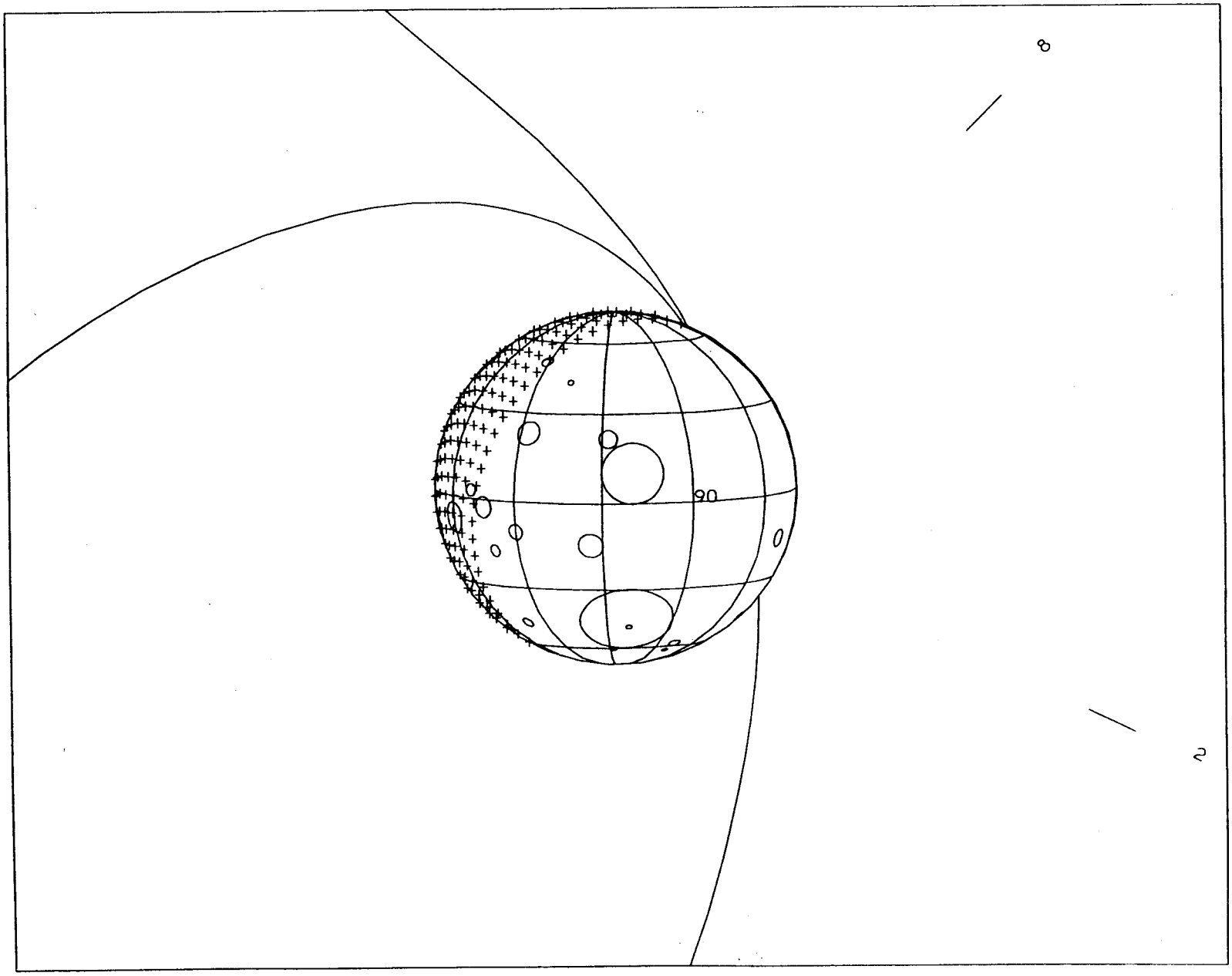


Fig 3

MOI 9/24/99: View From Sun

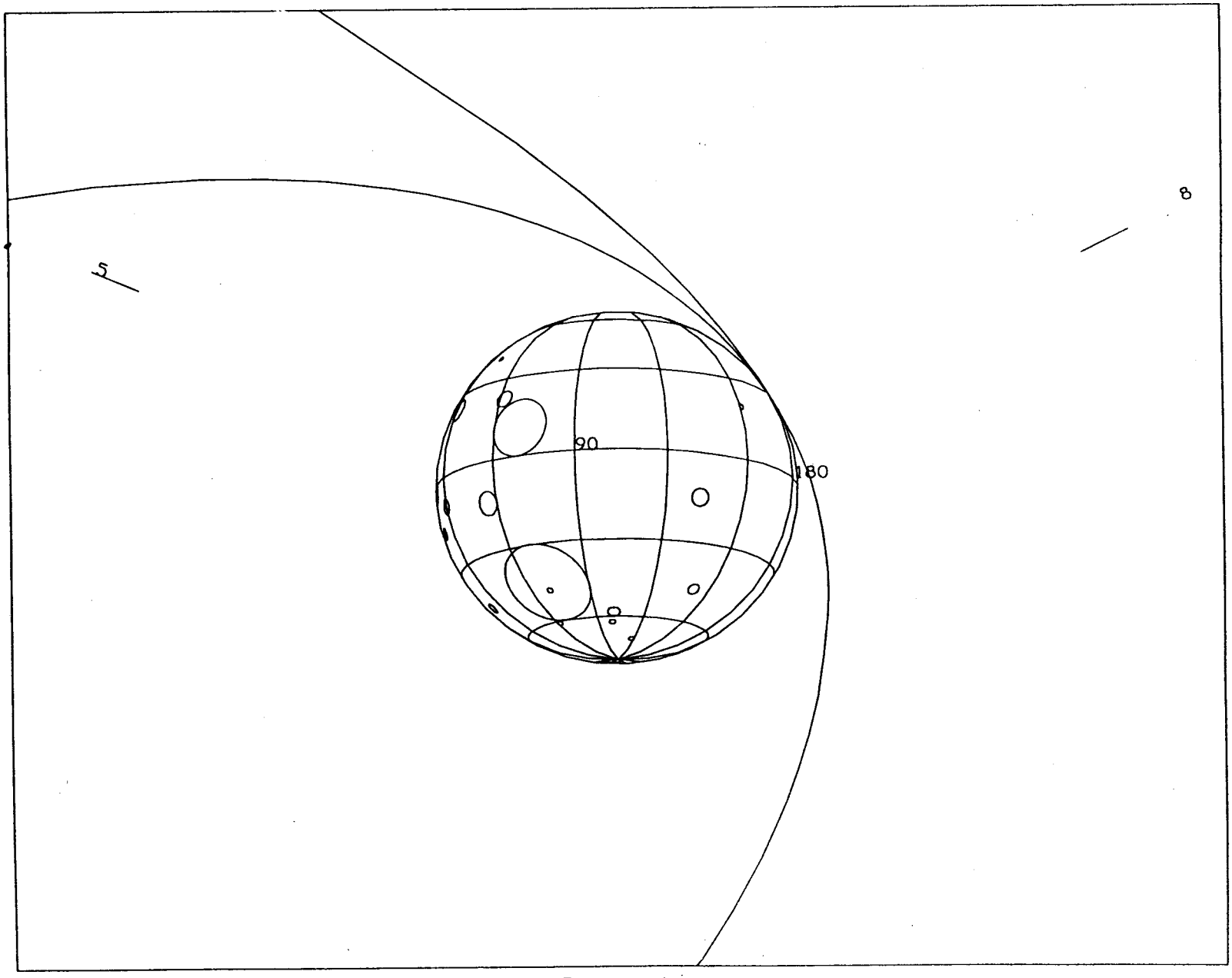


Fig 4

MOI 9/24/99: View From Approach Asymptote

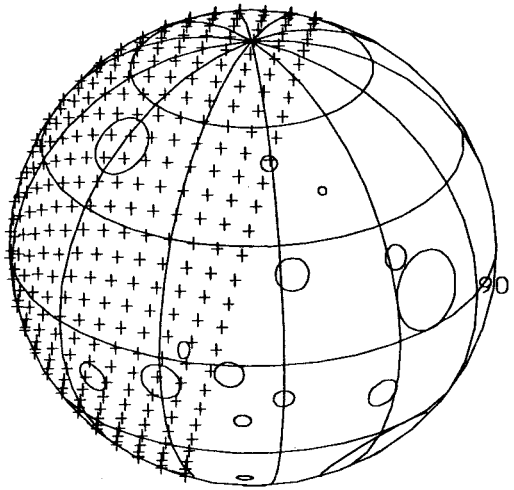


Fig 1

MOI 9/24/99: s/c View: Closest Appr - 30 min., FOV = 150 deg.

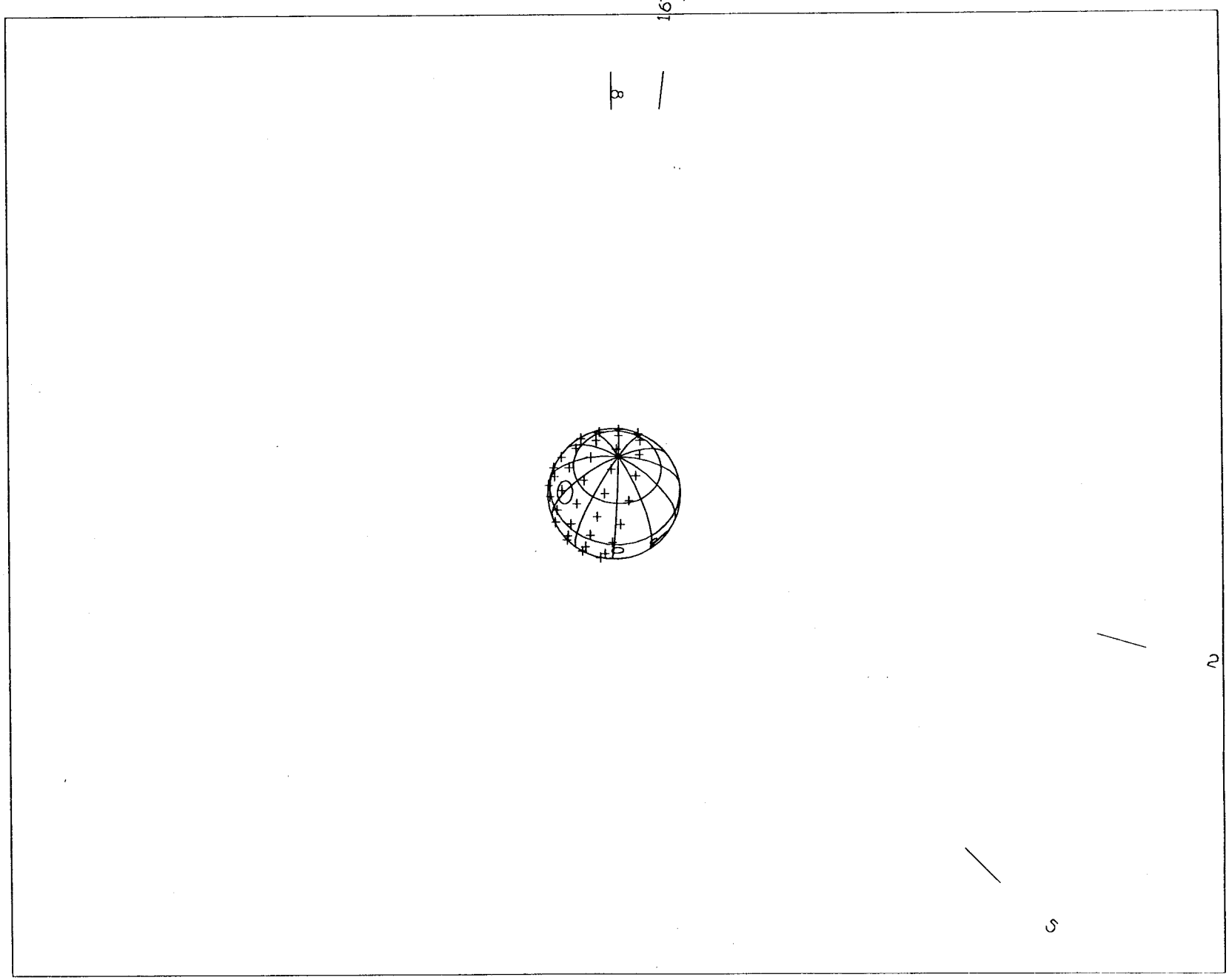


Fig 2

MOI 9/24/99: s/c View: Closest Appr - 25 min., FOV = 150 deg.

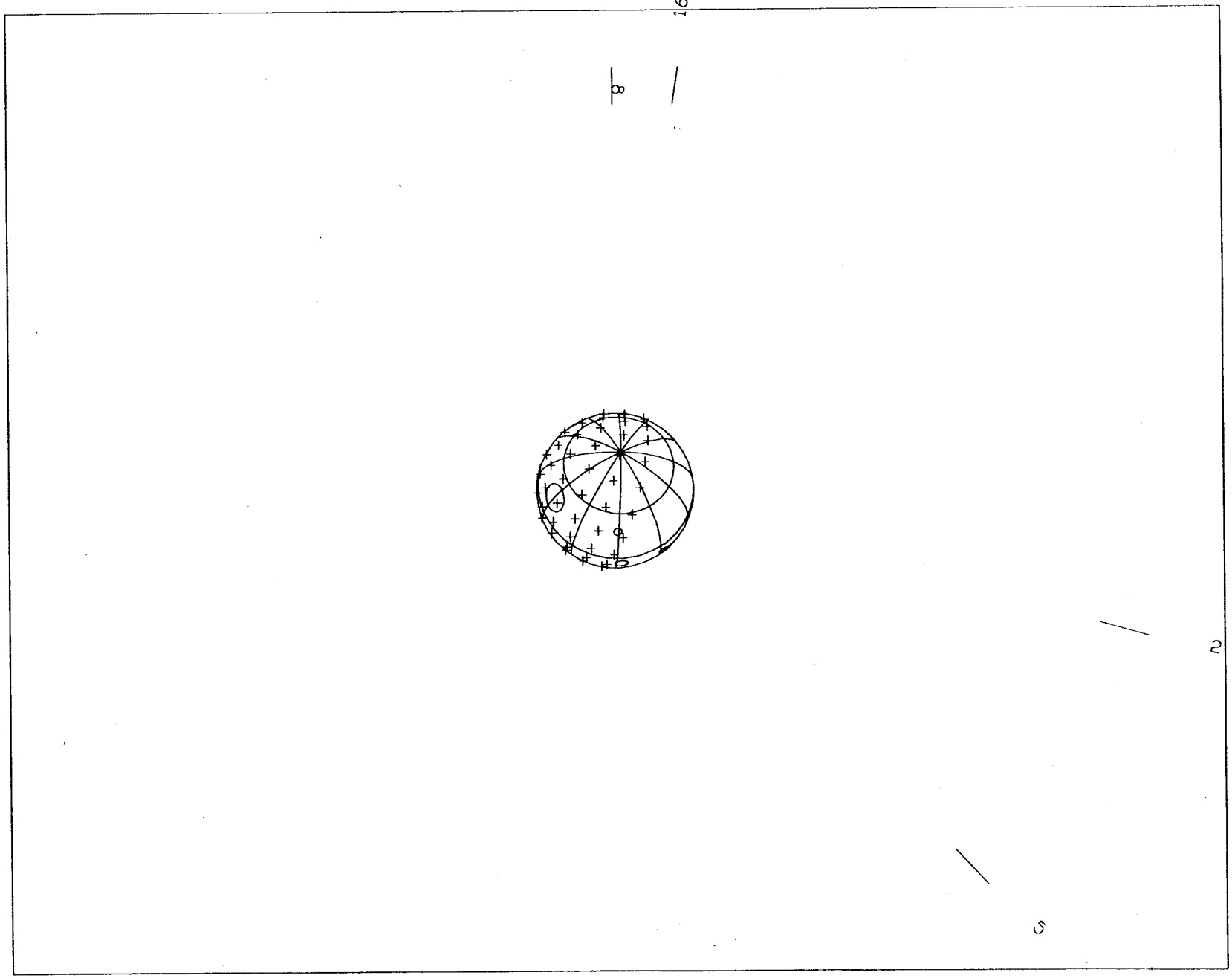


Fig 3

MOI 9/24/99: s/c View: Closest Appr - 20 min., FOV = 150 deg.

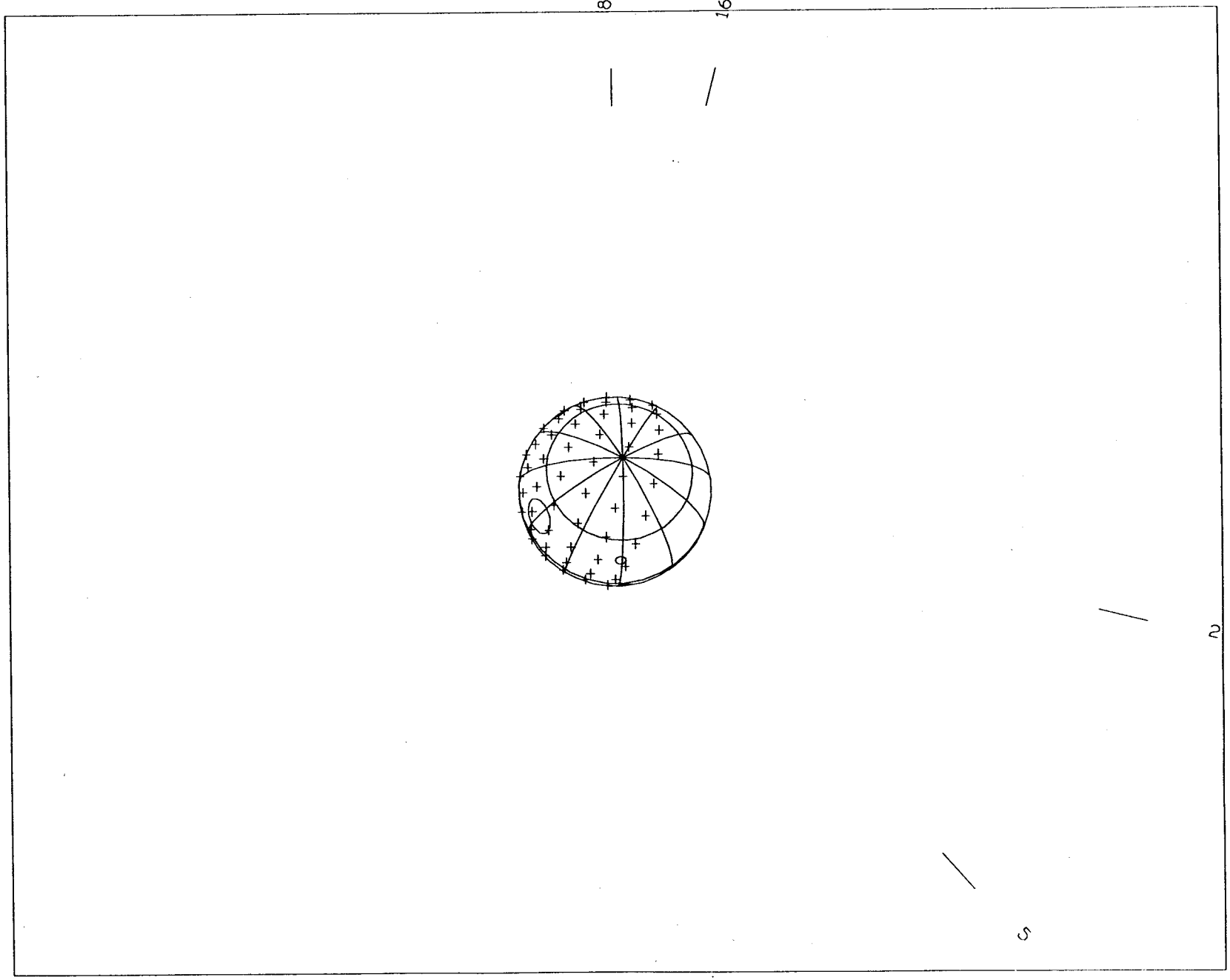


Fig 4

MOI 9/24/99: s/c View: Closest Appr - 15 min., FOV = 150 deg.

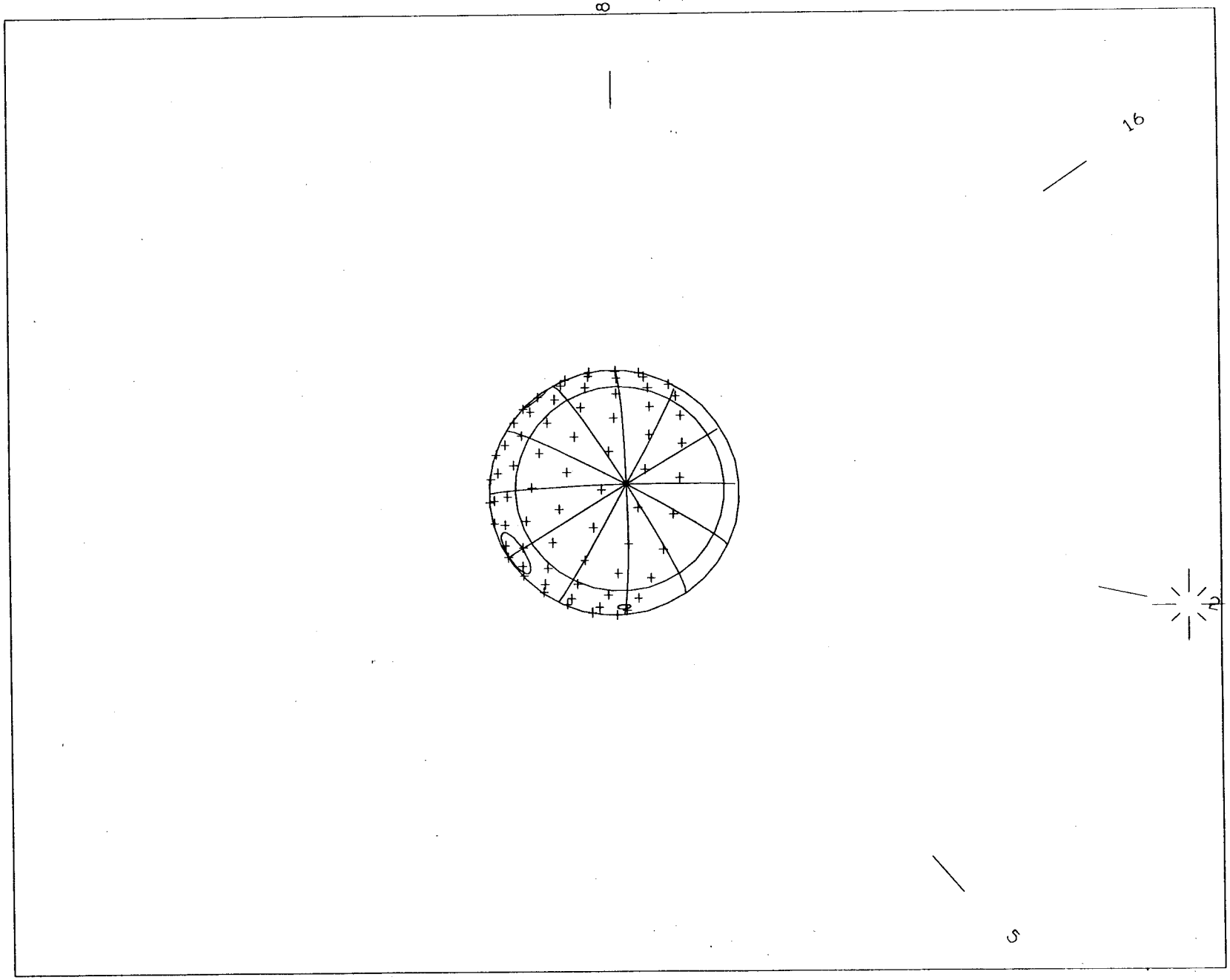


Fig 5

MOI 9/24/99: s/c View: Closest Appr - 10 min., FOV = 150 deg.

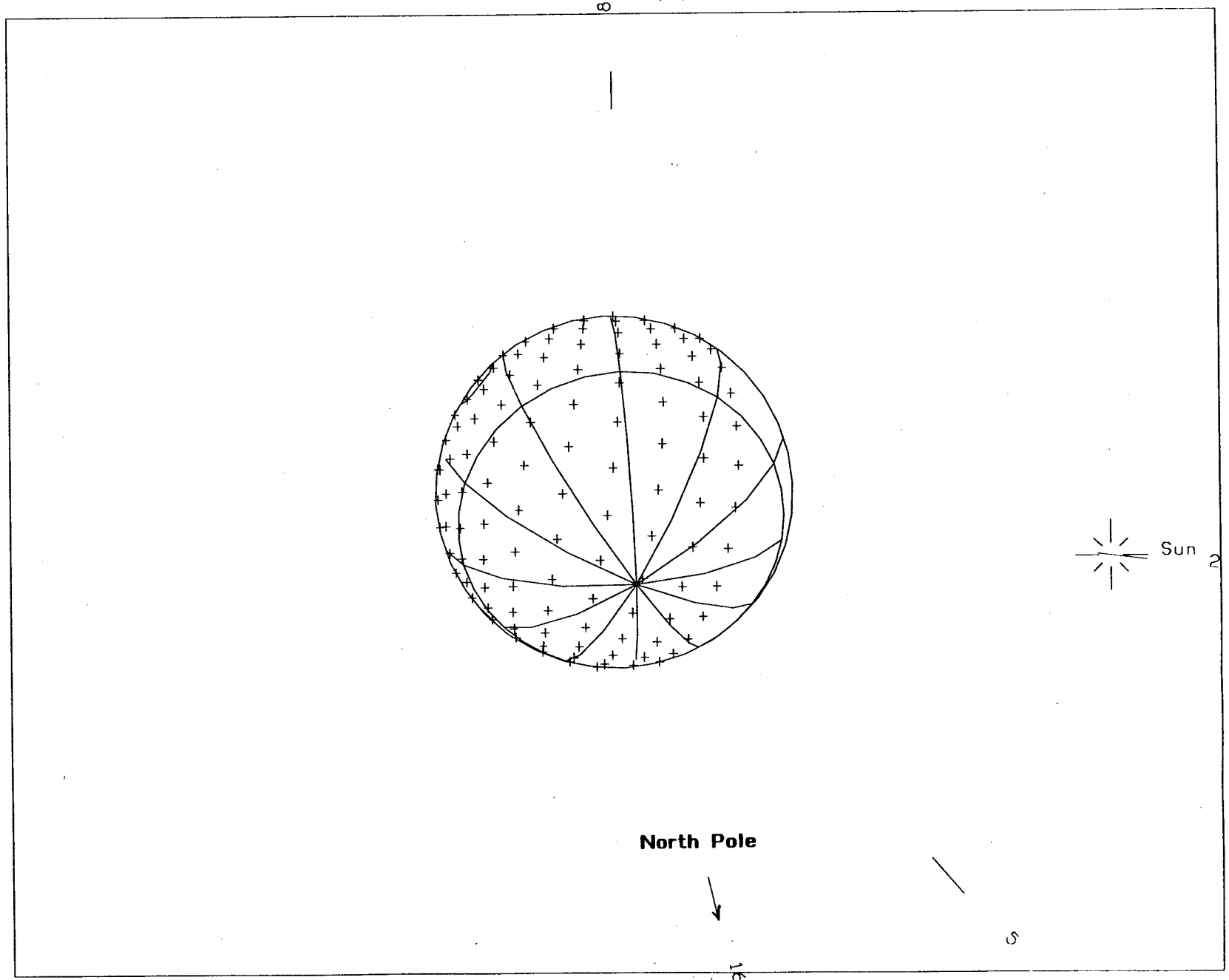


Fig 6

9/24/99: s/c View: Closest Appr - 8 min. MOI start, FOV = 150

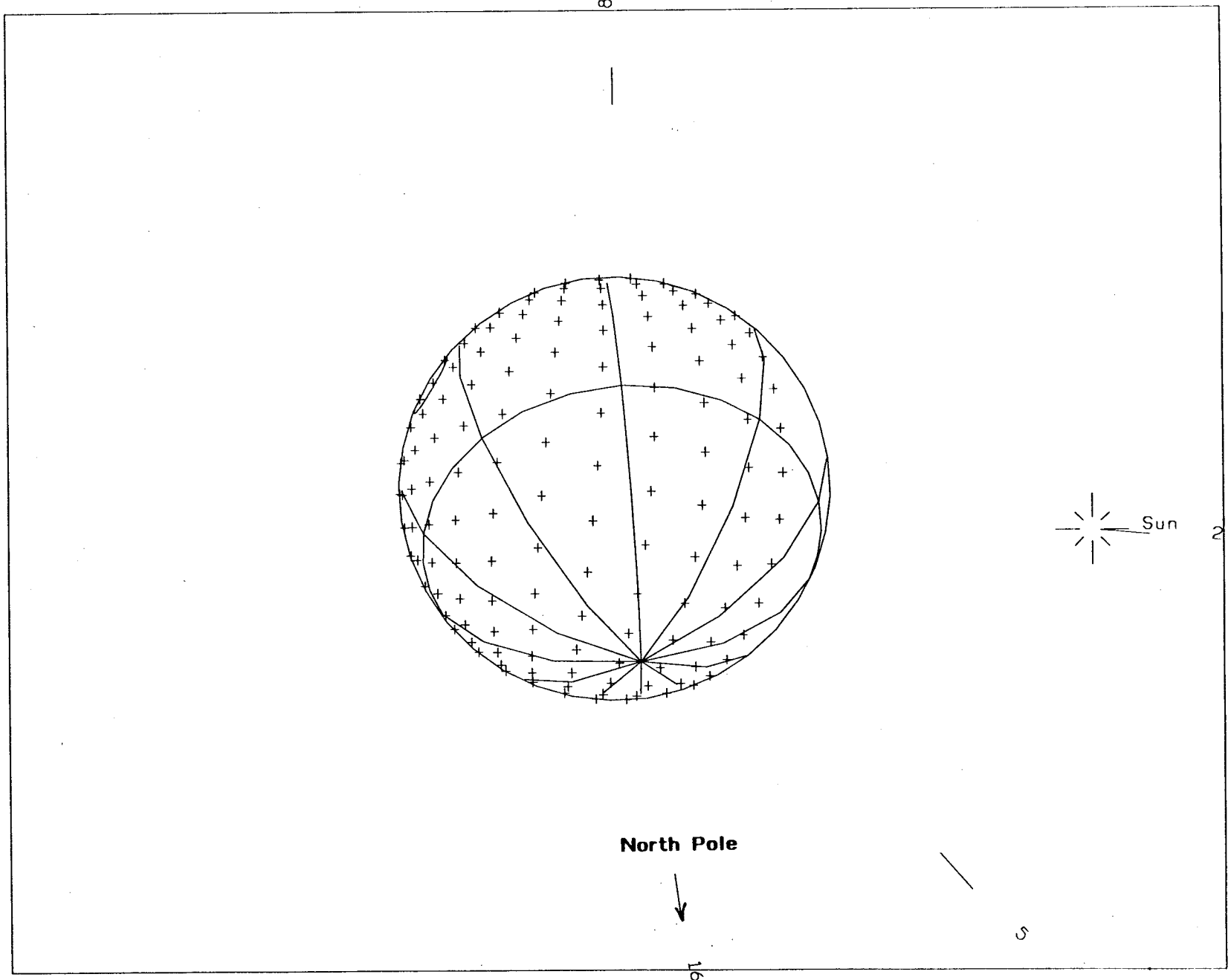


Fig 7

MOI 9/24/99: s/c View: Closest Appr - 6 min., FOV = 150 deg.

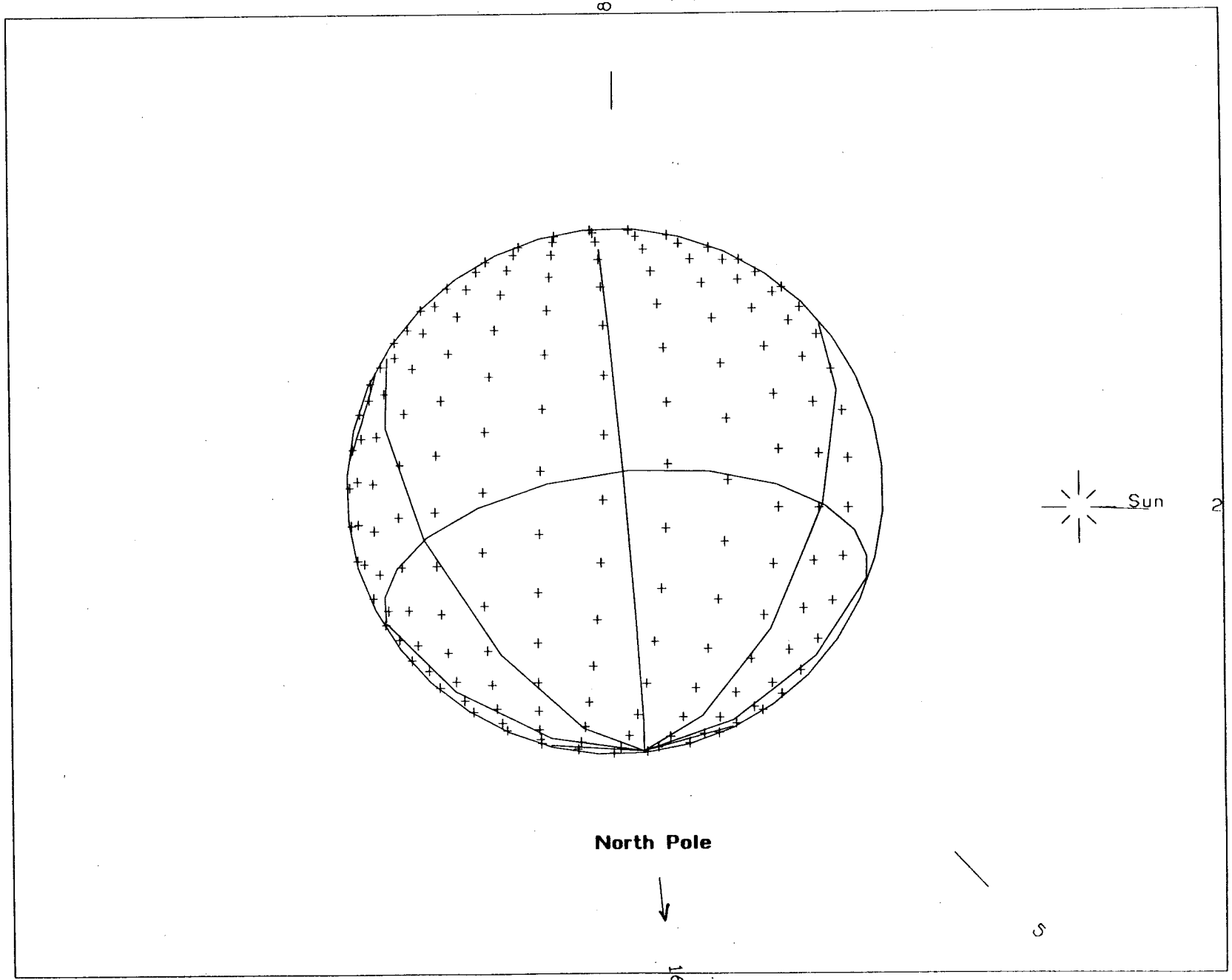


Fig 8

MOI 9/24/99: s/c View: Closest Appr - 4 min., FOV = 150 deg.

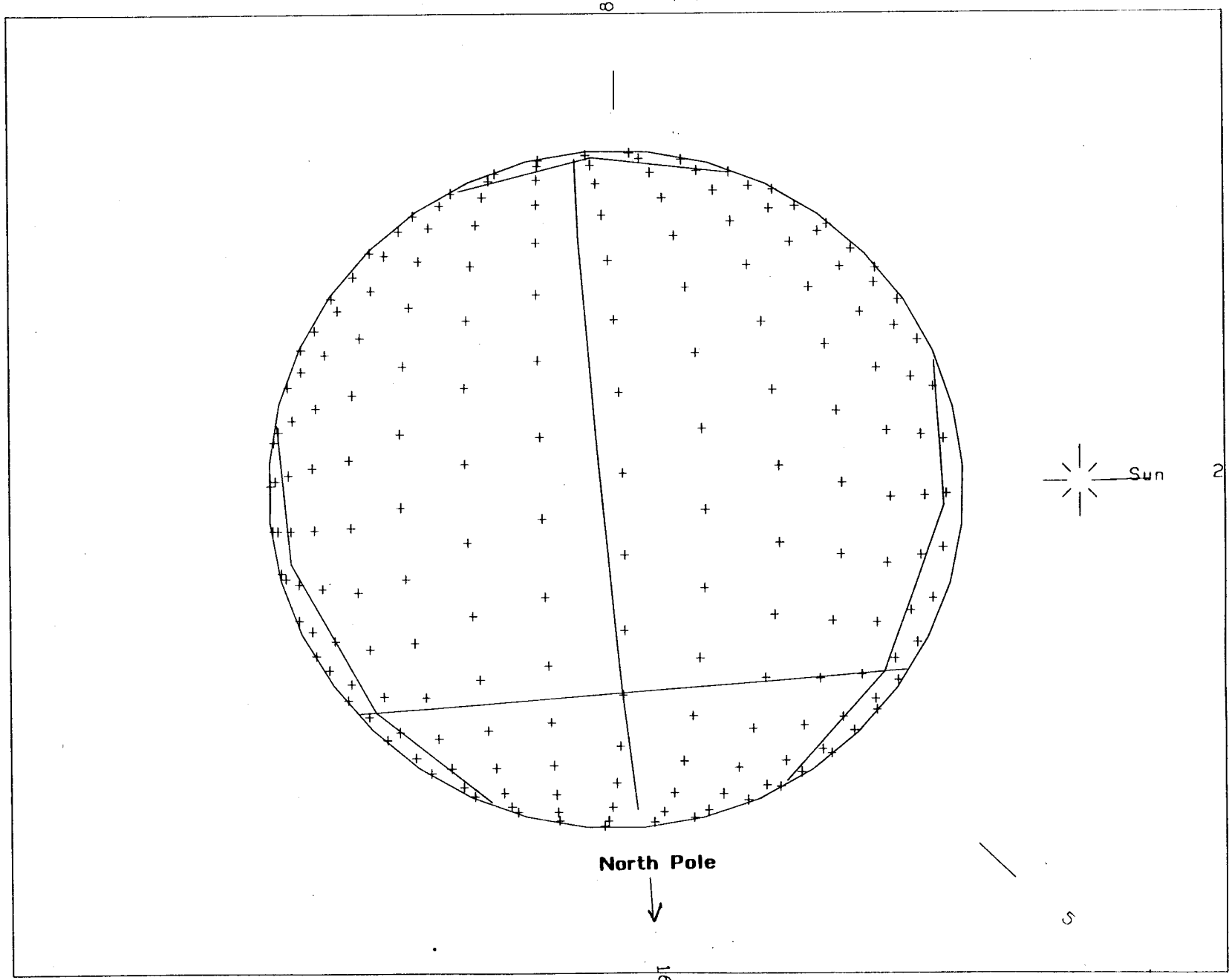


Fig 16

MOI 9/24/99: s/c View: Closest Appr - 2 min., FOV = 150 deg.

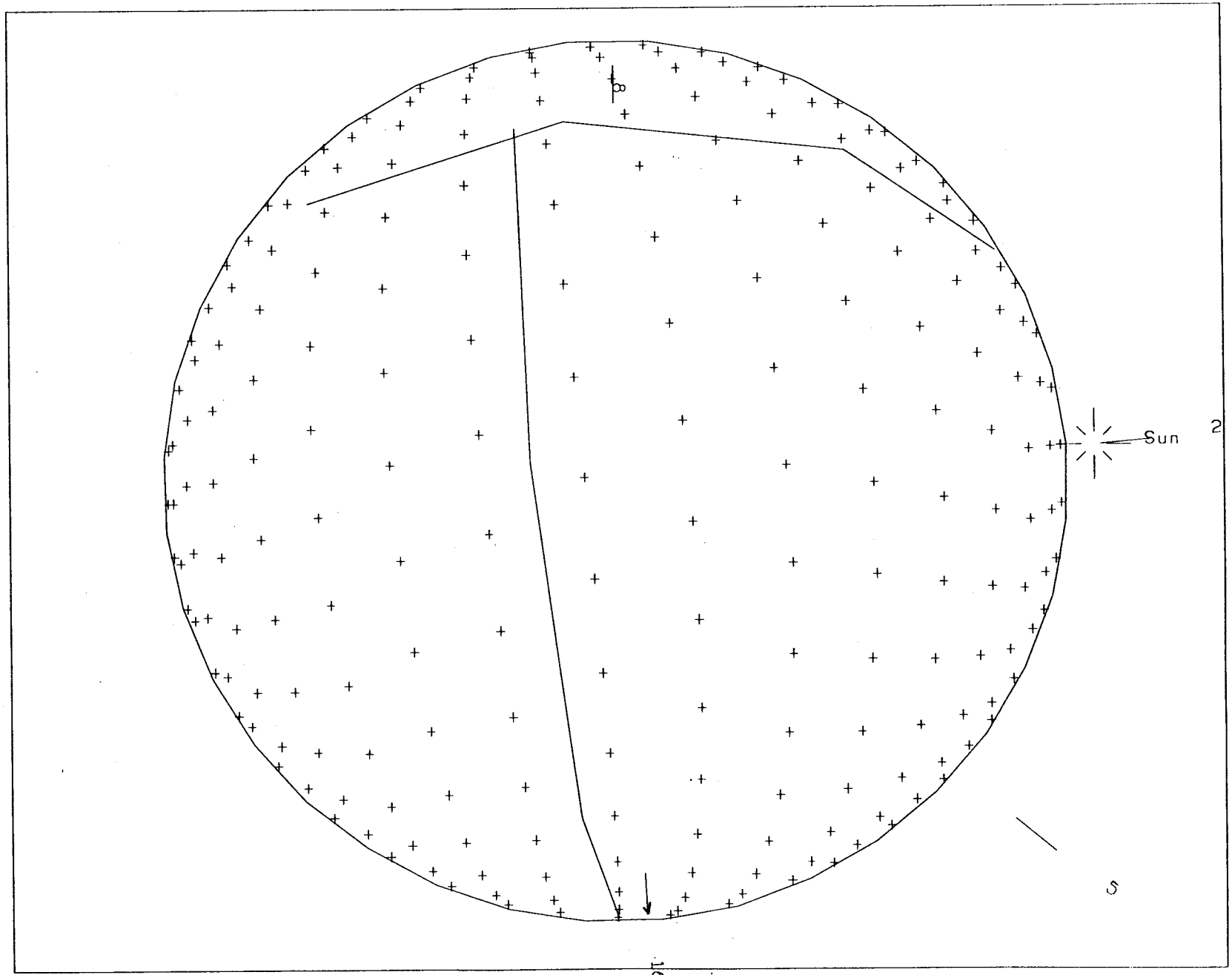


Fig 10

MUI 9/24/99: s/c View: Closest Approach, FOV = 150 deg.

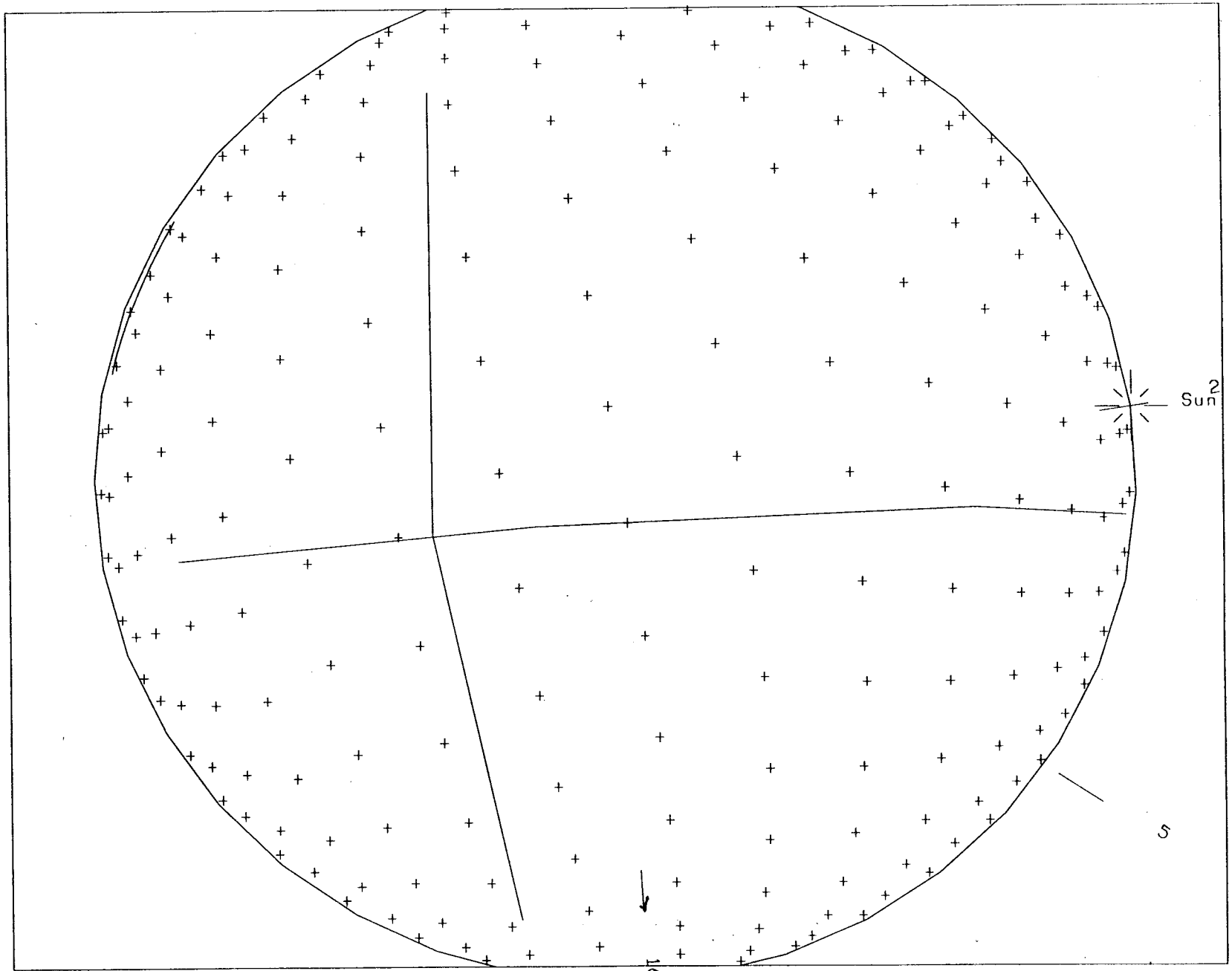


Fig 11

A.5 Aerobraking Database

A.5.1 Open Primary Launch Period: State Data and Strawman Tracking Schedule

A.5.2 Close Primary Launch Period: State Data and Strawman Tracking Schedule

State data are based on CDR aerobraking timelines provided by W. Willcockson 11/96. Strawman tracking schedules are based on the following assumptions, using the 11/96 aerobraking timelines:

- The first post-aeropass track starts 18 minutes from the end of the aeropass, which provides time for the RW slew to the DSN contact orientation and reconfiguration of the Orbiter.
- Tracking duration is the total time the SSPA is on
- Aeropass begin and end times include 5 minute pads at start and end
- 4 on: 5 off ratio is maintained throughout, except during the last 2 days, during which the tracking pass durations are 30 minutes per orbit.

OPEN LAUNCH PERIOD - AEROBRAKING TIMELINE

Open of Primary MSP Peer Review 11/96, Beg of L/W, Min Mass Config, Data written at periapsis point

Starting Time for Simulation: Sept. 28, 1999; 22:01 ET (Apoapsis, Last Walkin Maneuver)

9/28/99 22:01	DAY#	REV#	PERIAPS ALT	PER WRT ELLIPSOID	APOAPSIS ALT	NBURN	QDYN	QHTDYN	INCLIN	ASC NODE	ARGPER	(DO NOT USE) DYNAMIC DRAGDUR	SUN ECLIPSE BEGIN	SUN ECLIPSE END	EARTH OCCULT BEGIN	EARTH OCCULT END
9/29/99 11:01	0.54	1	105.74	111.14	35260.00	0	0.51	0.24	92.87	355.01	150.39	0.00	0.00	0.00	0.00	0.00
9/30/99 12:26	1.60	2	105.42	110.88	34596.00	0	0.52	0.25	92.89	355.03	150.21	231.24	-287.54	143.58	-367.04	944.78
10/1/99 13:14	2.63	3	105.16	110.68	33923.00	0	0.53	0.25	92.91	355.04	150.04	346.15	-282.73	134.31	-367.07	932.49
10/2/99 13:26	3.64	4	105.00	110.58	33239.00	0	0.56	0.26	92.93	355.06	149.86	246.53	-282.27	124.73	-367.10	920.22
10/3/99 13:01	4.63	5	104.93	110.56	32562.00	0	0.57	0.27	92.95	355.08	149.68	291.15	-280.83	115.00	-367.21	909.66
10/4/99 12:02	5.58	6	104.87	110.56	31930.00	0	0.57	0.27	92.95	355.09	149.50	273.23	-274.98	105.37	-367.30	898.04
10/5/99 10:30	6.52	7	104.60	110.34	31356.00	0	0.57	0.27	92.94	355.11	149.34	282.55	-264.00	96.13	-366.83	887.53
10/6/99 8:25	7.43	8	104.14	109.93	30756.00	0	0.63	0.30	92.94	355.12	149.21	289.30	-266.25	87.76	-367.09	877.35
10/7/99 5:46	8.32	9	104.23	110.06	30085.00	0	0.62	0.29	92.95	355.12	149.08	232.75	-252.99	79.27	-367.08	867.63
10/8/99 2:34	9.19	10	104.66	110.55	29379.00	0	0.56	0.27	92.96	355.13	148.91	268.33	-245.16	68.67	-367.09	856.74
10/8/99 22:54	10.04	11	104.15	110.10	28914.00	0	0.66	0.31	92.97	355.15	148.75	247.87	-236.47	54.57	-366.98	845.58
10/9/99 18:43	10.86	12	104.34	110.33	28238.00	0	0.58	0.27	92.96	355.16	148.60	260.85	-235.07	45.35	-367.39	835.83
10/10/99 14:04	11.67	13	104.26	110.31	27720.00	0	0.59	0.28	92.97	355.18	148.44	311.79	*-227.09*	36.21	-367.07	825.39
10/11/99 8:59	12.46	14	104.19	110.29	27221.00	0	0.62	0.29	92.97	355.19	148.30	233.95	*-219.11*	23.01	-366.99	816.11
10/12/99 3:26	13.23	15	104.45	110.61	26608.00	0	0.59	0.28	92.98	355.20	148.14	297.70	*-211.14*	13.56	-366.97	806.53
10/12/99 21:29	13.98	16	104.05	110.27	26158.00	0	0.60	0.28	92.98	355.22	147.95	283.21	*-203.16*	3.40	-366.62	797.89
10/13/99 15:09	14.71	17	103.91	110.19	25667.00	0	0.61	0.29	92.99	355.23	147.80	305.80	-195.18	-6.25	-366.38	788.85
10/14/99 8:24	15.43	18	104.42	110.75	25175.00	0	0.55	0.26	92.99	355.24	147.64	303.87	-184.70	-27.29	-366.59	781.54
10/15/99 1:18	16.14	19	104.14	110.51	24794.00	0	0.62	0.29	93.01	355.26	147.50	304.50	*-173.97*	-43.82	-366.27	773.28
10/15/99 17:50	16.83	20	104.89	111.31	24278.00	0	0.53	0.25	93.00	355.27	147.37	211.71	-163.23	-81.19	-366.96	764.97
10/16/99 10:03	17.50	21	105.28	111.76	23906.00	0	0.49	0.23	93.00	355.28	147.21	280.23	-138.46	-136.35	-367.09	756.98
10/17/99 1:58	18.17	22	102.41	108.94	23520.00	1	0.77	0.36	93.01	355.29	147.06	276.41	0.00	0.00	-366.36	749.42
10/17/99 17:30	18.81	23	105.32	111.89	23017.00	2	0.49	0.23	93.02	355.31	146.94	266.43	0.00	0.00	-367.15	742.77
10/18/99 8:44	19.45	24	103.27	109.90	22583.00	3	0.65	0.30	93.01	355.32	146.77	350.75	0.00	0.00	-366.26	733.03
10/18/99 23:40	20.07	25	105.83	112.53	22213.00	4	0.45	0.21	93.02	355.34	146.58	260.05	0.00	0.00	-366.39	726.70
10/19/99 14:20	20.68	26	103.00	109.75	21904.00	5	0.70	0.33	93.04	355.36	146.42	372.33	0.00	0.00	-365.09	718.80
10/20/99 4:41	21.28	27	105.25	112.06	21536.00	6	0.51	0.24	93.04	355.38	146.28	291.66	0.00	0.00	-366.03	713.24
10/20/99 18:48	21.87	28	105.46	112.30	21195.00	6	0.47	0.22	93.03	355.39	146.17	254.31	0.00	0.00	-366.54	705.66
10/21/99 8:41	22.45	29	103.25	110.16	20820.00	7	0.66	0.31	93.02	355.41	146.00	347.13	0.00	0.00	-365.62	698.77
10/21/99 22:18	23.01	30	105.79	112.77	20497.00	8	0.45	0.21	93.01	355.43	145.80	296.65	0.00	0.00	-365.70	692.75
10/22/99 11:43	23.57	31	103.86	110.91	20194.00	9	0.57	0.26	93.00	355.44	145.61	275.33	0.00	0.00	-363.37	685.90
10/23/99 0:52	24.12	32	104.19	111.30	19873.00	9	0.56	0.26	93.01	355.46	145.42	261.07	0.00	0.00	-363.73	680.17
10/23/99 13:49	24.66	33	104.47	111.66	19587.00	9	0.50	0.23	93.01	355.47	145.22	233.75	0.00	0.00	-363.41	675.78
10/24/99 2:33	25.19	34	104.86	112.10	19294.00	9	0.49	0.23	93.02	355.49	145.05	281.06	0.00	0.00	-362.94	668.40
10/24/99 15:06	25.71	35	102.83	110.15	19015.00	10	0.64	0.30	93.04	355.51	144.86	281.49	0.00	0.00	-362.98	662.44
10/25/99 3:23	26.22	36	103.18	110.56	18661.00	10	0.61	0.28	93.05	355.53	144.68	244.54	0.00	0.00	-364.06	656.97
10/25/99 15:27	26.73	37	103.49	110.94	18370.00	10	0.57	0.26	93.07	355.54	144.48	249.44	0.00	0.00	-364.82	651.75
10/26/99 3:19	27.22	38	103.99	111.50	18069.00	10	0.54	0.25	93.08	355.57	144.30	459.51	0.00	0.00	-363.90	646.45
10/26/99 14:59	27.71	39	104.28	111.87	17814.00	10	0.50	0.23	93.09	355.58	144.10	288.01	0.00	0.00	-363.12	641.07
10/27/99 2:28	28.19	40	102.71	110.37	17539.00	11	0.65	0.30	93.10	355.60	143.91	297.15	0.00	0.00	-362.01	637.54
10/27/99 13:47	28.66	41	102.91	110.65	17235.00	11	0.61	0.28	93.09	355.62	143.70	308.22	0.00	0.00	-362.27	633.36
10/28/99 0:52	29.12	42	102.92	110.73	16986.00	11	0.59	0.27	93.08	355.64	143.50	284.99	0.00	0.00	-361.52	627.67
10/28/99 11:46	29.57	43	102.80	110.68	16721.00	11	0.63	0.29	93.06	355.66	143.32	205.31	0.00	0.00	-361.04	622.51
10/28/99 22:29	30.02	44	102.16	110.09	16461.00	11	0.66	0.30	93.03	355.68	143.17	215.11	0.00	0.00	-360.62	618.47
10/29/99 9:00	30.46	45	103.92	111.91	16207.00	12	0.51	0.23	93.03	355.70	143.01	198.62	0.00	0.00	-360.56	614.99
10/29/99 19:24	30.89	46	104.52	112.56	15983.00	12	0.47	0.22	93.06	355.71	142.88	292.84	0.00	0.00	-360.07	609.41
10/30/99 5:37	31.32	47	103.16	111.26	15735.00	13	0.56	0.25	93.06	355.74	142.71	294.63	0.00	0.00	-359.85	603.90
10/30/99 15:42	31.74	48	103.28	111.46	15501.00	13	0.54	0.25	93.06	355.75	142.49	224.38	0.00	0.00	-360.46	601.80
10/31/99 1:38	32.15	49	102.91	111.17	15313.00	13	0.56	0.25	93.06	355.77	142.29	245.93	0.00	0.00	-359.83	596.65
10/31/99 11:25	32.56	50	102.57	110.88	15112.00	13	0.60	0.27	93.05	355.79	142.13	162.27	0.00	0.00	-359.62	593.37
10/31/99 21:04	32.96	51	103.21	111.57	14873.00	13	0.54	0.25	93.05	355.81	142.01	189.58	0.00	0.00	-359.67	589.40
11/1/99 6:33	33.36	52	103.92	112.35	14641.00	13	0.48	0.22	93.06	355.84	141.84	259.91	0.00	0.00	-359.64	584.92
11/1/99 15:56	33.75	53	101.95	110.46	14436.00	14	0.63	0.29	93.05	355.85	141.62	194.87	0.00	0.00	-359.38	581.16
11/2/99 1:11	34.13	54	101.01	109.59	14230.00	14	0.70	0.32	93.04	355.87	141.42	148.37	0.00	0.00	-360.10	579.09
11/2/99 10:13	34.51	55	102.73	111.37	13988.00	15	0.53	0.24	93.04	355.89	141.26	213.06	0.00	0.00	-360.65	575.19
11/2/99 19:11	34.88	56	103.42	112.13	13786.00	15	0.48	0.22	93.06	355.91	141.06	146.61	0.00	0.00	-359.95	570.89
11/3/99 3:59	35.25	57	101.64	110.43	13615.00	16	0.61	0.28	93.06	355.93	140.86	238.36	0.00	0.00	-362.01	566.71
11/3/99 12:40	35.61	58	101.24	110.09	13421.00	16	0.65	0.29	93.06	355.95	140.70	162.37	0.00	0.00	-360.87	564.64
11/3/99 21:14	35.97	59	102.38	111.29	13191.00	16	0.54	0.24	93.07	355.96	140.55	159.69	0.00	0.00	-361.25	561.89
11/4/99 5:40	36.32	60	103.00	111.98	13013.00	16	0.49	0.22	93.07	355.98	140.36	271.38	0.00	0.00	-360.09	559.06
11/4/99 14:00	36.67	61	100.75	109.79	12857.00	17	0.68	0.31	93.06	356.00	140.18	238.58	0.00	0.00	-359.76	556.30
11/4/99 22:12	37.01	62	103.57	112.67	12647.00	18	0.45	0.20	93.06	356.01	140.04	212.14	0.00	0.00	-361.63	554.24
11/5/99 6:19	37.35	63	102.50	111.67	12488.00	19	0.51	0.23	93.06	356.04	139.85	340.41	0.00	0.00	-361.93	548.66
11/5/99 14:18	37.68	64	100.26	109.50	12331.00	20	0.70	0.32	93.05	356.06	139.67	242.93	0.00	0.00	-361.64	548.06
11/5/99 22:11	38.01	65	103.20	112.50	12122.00	21	0.45	0.20	93.05	356.07	139.52	202.58	0.00	0.00	-362.08	546.00
11/6/99 5:59	38.33	66	101.80	111.17	11979.00	22	0.54	0.24	93.05	356.09	139.33	239.95	0.00	0.00	-360.22	540.53
11/6/99 13:39	38.65	67	101.39	110.82	11825.00	22	0.57	0.25	93.05	356.11	139.16	272.02	0.00	0.00	-360.43	539.57
11/6/99 21:14	38.97	68	102.36	111.86	11640.00	22	0.48	0.22	93.06	356.13	138.97	229.50	0.00	0.00	-360.29	537.26
11/7/99 4:44	39.28	69	99.99	109.57	11500.00	23	0.67	0.30	93.07	356.15	138.77	319.71	0.00	0.00	-359.80	532.08
11/7/99 12:07	39.59	70	101.71	111.36	11307.00	24	0.52	0.23	93.07	356.17	138.59	234.96	0.00	0.00	-361.44	530.89
11/7/99 19:25	39.89	71	101.72	111.46	11158.00	24	0.52	0.23	93.08	356.19	138.36	228.60	0.00	0.00	-360.48	528.36
11/8/99 2:37	40.19	72	100.90	110.71	11034.00	24	0.58	0.26	93.07	356.22	138.16	298.64	0.00	0.00	-360.61	525.37
11/8/99 9:43	40.49	73	101.85	111.73	10862.00	24	0.50	0.22	93.07	356.25	137.97	227.79	0.00	0.00	-361.41	525.09
11/8/99 16:45	40.78	74	99.58	109.54	10736.00	25	0.68	0.30	93.06	356.27	137.76	184.25	0.00	0.00	-361.21	521.57
11/8/99 23:41	41.07	75	102.42	112.45	10560.00	26	0.44	0.19	93.05	356.28	137.61	266.85	0.00	0.00	-363.21	522.45
11/9/99 6:32	41.36	76	100.56	110.65	10443.00	27	0.56	0.25	93.05	356.30	137.42	254.04	0.00	0.00	-361.41	516.32
11/9/99 13:18	41.64	77	100.60	110.77	10284.00	27	0.55	0.24	93.05	356.33	137.23	245.63	0.00	0.00	-363.91	517.64
11/9/99 20:00	41.92	78	100.43	110.68	10145.00	27	0.57	0.25	93.06	356.35	137.00	251.81	0.00	0.00	-364.57	515.86
11/10/99 2:36	42.19	79	100.12	110.45	10018.00	27	0.58	0.26	93.05	356.38	136.79	284.46	0.00	0.00	-364.59	511.62
11/10/99 9:07	42.46	80	100.88	111.29	9869.00	27	0.51	0.22	93.04	356.40	136.59	232.08	0.00	0.00	-364.09	512.77
11/10/99 15:33	42.73	81	100.40	110.88	9747.00	27	0.53	0.24	93.04	356.42	136.40	236.49	0.00	0.00	-363.29	510.28
11/10/99 21:56	43.00	82	100.90	111.47	9606.50	27	0.50	0.22	93.05	356.44	136.19	226.23	0.00	0.00	-363.19	508.05
11/11/99 4:13	43.26	83	100.10	110.75	9506.50	27	0.55	0.24	93.05	356.47	135.97	236.94	0.00	0.00	-362.80	505.66
11/11/99 10:28	43.52	84	101.07	111.80	9368.20	27	0.47	0.21	93.05	356.49	135.76	208.76	0.00	0.00	-363.06	506.84
11/11/99 16:38	43.78	85	98.22	109.03	9251.10	28	0.68	0.30	93.04	356.51	135.56	233.86	0.00	0.00	-362.27	502.00
11/11/99 22:42	44.03	86	101.12	112.01	9098.50	29	0.45	0.20	93.05	356.53	135.36	222.16	0.00	0.00	-366.99	503.44
11/12/99 4:44	44.28	87	98.17	109.14	8999.00	30	0.67	0.29	93.06	356.56	135.14	234.03	0.00	0.00	-362.33	500.17
11/12/99 10:39	44.53	88	101.23	112.28	8856.00	31	0.43	0.19	93.05	356.58	134.93	515.50	0.00	0.00	*-362.86*	501.40
11/12/99 16:32	44.77	89	98.56	109.69	8749.50	32	0.60	0.26	93.05	356.61	134.72	468.55	0.00	0.00	-363.38	497.30

Note: Earth & Sun positions use table lookup & data interpolation on 10 day centers

AUXILIARY CALCULATIONS

9/28/99 22:01	SUN DIST	SUN LAT	SUN LONG	EARTH DIST	EARTH LAT	EARTH LONG	PERIOD	VPER	DELT PERIOD	DELT APO	DELT V	DELT MEAN SUN	RAAN -180 TO 180°	DELT RAAN	SOLAR TIME	DRAGDUR	DRAGPASS BEGIN (Including 5 min delay segs)	DRAGPASS END	ORBIT PERIOD LESS DRAGP AND SOLAR
9/29/99 11:01	2.10190E+08	-14.01	75.40	2.01E+08	4.21	36.49	25.812	4.7351				0.284	-4.990		6:03:00 AM	308.1	-454.1	454.1	92014.68178
9/30/99 12:26	2.10070E+08	-14.24	76.03	2.02E+08	3.89	37.14	25.204	4.7319	2187.6	664.0	3.20	0.839	-4.970	0.020	5:59:43 AM	308.9	-454.5	454.5	89826.29427
10/1/99 13:14	2.09950E+08	-14.47	76.63	2.03E+08	3.57	37.78	24.593	4.7285	2199.3	673.0	3.41	1.380	-4.960	0.030	5:57:36 AM	309.5	-454.7	454.7	87626.47939
10/2/99 13:26	2.09830E+08	-14.69	77.23	2.03E+08	3.26	38.39	23.978	4.7248	2216.4	684.0	3.67	1.909	-4.940	0.050	5:55:34 AM	310.1	-455.0	455.0	85409.54042
10/3/99 13:01	2.09720E+08	-14.91	77.81	2.04E+08	2.96	39.00	23.374	4.7210	2174.9	677.0	3.82	2.424	-4.920	0.070	5:53:35 AM	310.6	-455.3	455.3	83234.08009
10/4/99 12:02	2.09600E+08	-15.13	78.37	2.05E+08	2.66	39.59	22.814	4.7173	2013.5	632.0	3.70	2.926	-4.910	0.080	5:51:37 AM	311.2	-455.6	455.6	81219.9911
10/5/99 10:30	2.09490E+08	-15.33	78.92	2.06E+08	2.37	40.16	22.310	4.7140	1815.3	574.0	3.31	3.417	-4.890	0.100	5:49:44 AM	311.7	-455.9	455.9	79404.19047
10/6/99 8:25	2.09400E+08	-15.53	79.47	2.07E+08	2.08	40.74	21.787	4.7105	1883.5	600.0	3.45	3.896	-4.880	0.110	5:47:51 AM	312.3	-456.1	456.1	77520.08678
10/7/99 5:46	2.09320E+08	-15.71	80.02	2.07E+08	1.80	41.30	21.207	4.7061	2086.8	671.0	4.45	4.362	-4.880	0.110	5:46:00 AM	312.9	-456.5	456.5	75432.61255
10/8/99 2:34	2.09240E+08	-15.88	80.55	2.08E+08	1.52	41.85	20.603	4.7010	2174.3	706.0	5.11	4.816	-4.870	0.120	5:44:13 AM	314.1	-457.1	457.1	73257.11446
10/8/99 22:54	2.09160E+08	-16.05	81.07	2.09E+08	1.24	42.39	20.208	4.6981	1423.0	465.0	2.89	5.260	-4.850	0.140	5:42:31 AM	314.6	-457.3	457.3	71833.55551
10/9/99 18:43	2.09090E+08	-16.22	81.58	2.09E+08	0.98	42.92	19.639	4.6931	2049.5	676.0	5.04	5.693	-4.840	0.150	5:40:50 AM	315.4	-457.7	457.7	69783.29054
10/10/99 14:04	2.09020E+08	-16.38	82.08	2.10E+08	0.72	43.43	19.206	4.6892	1557.9	518.0	3.83	6.115	-4.820	0.170	5:39:13 AM	316.0	-458.0	458.0	68224.80393
10/11/99 8:59	2.08940E+08	-16.54	82.56	2.11E+08	0.46	43.93	18.792	4.6854	1489.7	499.0	3.81	6.528	-4.810	0.180	5:37:36 AM	316.7	-458.3	458.3	66734.47231
10/12/99 3:26	2.08870E+08	-16.69	83.04	2.11E+08	0.21	44.42	18.288	4.6803	1814.2	613.0	5.10	6.931	-4.800	0.190	5:36:02 AM	317.4	-458.7	458.7	64919.53414
10/12/99 21:29	2.08810E+08	-16.84	83.50	2.12E+08	-0.03	44.90	17.921	4.6769	1323.0	450.0	3.42	7.325	-4.780	0.210	5:34:32 AM	318.0	-459.0	459.0	63595.95741
10/13/99 15:09	2.08740E+08	-16.99	83.95	2.12E+08	-0.27	45.37	17.523	4.6728	1432.4	491.0	4.08	7.711	-4.770	0.220	5:33:02 AM	318.6	-459.3	459.3	62162.88657
10/14/99 8:24	2.08670E+08	-17.14	84.40	2.13E+08	-0.50	45.82	17.127	4.6681	1422.7	492.0	4.70	8.088	-4.760	0.230	5:31:34 AM	319.3	-459.6	459.6	60739.55287
10/15/99 1:18	2.08610E+08	-17.28	84.83	2.13E+08	-0.72	46.27	16.823	4.6649	1096.2	381.0	3.23	8.456	-4.740	0.250	5:30:10 AM	320.5	-460.3	460.3	59642.11193
10/15/99 17:50	2.08550E+08	-17.42	85.25	2.14E+08	-0.95	46.71	16.414	4.6595	1470.9	516.0	5.35	8.818	-4.730	0.260	5:28:46 AM	321.4	-460.7	460.7	58170.36764
10/16/99 10:03	2.08490E+08	-17.55	85.67	2.15E+08	-1.17	47.14	16.122	4.6557	1053.3	372.0	3.85	9.172	-4.720	0.270	5:27:24 AM	322.0	-461.0	461.0	57116.4074
10/17/99 1:58	2.08430E+08	-17.69	86.08	2.15E+08	-1.38	47.56	15.817	4.6540	1095.5	386.0	1.66	9.519	-4.710	0.280	5:26:03 AM	322.7	-461.3	461.3	56020.27123
10/17/99 17:30	2.08370E+08	-17.82	86.48	2.16E+08	-1.59	47.97	15.429	4.6468	1398.5	503.0	7.25	9.858	-4.690	0.300	5:24:46 AM	323.5	-461.8	461.8	54620.86859
10/18/99 8:44	2.08310E+08	-17.94	86.87	2.16E+08	-1.79	48.38	15.093	4.6438	1209.9	434.0	3.02	10.191	-4.680	0.310	5:23:29 AM	324.3	-462.2	462.2	53410.15643
10/18/99 23:40	2.08250E+08	-18.07	87.25	2.17E+08	-1.99	48.77	14.812	4.6379	1012.6	370.0	5.88	10.517	-4.660	0.330	5:22:15 AM	325.0	-462.5	462.5	52396.84097
10/19/99 14:20	2.08200E+08	-18.19	87.63	2.17E+08	-2.19	49.16	14.574	4.6366	854.4	309.0	1.30	10.837	-4.640	0.350	5:21:03 AM	325.5	-462.8	462.8	51541.88007
10/20/99 4:41	2.08140E+08	-18.31	87.99	2.18E+08	-2.38	49.54	14.298	4.6308	996.2	368.0	5.82	11.151	-4.620	0.370	5:19:53 AM	326.2	-463.1	463.1	50544.94169
10/20/99 18:48	2.08090E+08	-18.43	88.36	2.18E+08	-2.57	49.92	14.041	4.6267	922.5	341.0	4.11	11.459	-4.610	0.380	5:18:41 AM	326.9	-463.4	463.4	49621.7762
10/21/99 8:41	2.08050E+08	-18.53	88.73	2.19E+08	-2.76	50.30	13.759	4.6238	1014.6	375.0	2.82	11.762	-4.590	0.400	5:17:33 AM	327.6	-463.8	463.8	48606.44924
10/21/99 22:18	2.08020E+08	-18.63	89.09	2.19E+08	-2.95	50.68	13.522	4.6180	856.6	323.0	5.83	12.059	-4.570	0.420	5:16:27 AM	328.3	-464.1	464.1	47749.25816
10/22/99 11:43	2.07980E+08	-18.72	89.45	2.19E+08	-3.13	51.05	13.296	4.6157	810.4	303.0	2.35	12.352	-4.560	0.430	5:15:19 AM	328.9	-464.4	464.4	46938.2434
10/23/99 0:52	2.07950E+08	-18.82	89.80	2.20E+08	-3.31	51.41	13.061	4.6113	847.3	321.0	4.35	12.639	-4.540	0.450	5:14:15 AM	330.9	-465.4	465.4	46088.89427
10/23/99 13:49	2.07920E+08	-18.91	90.15	2.20E+08	-3.48	51.77	12.853	4.6073	750.7	286.0	3.96	12.922	-4.530	0.460	5:13:09 AM	331.6	-465.8	465.8	45337.44697
10/24/99 2:33	2.07890E+08	-19.00	90.49	2.21E+08	-3.66	52.12	12.640	4.6031	764.6	293.0	4.22	13.200	-4.510	0.480	5:12:07 AM	332.4	-466.2	466.2	44572.05157
10/24/99 15:06	2.07850E+08	-19.09	90.83	2.21E+08	-3.83	52.46	12.437	4.6008	730.4	279.0	2.31	13.474	-4.490	0.500	5:11:06 AM	333.1	-466.6	466.6	43840.94966
10/25/99 3:23	2.07820E+08	-19.18	91.16	2.22E+08	-3.99	52.80	12.183	4.5956	913.5	354.0	5.24	13.742	-4.470	0.520	5:10:07 AM	334.1	-467.0	467.0	42926.5158
10/25/99 15:27	2.07790E+08	-19.27	91.48	2.22E+08	-4.16	53.13	11.976	4.5911	746.1	291.0	4.43	14.006	-4.460	0.530	5:09:06 AM	334.9	-467.4	467.4	42179.57614
10/26/99 3:19	2.07760E+08	-19.35	91.80	2.22E+08	-4.32	53.46	11.763	4.5863	766.8	301.0	4.83	14.265	-4.430	0.560	5:08:11 AM	335.7	-467.9	467.9	41411.91233
10/26/99 14:59	2.07730E+08	-19.44	92.11	2.23E+08	-4.48	53.78	11.584	4.5822	646.4	255.0	4.08	14.520	-4.420	0.570	5:07:12 AM	336.4	-468.2	468.2	40764.81379
10/27/99 2:28	2.07700E+08	-19.52	92.42	2.23E+08	-4.63	54.10	11.390	4.5792	698.1	275.0	3.08	14.771	-4.400	0.590	5:06:17 AM	337.2	-468.6	468.6	40065.93408
10/27/99 13:47	2.07670E+08	-19.60	92.72	2.23E+08	-4.79	54.41	11.178	4.5742	762.3	304.0	4.97	15.017	-4.380	0.610	5:05:22 AM	338.1	-469.1	469.1	39302.76399
10/28/99 0:52	2.07640E+08	-19.68	93.02	2.24E+08	-4.94	54.72	11.005	4.5701	621.2	249.0	4.05	15.260	-4.360	0.630	5:04:29 AM	338.9	-469.4	469.4	38680.83298
10/28/99 11:46	2.07620E+08	-19.76	93.31	2.24E+08	-5.09	55.02	10.823	4.5658	657.9	265.0	4.31	15.497	-4.340	0.650	5:03:37 AM	339.7	-469.8	469.8	38022.14917
10/28/99 22:29	2.07590E+08	-19.84	93.60	2.25E+08	-5.23	55.31	10.644	4.5619	643.2	260.0	3.94	15.732	-4.320	0.670	5:02:45 AM	340.5	-470.3	470.3	37378.17205
10/29/99 9:00	2.07560E+08	-19.91	93.88	2.25E+08	-5.37	55.60	10.472	4.5561	619.0	254.0	5.74	15.961	-4.300	0.690	5:01:55 AM	341.3	-470.7	470.7	36758.33462
10/29/99 19:24	2.07530E+08	-19.99	94.16	2.25E+08	-5.52	55.89	10.321	4.5517	545.4	224.0	4.43	16.188	-4.290	0.700	5:01:03 AM	342.0	-471.0	471.0	36212.17082
10/30/99 5:37	2.07510E+08	-20.06	94.43	2.26E+08	-5.65	56.17	10.152	4.5482	605.7	248.0	3.49	16.411	-4.260	0.730	5:00:16 AM	342.9	-471.4	471.4	35605.671
10/30/99 15:42	2.07480E+08	-20.13	94.70	2.26E+08	-5.79	56.45	9.995	4.5438	565.1	234.0	4.44	16.631	-4.250	0.740	4:59:26 AM	343.6	-471.8	471.8	35039.8275
10/31/99 1:38	2.07460E+08	-20.20	94.97	2.26E+08	-5.93	56.72	9.870	4.5405	453.0	188.0	3.29	16.848	-4.230	0.760	4:58:39 AM	344.3	-472.1	472.1	34586.21999
10/31/99 11:25	2.07430E+08	-20.27	95.23	2.27E+08	-6.06	56.99	9.736	4.5369	482.0	201.0	3.62	17.062	-4.210	0.780	4:57:52 AM	345.0	-472.5	472.5	34103.48911
10/31/99 21:04	2.07410E+08	-20.34	95.49	2.27E+08	-6.19	57.26	9.578	4.5317	567.8	239.0	5.19	17.273	-4.190	0.800	4:57:07 AM	348.9	-474.5	474.5	33531.72646
11/1/99 6:33	2.07380E+08	-20.41	95.74	2.27E+08	-6.32	57.52	9.426	4.5264	548.0	232.0	5.21	17.480	-4.160	0.830	4:56:24 AM	350.0	-475.0	475.0	32982.63241
11/1/99 15:56	2.07360E+08	-20.48	95.99	2.28E+08	-6.45	57.78	9.290	4.5237	487.9	205.0	2.74	17.685	-4.150	0.840	4:55:37 AM	350.9	-475.5	475.5	32493.75765
11/2/99 1:11	2.07340E+08	-20.54	96.24	2.28E+08	-6.57	58.04	9.155	4.5201	485.5	206.0	3.62	17.887	-4.130	0.860	4:54:54 AM	351.9	-476.0	476.0	32007.29287
11/2/99 10:13	2.07310E+08	-20.61	96.48	2.28E+08	-6.69	58.29	9.000	4.5136	560.7	242.0	6.50	18.084	-4.110	0.880	4:54:11 AM	353.1	-476.6	476.6	31445.39526
11/2/99 19:11	2.07290E+08	-20.67	96.72	2.28E+08	-6.82	58.53	8.870	4.5086	467.3	202.0	4.96	18.280	-4.090	0.900	4:53:29 AM	354.1	-477.1	477.1	30977.08956
11/3/99 3:59	2.07270E+08	-20.74	96.96	2.29E+08	-6.94	58.77	8.759	4.5061	399.3	171.0	2.49	18.472	-4.070	0.920	4:52:48 AM	355.0	-477.5	477.5	30576.95955
11/3/99 12:40	2.07240E+08	-20.80	97.19	2.29E+08	-7.05	59.01	8.635	4.5020	447.2	194.0	4.13	18.662	-4.050	0.940	4:52:07 AM	356.0	-478.0	478.0	30128.74378
11/3/99 21:14	2.07220E+08	-20.86	97.42	2.29E+08	-7.17	59.25	8.489	4.4958	523.8	230.0	6.22	18.849	-4.040	0.950	4:51:24 AM	357.2	-478.6	478.6	29603.78128
11/4/99 5:40	2.07200E+08	-20.92	97.65	2.30E+08	-7.28	59.48	8.377	4.4911	403.9	178.0	4.71	19.033	-4.020	0.970	4:50:45 AM	358.1	-479.1	479.1	29198.93405
11/4/99 14:00	2.07180E+08	-20.98	97.87	2.30E+08	-7.40	59.71	8.277	4.4890	358.8	156.0	2.09	19.214	-4.000	0.990	4:50:06 AM	359.0	-479.5	479.5	28839.26565
11/4/99 22:12	2.07160E+08	-21.03	98.09	2.30E+08	-7.51	59.94	8.147	4.4817	467.6	210.0	7.32	19.394	-3.990	1.000	4:49:26 AM	360.2	-480.1	480.1	28370.50831
11/5/99 6:19	2.07150E+08	-21.08	98.32	2.30E+08	-7.61	60.18	8.048	4.4785	359.6	159.0	3.20	19.571	-3.960	1.030	4:48:50 AM	361.0	-480.5	480.5	28010.03465
11/5/99 14:18	2.07140E+08	-21.12	98.54	2.31E+08	-7.72	60.41	7.949	4.4761	356.2	157.0	2.34	19.745	-3.940	1.050	4:48:13 AM	361.9	-481.0	481.0	27652.89334
11/5/99 22:11	2.07130E+08	-21.17	98.76	2.31E+08	-7.82	60.64	7.821	4.4684	458.8	209.0	7.70	19.917	-3.930	1.060	4:47:34 AM	363.2	-481.6	481.6	27192.87629
11/6/99 5:59	2.07120E+08	-21.21	98.98	2.31E+08	-7.92	60.86	7.732	4.4657	320.0	143.0	2.76	20.088	-3.910	1.080	4:46:58 AM	364.0	-482.0	482.0	26871.99351
11/6/99 13:39	2.07110E+08	-21.26	99.19	2.31E+08	-8.03	61.08	7.638	4.4618	340.9	154.0	3.87	20.255	-3.890	1.100	4:46:23 AM	364.9	-482.5	482.5	26530.19867
11/6/99 21:14	2.07100E+08	-21.30	99.40	2.32E+08	-8.13	61.30	7.525	4.4560	404.4	185.0	5.85	20.421	-3.870	1.120	4:45:48 AM	366.0	-483.0	483.0	26124.64329
11/7/99 4:44	2.07090E+08	-21.34	99.61	2.32E+08	-8.22	61.52	7.439	4.4538	311.5	140.0	2.15	20.584	-3.850	1.140	4:45:13 AM	366.9	-483.5	483.5	25812.27403
11/7/99 12:07	2.07090E+08	-21.38	99.82	2.32E+08	-8.32	61.73	7.323	4.4469	416.6	193.0	6.85	20.746	-3.830	1.160	4:44:39 AM	368.1	-484.1	484.1	25394.43666
11/7/99 19:25	2.07080E+08	-21.42	100.02	2.32E+08	-8.42	61.94	7.233	4.4426	323.0	149.0	4.38	20.905	-3.810	1.180	4:44:06 AM	369.1	-484.5	484.5	25070.48199
11/8/99 2:37	2.07070E+08	-21.47	100.22	2.33E+08	-8.51	62.15	7.158	4.4395	269.6	124.0	3.07	21.062	-3.780	1.210	4:43:35 AM	369.9	-484.9	484.9	24800.09832
11/8/99 9:43	2.07060E+08	-21.51	100.42	2.33E+08	-8.61	62.36	7.056	4.4336	367.9	172.0	5.94	21.217	-3.750	1.240	4:43:05 AM	371.0	-485.5	485.5	24431.06215
11/8/99 16:45	2.07050E+08	-21.55	100.61	2.33E+08	-8.70	62.56	6.980	4.4314	274.7	126.0	2.16	21.371	-3.730	1.260	4:42:33 AM	371.9	-485.9	485.9	24155.47948
11/8/99 23:41	2.07040E+08	-21.58	100.80	2.33E+08	-8.79	62.76	6.877	4.4237	369.3	176.0	7.69	21.522	-3.720	1.270	4:41:59 AM	373.1	-486.5	486.5	23784.99582
11/9/99 6:32	2.07030E+08	-21.62	100.99	2.34E+08	-8.88	62.96	6.807	4.4214	252.4	117.0	2.33	21.672	-3.700	1.290	4:41:28 AM	373.9	-487.0	487.0	23531.75323
11/9/99 13:18	2.07020E+08	-21.66	101.18	2.34E+08	-8.97	63.15	6.714	4.4162	336.2	159.0	5.20	21.819	-3.670	1.320	4:41:00 AM	375.0	-487.5	487.5	23194.3891
11/9/99 20:00	2.07020E+08	-21.70	101.37	2.34E+08	-9.06	63.35	6.632	4.4117	293.1	139.0	4.48	21.966	-3.650	1.340	4:40:30 AM	376.0	-488.0	488.0	22900.284
11/10/99 2:36	2.07010E+08	-21.74	101.55	2.34E+08	-9.14	63.54	6.558	4.4077	267.1	127.0	4.04	22.110	-3.620	1.370	4:40:02 AM	377.0	-488.5	488.5	22632.27512
11/10/99 9:07	2.07000E+08	-21.77	101.73	2.34E+08	-9.23	63.73	6.472	4.4020	309.7	149.0	5.69	22.252	-3.600	1.390	4:39:33 AM	388.0	-494.0	494.0	22311.53034
11/10/99 15:33	2.06990E+08	-21.81	101.91	2.35E+08	-9.31	63.91	6.401	4.3981	254.9	122.0	3.89	22.393	-3.580	1.410	4:39:04 AM	389.3	-494.7	494.7	22055.31406
11/10/99 21:56	2.06980E+08	-21.85	102.09	2.35E+08	-9.40	64.10	6.321	4.3927	290.2	140.5	5.37	22.532	-3.560	1.430	4:38:35 AM	390.9	-495.4	495.4	21763.55605
11/11/99 4:13	2.06970E+08	-21.88	102.27	2.35E+08	-9.48	64.28	6.263	4.3897	208.2	100.0	2.99	22.669	-3.530	1.460	4:38:10 AM	392.0	-496.0	496.0	21554.24554
11/11/99 10:28	2.06970E+08	-21.92	102.44	2.35E+08	-9.56	64.46	6.184	4.3839	282.6	138.3	5.80	22.806	-3.510	1.480	4:37:42 AM	393.6	-496.8	496.8	21270.06009
11/11/99 16:38	2.06960E+08	-21.95	102.61	2.35E+08	-9.64	64.64	6.116	4.3817	245.9	117.1	2.19	22.940	-3.490	1.500	4:37:14 AM	395.0	-497.5	497.5	21022.83101
11/11/99 22:42	2.06950E+08	-21.99	102.78	2.36E+08	-9.72	64.81	6.031	4.3737	305.5	152.6	7.99	23.073	-3.470	1.520	4:36:47 AM	396.8	-498.4	498.4	20715.45817
11/12/99 4:44	2.06940E+08	-22.02	102.95	2.36E+08	-9.80	64.99	5.973	4.3722	208.3	99.5	1.58	23.205	-3.440	1.550	4:36:23 AM	398.1	-499.0	499.0	20505.95407
11/12/99 10:39	2.06940E+08	-22.05	103.11	2.36E+08	-9.88	65.16	5.895	4.3642	283.4	143.0	7.94	23.334	-3.420	1.570	4:35:57 AM	399.8	-499.9	499.9	20220.76619
11/12/99 16:32	2.06930E+08	-22.09	103.27	2.36E+08	-9.96	65.33	5.833	4.3620	220.2	106.5	2.21	23.462	-3.390	1.600	4:35:33 AM	401.2	-500.6	500.6	19999.19547

OPEN LAUNCH PERIOD - AEROBRAKING TIMELINE

Open of Primary MSP Peer Review 11/96, Beg of L/W, Min Mass Config, Data written at periapsis point
Starting Time for Simulation: Sept. 28, 1999; 22:01 ET (Apoapsis, Last Walkin Maneuver)

9/28/99 22:01	DAY#	REV#	PERIAPS ALT	PER WRT ELLIPSOID	APOAPSIS ALT	NBURN	QDYN	QHTDYN	INCLIN	ASC NODE	ARGPER	(DO NOT USE) DYNAMIC DRAGDUR	SUN ECLIPSE BEGIN	SUN ECLIPSE END	EARTH OCCULT BEGIN	EARTH OCCULT END
11/12/99 22:21	45.01	90	98.78	110.00	8612.10	32	0.59	0.26	93.06	356.63	134.50	516.85	0.00	0.00	-365.23	498.64
11/13/99 4:05	45.25	91	98.50	109.81	8500.30	32	0.59	0.26	93.05	356.65	134.26	494.86	0.00	0.00	-365.50	496.53
11/13/99 9:45	45.49	92	98.74	110.12	8371.60	32	0.56	0.24	93.05	356.67	134.06	393.92	0.00	0.00	-367.89	497.02
11/13/99 15:20	45.72	93	98.83	110.29	8246.20	32	0.54	0.23	93.04	356.71	133.86	420.19	0.00	0.00	-365.34	495.64
11/13/99 20:53	45.95	94	98.20	109.75	8142.40	32	0.59	0.26	93.05	356.73	133.62	453.74	0.00	0.00	-365.96	495.79
11/14/99 2:21	46.18	95	99.21	110.84	8019.70	32	0.49	0.21	93.03	356.75	133.42	422.66	0.00	0.00	-367.46	495.71
11/14/99 7:47	46.41	96	98.38	110.09	7926.60	32	0.55	0.24	93.04	356.77	133.21	426.03	0.00	0.00	-368.16	493.27
11/14/99 13:08	46.63	97	99.40	111.19	7809.70	32	0.47	0.20	93.03	356.80	132.99	352.36	-331.41	-325.33	-367.34	494.90
11/14/99 18:26	46.85	98	96.57	108.44	7708.90	33	0.68	0.29	93.03	356.83	132.77	360.82	-340.17	-310.85	-366.68	493.16
11/14/99 23:40	47.07	99	99.07	111.03	7581.10	34	0.48	0.21	93.04	356.84	132.56	369.63	-404.29	-236.30	-370.18	495.56
11/15/99 4:51	47.29	100	96.92	108.98	7488.70	35	0.62	0.27	93.04	356.87	132.30	407.91	-409.40	-255.46	-368.34	490.92
11/15/99 9:58	47.50	101	96.61	108.74	7368.70	35	0.64	0.27	93.04	356.89	132.10	359.54	-473.04	-209.04	-369.54	493.98
11/15/99 15:01	47.71	102	97.30	109.51	7243.30	35	0.57	0.24	93.03	356.92	131.88	393.27	-488.40	-195.08	-370.26	493.00
11/15/99 20:01	47.92	103	96.32	108.62	7143.70	35	0.64	0.28	93.03	356.95	131.64	407.16	-500.74	-193.37	-369.92	491.53
11/16/99 0:58	48.12	104	97.36	109.74	7019.50	35	0.55	0.23	93.04	356.97	131.45	286.30	-526.90	-175.47	-371.26	491.97
11/16/99 5:50	48.33	105	97.07	109.55	6931.00	35	0.56	0.24	93.04	356.99	131.18	310.31	-547.28	-178.84	-370.92	492.51
11/16/99 10:39	48.53	106	96.82	109.37	6829.10	35	0.56	0.24	93.04	357.01	130.99	417.96	-568.59	-168.32	-371.62	494.19
11/16/99 15:26	48.73	107	97.59	110.23	6723.90	35	0.50	0.21	93.03	357.05	130.76	307.23	-582.49	-160.74	-372.80	490.66
11/16/99 20:10	48.92	108	96.60	109.33	6640.40	35	0.56	0.24	93.03	357.07	130.51	295.70	-593.93	-159.91	-372.85	490.87
11/17/99 0:50	49.12	109	97.27	110.08	6537.40	35	0.50	0.22	93.04	357.09	130.31	459.18	-623.34	-150.34	-376.17	492.18
11/17/99 5:28	49.31	110	97.29	110.21	6457.00	35	0.48	0.21	93.03	357.12	130.03	415.44	-637.39	-147.51	-376.61	490.68
11/17/99 10:05	49.50	111	94.63	107.63	6365.90	36	0.68	0.29	93.04	357.14	129.81	362.26	-648.52	-140.65	-377.12	491.03
11/17/99 14:36	49.69	112	97.60	110.69	6256.80	37	0.45	0.19	93.03	357.17	129.57	254.25	-675.45	-120.70	-378.84	493.74
11/17/99 19:05	49.88	113	95.10	108.28	6171.40	38	0.61	0.26	93.03	357.20	129.33	395.92	-677.70	-131.24	-377.97	493.59
11/17/99 23:31	50.06	114	94.68	107.95	6073.10	38	0.64	0.27	93.04	357.22	129.07	245.01	-700.24	-113.43	-379.60	494.59
11/18/99 3:55	50.25	115	95.70	109.05	5967.80	38	0.54	0.23	93.01	357.25	128.85	350.97	*-717.35*	-106.36	-379.73	496.97
11/18/99 8:15	50.43	116	95.10	108.55	5889.40	38	0.57	0.24	93.04	357.27	128.59	364.69	-734.46	-111.14	-377.86	496.53
11/18/99 12:33	50.61	117	95.21	108.74	5794.10	38	0.55	0.23	93.03	357.30	128.37	326.20	-750.08	-101.93	-379.40	497.29
11/18/99 16:48	50.78	118	95.92	109.55	5702.80	38	0.49	0.21	93.02	357.33	128.13	297.60	-762.78	-98.44	-379.94	498.22
11/18/99 21:00	50.96	119	93.07	106.79	5618.60	39	0.70	0.29	93.02	357.36	127.87	316.83	-775.57	-96.65	-379.95	500.11
11/19/99 1:09	51.13	120	95.13	108.93	5515.70	40	0.53	0.22	93.03	357.38	127.64	340.16	-798.79	-81.47	-384.07	501.33
11/19/99 5:15	51.30	121	95.48	109.40	5435.40	40	0.48	0.20	93.00	357.41	127.35	476.25	-816.54	-83.97	-384.62	503.06
11/19/99 9:20	51.47	122	93.09	107.10	5360.60	41	0.65	0.27	93.03	357.44	127.10	483.44	-824.72	-80.97	-384.70	502.38
11/19/99 13:22	51.64	123	93.36	107.45	5259.80	41	0.61	0.26	93.01	357.46	126.87	400.32	-841.29	-67.88	-388.39	506.50
11/19/99 17:21	51.81	124	94.09	108.27	5165.60	41	0.55	0.23	93.00	357.50	126.62	356.38	-854.08	-65.46	-389.06	505.12
11/19/99 21:17	51.97	125	93.01	107.30	5084.30	41	0.61	0.26	93.01	357.53	126.35	507.67	-869.10	-64.82	-385.70	504.91
11/20/99 1:11	52.13	126	92.99	107.36	4994.00	41	0.60	0.25	93.02	357.55	126.09	426.17	-882.20	-56.01	-388.74	509.11
11/20/99 5:02	52.29	127	93.83	108.29	4906.50	41	0.52	0.22	92.98	357.58	125.85	325.19	-904.34	-52.04	-389.01	510.33
11/20/99 8:51	52.45	128	93.47	108.04	4837.20	41	0.54	0.22	93.00	357.61	125.55	302.79	-912.36	-52.45	-387.55	508.53
11/20/99 12:37	52.61	129	92.96	107.61	4758.40	41	0.56	0.23	93.01	357.63	125.33	434.23	-923.96	-46.31	-388.78	514.13
11/20/99 16:22	52.77	130	94.16	108.91	4677.40	41	0.47	0.20	92.99	357.67	125.06	421.99	-935.53	-41.82	-390.26	515.31
11/20/99 20:04	52.92	131	92.02	106.87	4603.00	42	0.60	0.25	92.99	357.70	124.79	425.59	-945.76	-41.74	-389.39	514.71
11/20/99 23:44	53.07	132	91.06	106.01	4520.70	42	0.66	0.27	93.01	357.73	124.49	466.61	-960.52	-32.36	-392.21	517.48
11/21/99 3:22	53.22	133	92.17	107.20	4428.40	42	0.56	0.23	92.99	357.76	124.27	465.94	-979.32	-25.36	-394.71	521.55
11/21/99 6:56	53.37	134	92.24	107.39	4353.20	42	0.54	0.22	92.97	357.78	123.93	461.39	-995.52	-25.97	-394.04	522.54
11/21/99 10:29	53.52	135	91.76	107.00	4284.00	42	0.56	0.23	93.00	357.81	123.66	493.42	-1004.40	-21.97	-393.91	522.90
11/21/99 14:00	53.67	136	91.63	106.95	4206.70	42	0.55	0.23	92.99	357.84	123.43	497.37	-1016.90	-16.47	-396.56	525.40
11/21/99 17:28	53.81	137	92.78	108.21	4131.00	42	0.47	0.19	92.97	357.88	123.15	486.14	-1033.30	-13.45	-397.60	528.12
11/21/99 20:56	53.96	138	90.52	106.04	4061.30	43	0.60	0.25	92.98	357.92	122.87	481.63	-1039.10	-12.76	-398.08	529.54
11/22/99 0:20	54.10	139	89.56	105.20	3981.80	43	0.66	0.27	93.00	357.94	122.55	476.02	-1047.60	-3.46	-399.35	532.75
11/22/99 3:42	54.24	140	95.95	111.66	3906.70	44	0.29	0.12	92.98	357.97	122.32	368.71	*-1061.55*	3.53	-401.17	537.11
11/22/99 7:03	54.38	141	96.07	111.89	3868.70	44	0.28	0.11	92.95	358.00	121.98	543.93	-1075.50	-9.32	-395.37	531.47
11/22/99 10:22	54.52	142	95.78	111.71	3835.40	44	0.28	0.12	92.99	358.02	121.68	540.57	-1085.10	-5.58	-394.20	530.90
11/22/99 13:42	54.65	143	95.17	111.18	3797.30	44	0.30	0.12	92.99	358.05	121.44	588.83	-1095.20	-0.22	-395.76	534.66
11/22/99 17:00	54.79	144	96.42	112.53	3756.20	44	0.25	0.10	92.97	358.08	121.16	484.78	*-1102.03*	4.14	-397.32	535.64
11/22/99 20:17	54.93	145	96.49	112.69	3721.00	44	0.24	0.10	92.97	358.12	120.87	255.81	*-1108.85*	4.57	-395.61	534.41
11/22/99 23:33	55.06	146	89.95	106.26	3679.00	45	0.52	0.21	92.98	358.16	120.56	755.83	*-1115.68*	8.17	-395.67	536.62
11/23/99 2:47	55.20	147	95.26	111.66	3620.90	46	0.27	0.11	93.00	358.18	120.29	584.07	-1122.50	27.19	-403.70	547.93
11/23/99 6:00	55.33	148	96.20	112.68	3585.70	46	0.23	0.10	92.96	358.20	120.03	280.19	*-1131.15*	19.05	-398.52	541.11
11/23/99 9:12	55.47	149	91.01	107.61	3549.10	47	0.42	0.17	92.96	358.23	119.68	365.79	-1139.80	19.36	-396.11	541.97
11/23/99 12:23	55.60	150	90.29	106.99	3495.80	47	0.45	0.18	93.00	358.26	119.39	627.55	-1143.80	35.32	-402.83	548.87
11/23/99 15:32	55.73	151	90.34	107.12	3438.40	47	0.43	0.18	92.98	358.29	119.13	621.92	-1154.50	40.92	-405.21	552.85
11/23/99 18:39	55.86	152	91.57	108.45	3381.70	47	0.36	0.15	92.96	358.33	118.83	640.04	-1164.00	43.64	-404.33	555.98
11/23/99 21:46	55.99	153	91.03	108.01	3333.50	47	0.38	0.15	92.96	358.37	118.52	654.22	-1172.20	44.61	-402.73	557.95
11/24/99 0:50	56.12	154	89.85	106.93	3284.80	47	0.42	0.17	92.98	358.40	118.19	603.61	*-1182.45*	49.67	-402.06	559.50
11/24/99 3:55	56.25	155	90.46	107.63	3231.00	47	0.38	0.15	92.99	358.43	117.93	649.62	-1192.70	56.64	-404.65	563.17
11/24/99 6:56	56.37	156	91.00	108.26	3183.60	47	0.35	0.14	92.94	358.46	117.63	607.44	-1203.80	58.44	-405.28	566.00
11/24/99 9:58	56.50	157	91.00	108.38	3141.30	47	0.34	0.14	92.95	358.49	117.24	630.19	-1210.30	60.26	-403.46	566.26
11/24/99 12:58	56.62	158	90.32	107.78	3099.30	47	0.36	0.14	92.99	358.51	116.95	657.09	-1217.20	65.24	-403.45	568.24
11/24/99 15:56	56.75	159	90.20	107.75	3054.90	47	0.35	0.14	92.97	358.54	116.68	461.24	-1220.10	70.55	-405.21	573.55
11/24/99 18:53	56.87	160	91.55	109.20	3009.60	47	0.29	0.12	92.94	358.58	116.37	570.91	-1232.70	73.75	-406.33	575.64
11/24/99 21:49	56.99	161	91.31	109.05	2971.40	47	0.29	0.12	92.94	358.63	116.05	543.82	-1235.60	74.65	-403.69	576.77
11/25/99 0:45	57.11	162	89.93	107.78	2933.60	47	0.33	0.13	92.96	358.66	115.71	552.45	-1240.10	78.90	-403.86	577.82
11/25/99 3:39	57.24	163	89.94	107.87	2891.00	47	0.32	0.13	92.99	358.69	115.42	600.13	-1246.00	86.25	-405.67	582.92
11/25/99 6:33	57.36	164	90.83	108.84	2851.30	47	0.29	0.11	92.94	358.72	115.14	595.20	-1253.10	89.88	-406.48	586.40
11/25/99 9:25	57.48	165	90.75	108.88	2816.90	47	0.28	0.11	92.93	358.75	114.73	458.77	-1259.70	91.28	-405.86	586.61
11/25/99 12:16	57.59	166	90.63	108.86	2782.90	47	0.28	0.11	92.97	358.78	114.40	721.69	-1262.60	95.93	-403.96	589.18
11/25/99 15:07	57.71	167	89.79	108.10	2748.50	47	0.30	0.12	92.98	358.80	114.14	436.51	-1269.70	101.09	-405.33	593.25
11/25/99 17:56	57.83	168	90.79	109.19	2712.00	47	0.26	0.10	92.95	358.83	113.82	663.08	-1276.30	105.72	-407.37	595.31
11/25/99 20:44	57.95	169	91.71	110.19	2678.60	47	0.23	0.09	92.94	358.88	113.49	756.60	-1281.50	107.04	-406.34	596.85
11/25/99 23:33	58.06	170	85.91	104.48	2642.60	48	0.42	0.17	92.95	358.92	113.17	722.07	-1285.20	109.40	-404.64	598.57
11/26/99 2:18	58.18	171	84.77	103.45	2588.90	48	0.46	0.18	92.97	358.96	112.80	599.66	-1290.70	124.43	-412.09	608.71
11/26/99 5:04	58.29	172	85.52	104.27	2532.00	48	0.41	0.16	92.98	358.98	112.52	656.47	-1299.60	131.49	-413.48	614.74
11/26/99 7:47	58.41	173	86.10	104.94	2483.10	48	0.37	0.15	92.92	359.02	112.18	498.75	-1310.50	133.53	-414.04	619.73
11/26/99 10:29	58.52	174	86.04	105.00	2438.00	48	0.36	0.14	92.92	359.05	111.74	538.20	-1316.90	135.93	-412.50	621.35
11/26/99 13:11	58.63	175	85.85	104.90	2393.30	48	0.36	0.14	92.96	359.08	111.39	526.52	-1319.30	141.49	-412.70	626.60
11/26/99 15:50	58.74	176	84.95	104.07	2348.80	48	0.39	0.15	92.97	359.11	111.11	486.31	-1326.50	147.15	-415.51	632.41
11/26/99 18:29	58.85	177	85.93	105.14	2302.20	48	0.34	0.13	92.94	359.14	110.75	454.03	-1335.50	152.16	-416.59	637.50
11/26/99 21:07	58.96	178	86.98	106.28	2260.10	48	0.29	0.11	92.92	359.19	110.39	410.19	-1344.20	153.85	-414.71	640.33

Note: Earth & Sun positions use table lookup & data interpolation on 10 day cen... AUXILIARY CALCULATIONS

9/28/99 22:01	SUN DIST	SUN LAT	SUN LONG	EARTH DIST	EARTH LAT	EARTH LONG	PERIOD	VPER	DELT PERIOD	DELT APO	DELT V	DELT MEAN SUN	RAAN -180 TO 180°	DELT RAAN	SOLAR TIME	DRAGDUR	DRAGPASS BEGIN (Including 5 min delay segs)	DRAGPASS END	ORBIT PERIOD LESS DRAGP AND SOLAR
11/12/99 22:21	2.06920E+08	-22.12	103.44	2.36E+08	-10.03	65.50	5.757	4.3563	275.6	137.4	5.73	23.589	-3.370	1.620	4:35:07 AM	402.9	-501.5	501.5	19721.78425
11/13/99 4:05	2.06910E+08	-22.15	103.60	2.37E+08	-10.11	65.66	5.695	4.3519	224.3	111.8	4.39	23.714	-3.350	1.640	4:34:42 AM	404.4	-502.2	502.2	19496.01165
11/13/99 9:45	2.06910E+08	-22.18	103.75	2.37E+08	-10.18	65.82	5.623	4.3463	256.1	128.7	5.57	23.838	-3.330	1.660	4:34:17 AM	406.1	-503.1	503.1	19238.20193
11/13/99 15:20	2.06900E+08	-22.22	103.91	2.37E+08	-10.26	65.99	5.554	4.3409	248.8	125.4	5.42	23.960	-3.290	1.700	4:33:58 AM	407.8	-503.9	503.9	18987.73295
11/13/99 20:53	2.06890E+08	-22.25	104.06	2.37E+08	-10.33	66.15	5.497	4.3369	206.5	103.8	4.02	24.081	-3.270	1.720	4:33:33 AM	409.3	-504.6	504.6	18779.7533
11/14/99 2:21	2.06890E+08	-22.28	104.22	2.37E+08	-10.40	66.30	5.430	4.3307	239.8	122.7	6.18	24.201	-3.250	1.740	4:33:09 AM	411.0	-505.5	505.5	18538.26112
11/14/99 7:47	2.06880E+08	-22.31	104.37	2.38E+08	-10.47	66.46	5.379	4.3271	184.4	93.1	3.53	24.319	-3.230	1.760	4:32:46 AM	412.3	-506.2	506.2	18352.52063
11/14/99 13:08	2.06870E+08	-22.34	104.51	2.38E+08	-10.54	66.62	5.316	4.3211	226.7	116.9	6.09	24.436	-3.200	1.790	4:32:25 AM	414.0	-507.0	507.0	18124.11814
11/14/99 18:26	2.06870E+08	-22.37	104.66	2.38E+08	-10.61	66.77	5.260	4.3186	202.0	100.8	2.49	24.552	-3.170	1.820	4:32:04 AM	415.5	-507.8	507.8	17920.64726
11/14/99 23:40	2.06860E+08	-22.40	104.81	2.38E+08	-10.68	66.92	5.192	4.3106	243.2	127.8	7.92	24.666	-3.160	1.830	4:31:39 AM	417.5	-508.7	508.7	17675.47614
11/15/99 4:51	2.06850E+08	-22.43	104.95	2.38E+08	-10.75	67.07	5.142	4.3079	182.9	92.4	2.76	24.779	-3.130	1.860	4:31:19 AM	418.9	-509.5	509.5	17491.18877
11/15/99 9:58	2.06850E+08	-22.46	105.09	2.38E+08	-10.82	67.22	5.077	4.3023	231.8	120.0	5.58	24.891	-3.110	1.880	4:30:57 AM	420.8	-510.4	510.4	17257.48457
11/15/99 15:01	2.06840E+08	-22.49	105.23	2.39E+08	-10.88	67.36	5.011	4.2956	239.3	125.4	6.73	25.001	-3.080	1.910	4:30:38 AM	422.8	-511.4	511.4	17016.22086
11/15/99 20:01	2.06830E+08	-22.51	105.37	2.39E+08	-10.95	67.51	4.957	4.2913	192.2	99.6	4.26	25.110	-3.050	1.940	4:30:19 AM	424.4	-512.2	512.2	16822.39208
11/16/99 0:58	2.06830E+08	-22.54	105.51	2.39E+08	-11.02	67.65	4.892	4.2842	234.4	124.2	7.15	25.218	-3.030	1.960	4:29:58 AM	426.5	-513.3	513.3	16572.27182
11/16/99 5:50	2.06820E+08	-22.57	105.65	2.39E+08	-11.08	67.79	4.846	4.2798	168.4	88.5	4.38	25.325	-3.010	1.980	4:29:37 AM	428.0	-514.0	514.0	16382.77504
11/16/99 10:39	2.06820E+08	-22.60	105.78	2.39E+08	-11.14	67.93	4.792	4.2746	193.0	101.9	5.19	25.430	-2.990	2.000	4:29:17 AM	429.8	-514.9	514.9	16167.57824
11/16/99 15:26	2.06810E+08	-22.62	105.91	2.39E+08	-11.21	68.07	4.737	4.2684	196.6	105.2	6.23	25.534	-2.950	2.040	4:29:01 AM	431.6	-515.8	515.8	15956.16134
11/16/99 20:10	2.06800E+08	-22.65	106.05	2.40E+08	-11.27	68.21	4.693	4.2646	158.5	83.5	3.79	25.638	-2.930	2.060	4:28:41 AM	433.1	-516.6	516.6	15785.47235
11/17/99 0:50	2.06800E+08	-22.68	106.18	2.40E+08	-11.33	68.34	4.640	4.2584	191.3	103.0	6.21	25.740	-2.910	2.080	4:28:22 AM	435.0	-517.5	517.5	15563.82442
11/17/99 5:28	2.06790E+08	-22.70	106.30	2.40E+08	-11.39	68.48	4.599	4.2538	149.8	80.4	4.53	25.841	-2.880	2.110	4:28:05 AM	436.5	-518.3	518.3	15399.27406
11/17/99 10:05	2.06790E+08	-22.73	106.43	2.40E+08	-11.45	68.61	4.550	4.2507	174.1	91.1	3.14	25.942	-2.860	2.130	4:27:45 AM	438.3	-519.1	519.1	15213.17027
11/17/99 14:36	2.06780E+08	-22.75	106.56	2.40E+08	-11.51	68.74	4.496	4.2421	196.3	109.1	8.60	26.040	-2.830	2.160	4:27:29 AM	440.4	-520.2	520.2	14988.83979
11/17/99 19:05	2.06780E+08	-22.78	106.68	2.40E+08	-11.57	68.87	4.451	4.2390	162.0	85.4	3.10	26.138	-2.800	2.190	4:27:12 AM	442.0	-521.0	521.0	14823.72291
11/17/99 23:31	2.06770E+08	-22.80	106.81	2.40E+08	-11.63	69.00	4.400	4.2334	181.3	98.3	5.55	26.235	-2.780	2.210	4:26:54 AM	444.0	-522.0	522.0	14618.88286
11/18/99 3:55	2.06760E+08	-22.83	106.93	2.41E+08	-11.69	69.12	4.347	4.2263	190.8	105.3	7.18	26.331	-2.750	2.240	4:26:38 AM	446.2	-523.1	523.1	14409.90893
11/18/99 8:15	2.06760E+08	-22.85	107.05	2.41E+08	-11.74	69.25	4.307	4.2219	144.0	78.4	4.38	26.426	-2.730	2.260	4:26:20 AM	447.8	-523.9	523.9	14247.96541
11/18/99 12:33	2.06750E+08	-22.88	107.17	2.41E+08	-11.80	69.37	4.259	4.2158	172.9	95.3	6.06	26.520	-2.700	2.290	4:26:05 AM	449.9	-524.9	524.9	14058.39806
11/18/99 16:48	2.06750E+08	-22.90	107.29	2.41E+08	-11.85	69.50	4.214	4.2095	164.0	91.3	6.36	26.612	-2.670	2.320	4:25:50 AM	451.9	-525.9	525.9	13880.73167
11/18/99 21:00	2.06740E+08	-22.93	107.40	2.41E+08	-11.91	69.62	4.170	4.2062	157.0	84.2	3.24	26.704	-2.640	2.350	4:25:35 AM	453.7	-526.9	526.9	13709.98426
11/19/99 1:09	2.06740E+08	-22.95	107.52	2.41E+08	-11.96	69.74	4.120	4.1979	181.2	102.9	8.34	26.795	-2.620	2.370	4:25:18 AM	456.1	-528.0	528.0	13504.37749
11/19/99 5:15	2.06730E+08	-22.97	107.63	2.41E+08	-12.02	69.86	4.080	4.1922	143.1	80.3	5.64	26.884	-2.590	2.400	4:25:04 AM	457.9	-529.0	529.0	13342.5623
11/19/99 9:20	2.06730E+08	-23.00	107.75	2.42E+08	-12.07	69.97	4.042	4.1890	137.8	74.8	3.22	26.973	-2.560	2.430	4:24:50 AM	459.7	-529.8	529.8	13195.73202
11/19/99 13:22	2.06720E+08	-23.02	107.86	2.42E+08	-12.13	70.09	3.992	4.1819	178.8	100.8	7.14	27.061	-2.540	2.450	4:24:33 AM	462.1	-531.1	531.1	12999.17158
11/19/99 17:21	2.06720E+08	-23.04	107.97	2.42E+08	-12.18	70.21	3.946	4.1747	165.6	94.2	7.16	27.148	-2.500	2.490	4:24:22 AM	464.5	-532.2	532.2	12819.66575
11/19/99 21:17	2.06720E+08	-23.06	108.08	2.42E+08	-12.23	70.32	3.906	4.1698	145.4	81.3	4.95	27.234	-2.470	2.520	4:24:09 AM	466.5	-533.3	533.3	12658.24617
11/20/99 1:11	2.06720E+08	-23.07	108.19	2.42E+08	-12.27	70.44	3.862	4.1633	158.8	90.3	6.51	27.319	-2.450	2.540	4:23:53 AM	496.9	-548.4	548.4	12471.12948
11/20/99 5:02	2.06720E+08	-23.09	108.30	2.42E+08	-12.32	70.56	3.819	4.1562	151.8	87.5	7.08	27.404	-2.420	2.570	4:23:40 AM	500.4	-550.2	550.2	12295.42173
11/20/99 8:51	2.06720E+08	-23.10	108.41	2.42E+08	-12.37	70.67	3.786	4.1513	121.6	69.3	4.89	27.487	-2.390	2.600	4:23:27 AM	503.2	-551.6	551.6	12164.35042
11/20/99 12:37	2.06720E+08	-23.12	108.52	2.42E+08	-12.41	70.79	3.747	4.1457	138.0	78.8	5.56	27.569	-2.370	2.620	4:23:12 AM	506.5	-553.3	553.3	12013.06296
11/20/99 16:22	2.06720E+08	-23.13	108.63	2.43E+08	-12.46	70.90	3.709	4.1386	138.4	81.0	7.14	27.651	-2.330	2.660	4:23:02 AM	510.0	-555.0	555.0	11861.33829
11/20/99 20:04	2.06720E+08	-23.15	108.73	2.43E+08	-12.50	71.02	3.672	4.1344	132.3	74.4	4.15	27.732	-2.300	2.690	4:22:50 AM	513.3	-556.6	556.6	11717.16535
11/20/99 23:44	2.06720E+08	-23.16	108.84	2.43E+08	-12.55	71.13	3.632	4.1287	143.4	82.3	5.77	27.812	-2.270	2.720	4:22:38 AM	516.9	-558.5	558.5	11557.12152
11/21/99 3:22	2.06720E+08	-23.18	108.94	2.43E+08	-12.59	71.24	3.589	4.1204	156.5	92.3	8.28	27.891	-2.240	2.750	4:22:26 AM	521.2	-560.6	560.6	11379.68982
11/21/99 6:56	2.06720E+08	-23.19	109.04	2.43E+08	-12.63	71.35	3.553	4.1142	128.5	75.2	6.21	27.969	-2.220	2.770	4:22:12 AM	524.8	-562.4	562.4	11233.24891
11/21/99 10:29	2.06720E+08	-23.20	109.14	2.43E+08	-12.68	71.45	3.520	4.1088	118.8	69.2	5.37	28.047	-2.190	2.800	4:22:01 AM	528.1	-564.1	564.1	11103.93011
11/21/99 14:00	2.06720E+08	-23.22	109.24	2.43E+08	-12.72	71.56	3.484	4.1024	131.5	77.3	6.41	28.123	-2.160	2.830	4:21:50 AM	531.9	-566.0	566.0	10957.97649
11/21/99 17:28	2.06720E+08	-23.23	109.34	2.43E+08	-12.76	71.67	3.449	4.0951	126.2	75.7	7.36	28.199	-2.120	2.870	4:21:41 AM	535.8	-567.9	567.9	10813.44647
11/21/99 20:56	2.06720E+08	-23.24	109.44	2.44E+08	-12.80	71.77	3.415	4.0908	121.4	69.7	4.29	28.275	-2.080	2.910	4:21:32 AM	539.4	-569.7	569.7	10684.3938
11/22/99 0:20	2.06720E+08	-23.26	109.54	2.44E+08	-12.85	71.88	3.377	4.0845	135.3	79.5	6.27	28.349	-2.060	2.930	4:21:19 AM	543.7	-571.8	571.8	10538.488
11/22/99 3:42	2.06720E+08	-23.27	109.64	2.44E+08	-12.89	71.98	3.345	4.0728	115.1	75.1	11.66	28.422	-2.030	2.960	4:21:09 AM	547.8	-573.9	573.9	10407.32937
11/22/99 7:03	2.06720E+08	-23.28	109.73	2.44E+08	-12.93	72.08	3.328	4.0693	63.3	38.0	3.53	28.496	-2.000	2.990	4:20:59 AM	549.9	-575.0	575.0	10328.985
11/22/99 10:22	2.06720E+08	-23.30	109.83	2.44E+08	-12.97	72.18	3.312	4.0665	56.0	33.3	2.82	28.568	-1.980	3.010	4:20:46 AM	551.8	-575.9	575.9	10262.39139
11/22/99 13:42	2.06720E+08	-23.31	109.92	2.44E+08	-13.01	72.28	3.294	4.0635	64.5	38.1	3.03	28.641	-1.950	3.040	4:20:36 AM	554.0	-577.0	577.0	10186.7016
11/22/99 17:00	2.06720E+08	-23.32	110.02	2.44E+08	-13.05	72.38	3.276	4.0587	66.3	41.1	4.78	28.713	-1.920	3.070	4:20:26 AM	556.4	-578.2	578.2	10112.41404
11/22/99 20:17	2.06720E+08	-23.33	110.11	2.44E+08	-13.09	72.48	3.260	4.0553	58.3	35.2	3.34	28.785	-1.880	3.110	4:20:18 AM	558.5	-579.3	579.3	10046.21942
11/22/99 23:33	2.06720E+08	-23.35	110.20	2.44E+08	-13.13	72.58	3.237	4.0564	80.4	42.0	-1.09	28.856	-1.840	3.150	4:20:11 AM	561.0	-580.5	580.5	9957.719473
11/23/99 2:47	2.06720E+08	-23.36	110.30	2.45E+08	-13.17	72.68	3.213	4.0468	87.2	58.1	9.64	28.927	-1.820	3.170	4:19:58 AM	564.6	-582.3	582.3	9861.866967
11/23/99 6:00	2.06720E+08	-23.37	110.39	2.45E+08	-13.21	72.78	3.197	4.0427	56.5	35.2	4.11	28.997	-1.800	3.190	4:19:46 AM	566.8	-583.4	583.4	9795.603229
11/23/99 9:12	2.06720E+08	-23.38	110.48	2.45E+08	-13.24	72.88	3.178	4.0432	68.8	36.6	-0.46	29.066	-1.770	3.220	4:19:37 AM	569.1	-584.6	584.6	9716.99814
11/23/99 12:23	2.06720E+08	-23.40	110.57	2.45E+08	-13.28	72.97	3.154	4.0385	88.7	53.3	4.66	29.136	-1.740	3.250	4:19:27 AM	572.5	-586.3	586.3	9622.550075
11/23/99 15:32	2.06720E+08	-23.41	110.66	2.45E+08	-13.32	73.07	3.127	4.0328	94.0	57.4	5.72	29.205	-1.710	3.280	4:19:18 AM	576.3	-588.2	588.2	9516.009469
11/23/99 18:39	2.06720E+08	-23.42	110.75	2.45E+08	-13.36	73.16	3.102	4.0261	90.6	56.7	6.63	29.273	-1.670	3.320	4:19:11 AM	580.1	-590.1	590.1	9413.969359
11/23/99 21:46	2.06720E+08	-23.43	110.84	2.45E+08	-13.40	73.26	3.080	4.0217	79.4	48.2	4.47	29.341	-1.630	3.360	4:19:05 AM	583.5	-591.7	591.7	9324.686667
11/24/99 0:50	2.06720E+08	-23.44	110.93	2.45E+08	-13.43	73.35	3.058	4.0176	81.1	48.7	4.08	29.408	-1.600	3.390	4:18:56 AM	586.9	-593.4	593.4	9231.637238
11/24/99 3:55	2.06720E+08	-23.46	111.01	2.45E+08	-13.47	73.44	3.034	4.0115	86.2	53.8	6.05	29.475	-1.570	3.420	4:18:47 AM	590.8	-595.4	595.4	9133.209676
11/24/99 6:56	2.06720E+08	-23.47	111.10	2.45E+08	-13.51	73.54	3.013	4.0061	75.8	47.4	5.39	29.541	-1.540	3.450	4:18:38 AM	594.2	-597.1	597.1	9044.573114
11/24/99 9:58	2.06720E+08	-23.48	111.19	2.46E+08	-13.54	73.63	2.994	4.0017	68.3	42.3	4.48	29.607	-1.510	3.480	4:18:29 AM	597.4	-598.7	598.7	8968.213753
11/24/99 12:58	2.06730E+08	-23.49	111.27	2.46E+08	-13.58	73.72	2.975	3.9977	68.7	42.0	3.96	29.673	-1.490	3.500	4:18:19 AM	600.6	-600.3	600.3	8890.963552
11/24/99 15:56	2.06730E+08	-23.50	111.36	2.46E+08	-13.62	73.81	2.955	3.9930	71.5	44.4	4.71	29.738	-1.460	3.530	4:18:10 AM	604.1	-602.0	602.0	8814.803984
11/24/99 18:53	2.06730E+08	-23.51	111.44	2.46E+08	-13.65	73.90	2.935	3.9870	70.5	45.3	5.99	29.802	-1.420	3.570	4:18:04 AM	607.7	-603.8	603.8	8729.929824
11/24/99 21:49	2.06730E+08	-23.53	111.53	2.46E+08	-13.69	73.99	2.918	3.9830	61.5	38.2	4.02	29.866	-1.370	3.620	4:18:01 AM	610.7	-605.4	605.4	8663.97116
11/25/99 0:45	2.06730E+08	-23.54	111.61	2.46E+08	-13.72	74.08	2.901	3.9798	62.6	37.8	3.14	29.930	-1.340	3.650	4:17:53 AM	613.9	-606.9	606.9	8595.349883
11/25/99 3:39	2.06730E+08	-23.55	111.69	2.46E+08	-13.76	74.17	2.882	3.9751	67.9	42.6	4.79	29.993	-1.310	3.680	4:17:45 AM	617.4	-608.7	608.7	8519.784627
11/25/99 6:33	2.06730E+08	-23.56	111.77	2.46E+08	-13.79	74.25	2.865	3.9699	61.7	39.7	5.18	30.057	-1.280	3.710	4:17:37 AM	620.8	-610.4	610.4	8449.252441
11/25/99 9:25	2.06730E+08	-23.57	111.86	2.46E+08	-13.83	74.34	2.849	3.9660	54.7	34.4	3.87	30.119	-1.250	3.740	4:17:29 AM	623.8	-611.9	611.9	8386.422391
11/25/99 12:16	2.06730E+08	-23.58	111.94	2.46E+08	-13.86	74.43	2.834	3.9622	54.1	34.0	3.83	30.182	-1.220	3.770	4:17:21 AM	626.9	-613.4	613.4	8327.953091
11/25/99 15:07	2.06730E+08	-23.59	112.02	2.47E+08	-13.90	74.52	2.819	3.9588	55.7	34.4	3.35	30.244	-1.200	3.790	4:17:11 AM	630.0	-615.0	615.0	8263.564936
11/25/99 17:56	2.06730E+08	-23.60	112.10	2.47E+08	-13.93	74.60	2.803	3.9538	56.1	36.5	5.05	30.305	-1.170	3.820	4:17:04 AM	633.3	-616.7	616.7	8199.23585
11/25/99 20:44	2.06730E+08	-23.61	112.18	2.47E+08	-13.97	74.69	2.789	3.9491	51.2	33.4	4.65	30.367	-1.120	3.870	4:17:01 AM	636.4	-618.2	618.2	8141.276999
11/25/99 23:33	2.06730E+08	-23.62	112.26	2.47E+08	-14.00	74.77	2.771	3.9493	65.7	36.0	-0.20	30.428	-1.080	3.910	4:16:56 AM	639.9	-619.9	619.9	8070.114342
11/26/99 2:18	2.06730E+08	-23.64	112.34	2.47E+08	-14.03	74.86	2.747	3.9437	86.0	53.7	5.58	30.488	-1.040	3.950	4:16:51 AM	645.1	-622.6	622.6	7975.953687
11/26/99 5:04	2.06730E+08	-23.65	112.42	2.47E+08	-14.07	74.94	2.723	3.9362	87.8	56.9	7.52	30.548	-1.020	3.970	4:16:41 AM	650.8	-625.4	625.4	7876.353549
11/26/99 7:47	2.06730E+08	-23.66	112.50	2.47E+08	-14.10	75.02	2.702	3.9297	75.4	48.9	6.49	30.608	-0.980	4.010	4:16:37 AM	655.9	-628.0	628.0	7787.535301
11/26/99 10:29	2.06730E+08	-23.67	112.57	2.47E+08	-14.13	75.10	2.682	3.9241	70.3	45.1	5.59	30.667	-0.950	4.040	4:16:30 AM	660.7	-630.3	630.3	7708.459758
11/26/99 13:11	2.06730E+08	-23.68	112.65	2.47E+08	-14.16	75.19	2.663	3.9186	69.7	44.7	5.50	30.726	-0.920	4.070	4:16:23 AM	665.6	-632.8	632.8	7633.933823
11/26/99 15:50	2.06730E+08	-23.69	112.73	2.47E+08	-14.20	75.27	2.643	3.9137	70.3	44.5	4.99	30.784	-0.890	4.100	4:16:16 AM	670.6	-635.3	635.3	7553.940565
11/26/99 18:29	2.06730E+08	-23.70	112.80	2.47E+08	-14.23	75.35	2.624	3.9069	70.5	46.6	6.78	30.841	-0.860	4.130	4:16:09 AM	675.9	-638.0	638.0	7471.785149
11/26/99 21:07	2.06730E+08	-23.71	112.88	2.48E+08	-14.26	75.43	2.606	3.9006	63.3	42.1	6.31	30.899	-0.810	4.180	4:16:07 AM	680.9	-640.4	640.4	7397.327235

Open of Primary MSP Peer Review 11/96, Beg of L/W, Min Mass Config, Data written at periapsis point

Starting Time for Simulation: Sept. 28, 1999; 22:01 ET (Apoapsis, Last Walkin Maneuver)

Note: Earth & Sun positions use table lookup & data interpolation on 10 day cen

AUXILIARY CALCULATIONS

9/28/99 22:01	DAY#	REV#	PERIAPS ALT	PER WRT ELLIPSOID	APOAPSIS ALT	NBURN	QDYN	QHTDYN	INCLIN	ASC NODE	ARGPER	(DO NOT USE) DYNAMIC DRAGDUR	SUN ECLIPSE BEGIN	SUN ECLIPSE END	EARTH OCCULT BEGIN	EARTH OCCULT END	SUN DIST	SUN LAT	SUN LONG	EARTH DIST	EARTH LAT	EARTH LONG	PERIOD	VPER	DELT PERIOD	DELT APO	DELT V	DELT MEAN SUN	RAAN -180 TO 180°	DELT RAAN	SOLAR TIME	DRAGDUR	DRAGPASS BEGIN (Including 5 min delay segs)	DRAGPASS END	ORBIT PERIOD LESS DRAGP AND SOLAR
11/26/99 23:43	59.07	179	86.20	105.59	2223.10	48	0.31	0.12	92.93	359.23	110.03	371.22	-1349.30	156.40	-413.04	644.16	2.06730E+08	-23.72	112.95	2.48E+08	-14.29	75.51	2.590	3.8963	58.1	37.0	4.28	30.956	-0.770	4.220	4:16:03 AM	685.4	-642.7	642.7	7331.890894
11/27/99 2:18	59.18	180	84.82	104.31	2183.70	48	0.34	0.13	92.96	359.27	109.65	687.57	-1352.70	163.33	-414.23	648.53	2.06730E+08	-23.73	113.03	2.48E+08	-14.32	75.59	2.573	3.8921	62.6	39.4	4.18	31.012	-0.730	4.260	4:15:59 AM	690.3	-645.1	645.1	7263.466639
11/27/99 4:54	59.29	181	85.00	104.56	2140.20	48	0.33	0.13	92.97	359.30	109.33	681.63	-1356.50	170.86	-416.96	656.02	2.06730E+08	-23.74	113.10	2.48E+08	-14.35	75.66	2.554	3.8861	66.3	43.5	6.00	31.069	-0.700	4.290	4:15:53 AM	695.8	-647.9	647.9	7190.573342
11/27/99 7:26	59.39	182	85.83	105.47	2100.90	48	0.29	0.11	92.93	359.33	109.01	675.36	-1362.70	174.65	-418.00	660.86	2.06730E+08	-23.75	113.17	2.48E+08	-14.39	75.74	2.538	3.8801	58.8	39.3	5.99	31.124	-0.670	4.320	4:15:47 AM	700.9	-650.5	650.5	7123.040757
11/27/99 9:59	59.50	183	85.57	105.32	2066.10	48	0.29	0.11	92.90	359.37	108.55	662.49	-1366.90	176.66	-416.16	662.55	2.06730E+08	-23.76	113.25	2.48E+08	-14.42	75.82	2.523	3.8755	53.4	34.8	4.58	31.180	-0.630	4.360	4:15:43 AM	705.6	-652.8	652.8	7063.059654
11/27/99 12:32	59.61	184	85.66	105.50	2030.10	48	0.28	0.11	92.94	359.40	108.12	679.04	-1369.70	182.62	-415.19	668.86	2.06730E+08	-23.77	113.32	2.48E+08	-14.45	75.90	2.508	3.8705	54.6	36.0	5.06	31.235	-0.600	4.390	4:15:37 AM	710.6	-655.3	655.3	7003.150758
11/27/99 15:01	59.71	185	85.06	104.97	1994.90	48	0.29	0.11	92.98	359.43	107.81	662.52	-1374.50	188.35	-415.66	673.93	2.06730E+08	-23.78	113.39	2.48E+08	-14.48	75.97	2.493	3.8660	54.4	35.2	4.46	31.290	-0.570	4.420	4:15:31 AM	751.5	-675.7	675.7	6923.53132
11/27/99 17:31	59.81	186	84.61	104.59	1960.00	48	0.29	0.11	92.96	359.46	107.48	645.38	-1380.50	193.46	-418.02	679.49	2.06730E+08	-23.79	113.46	2.48E+08	-14.51	76.05	2.478	3.8614	53.6	34.9	4.59	31.344	-0.540	4.450	4:15:25 AM	758.3	-679.2	679.2	6860.550459
11/27/99 20:01	59.92	187	86.13	106.20	1923.60	48	0.24	0.09	92.92	359.50	107.10	585.49	-1385.20	197.79	-418.35	684.66	2.06730E+08	-23.80	113.53	2.48E+08	-14.54	76.12	2.463	3.8550	52.8	36.4	6.37	31.399	-0.500	4.490	4:15:22 AM	765.7	-682.8	682.8	6799.429234
11/27/99 22:29	60.02	188	82.09	102.23	1887.20	49	0.36	0.14	92.92	359.55	106.73	680.10	-1389.00	200.27	-414.94	688.06	2.06730E+08	-23.81	113.60	2.48E+08	-14.57	76.20	2.446	3.8529	61.0	36.4	2.12	31.453	-0.450	4.540	4:15:21 AM	773.2	-686.6	686.6	6730.828274
11/28/99 0:56	60.12	189	80.85	101.07	1841.00	49	0.39	0.15	92.93	359.59	106.34	497.00	-1392.30	211.13	-421.16	698.65	2.06730E+08	-23.82	113.67	2.48E+08	-14.60	76.27	2.426	3.8472	71.4	46.2	5.76	31.506	-0.410	4.580	4:15:18 AM	783.1	-691.6	691.6	6651.151116
11/28/99 3:22	60.22	190	79.57	99.88	1789.70	49	0.43	0.17	92.96	359.63	105.90	762.82	-1398.30	219.67	-424.05	705.51	2.06730E+08	-23.82	113.74	2.49E+08	-14.63	76.35	2.404	3.8406	78.9	51.3	6.58	31.559	-0.370	4.620	4:15:15 AM	794.6	-697.3	697.3	6560.512331
11/28/99 5:46	60.32	191	80.07	100.45	1734.90	49	0.40	0.15	92.97	359.66	105.56	526.18	-1405.40	227.95	-427.57	716.04	2.06730E+08	-23.83	113.81	2.49E+08	-14.66	76.42	2.382	3.8320	81.3	54.8	8.59	31.612	-0.340	4.650	4:15:09 AM	807.4	-703.7	703.7	6465.760507
11/28/99 8:08	60.42	192	80.85	101.30	1686.30	49	0.35	0.14	92.92	359.69	105.19	458.76	-1414.70	232.66	-428.73	723.81	2.06730E+08	-23.84	113.88	2.49E+08	-14.69	76.49	2.362	3.8240	71.3	48.6	7.98	31.664	-0.310	4.680	4:15:04 AM	819.2	-709.6	709.6	6379.174805
11/28/99 10:31	60.52	193	80.43	100.99	1642.40	49	0.35	0.13	92.90	359.73	104.66	591.52	-1421.40	235.74	-427.10	730.31	2.06730E+08	-23.85	113.95	2.49E+08	-14.71	76.57	2.344	3.8176	65.9	43.9	6.43	31.715	-0.270	4.720	4:15:01 AM	830.4	-715.2	715.2	6300.953319
11/28/99 12:52	60.62	194	80.52	101.17	1597.00	49	0.34	0.13	92.93	359.77	104.15	804.34	-1424.80	243.34	-425.42	738.34	2.06730E+08	-23.86	114.01	2.49E+08	-14.74	76.64	2.325	3.8104	67.2	45.4	7.13	31.767	-0.230	4.760	4:14:58 AM	842.5	-721.2	721.2	6224.287056
11/28/99 15:12	60.72	195	80.06	100.77	1552.50	49	0.34	0.13	92.98	359.80	103.77	636.13	-1431.10	249.44	-426.04	749.37	2.06730E+08	-23.87	114.08	2.49E+08	-14.77	76.71	2.307	3.8038	66.5	44.5	6.66	31.818	-0.200	4.790	4:14:53 AM	854.8	-727.4	727.4	6145.280109
11/28/99 17:30	60.81	196	79.13	99.90	1508.40	49	0.36	0.14	92.97	359.83	103.41	888.26	-1439.50	258.00	-430.74	756.92	2.06730E+08	-23.88	114.15	2.49E+08	-14.80	76.78	2.288	3.7975	66.5	44.1	6.32	31.868	-0.170	4.820	4:14:48 AM	867.5	-733.8	733.8	6064.03898
11/28/99 19:47	60.91	197	80.29	101.14	1462.20	49	0.31	0.12	92.93	359.87	102.95	450.73	-1445.80	264.37	-431.21	766.51	2.06730E+08	-23.89	114.21	2.49E+08	-14.83	76.85	2.270	3.7891	66.3	46.2	8.36	31.918	-0.130	4.860	4:14:46 AM	881.5	-740.8	740.8	5984.434729
11/28/99 22:03	61.00	198	81.49	102.41	1421.00	49	0.27	0.10	92.91	359.92	102.50	546.58	-1452.60	268.89	-428.80	773.67	2.06730E+08	-23.90	114.28	2.49E+08	-14.85	76.92	2.253	3.7814	58.7	41.2	7.67	31.968	-0.080	4.910	4:14:46 AM	894.6	-747.3	747.3	5912.380088
11/29/99 0:19	61.10	199	80.93	101.93	1384.70	49	0.28	0.11	92.92	359.97	102.07	526.78	-1457.00	273.05	-426.44	781.87	2.06730E+08	-23.91	114.34	2.49E+08	-14.88	76.98	2.238	3.7759	54.0	36.3	5.58	32.017	-0.030	4.960	4:14:46 AM	906.5	-753.3	753.3	5848.003868
11/29/99 2:33	61.19	200	79.17	100.24	1346.80	49	0.32	0.12	92.95	0.01	101.62	957.85	-1461.10	280.47	-427.19	790.63	2.06730E+08	-23.91	114.40	2.49E+08	-14.91	77.05	2.222	3.7709	58.0	37.9	4.98	32.066	0.014	5.004	4:14:45 AM	919.6	-759.8	759.8	5779.428464
11/29/99 4:47	61.28	201	78.38	99.51	1303.00	49	0.33	0.12	92.98	0.05	101.16	516.66	-1464.80	290.86	-430.66	803.24	2.06730E+08	-23.92	114.47	2.49E+08	-14.94	77.12	2.204	3.7641	65.0	43.8	6.80	32.114	0.049	5.039	4:14:42 AM	935.3	-767.7	767.7	5702.845007
11/29/99 6:59	61.37	202	79.45	100.63	1258.80	49	0.29	0.11	92.97	0.08	100.79	514.61	-1470.80	299.23	-432.80	816.18	2.06740E+08	-23.93	114.53	2.49E+08	-14.96	77.19	2.187	3.7557	62.7	44.2	8.40	32.162	0.080	5.070	4:14:38 AM	952.0	-776.0	776.0	5625.765029
11/29/99 9:10	61.47	203	79.78	101.02	1221.00	49	0.27	0.10	92.90	0.13	100.34	753.17	-1478.60	301.85	-431.68	824.98	2.06740E+08	-23.94	114.59	2.50E+08	-14.99	77.25	2.172	3.7489	54.4	37.8	6.80	32.210	0.125	5.115	4:14:37 AM	967.1	-783.5	783.5	5556.096913
11/29/99 11:21	61.56	204	79.24	100.56	1184.40	49	0.27	0.10	92.88	0.17	99.73	553.86	-1482.20	308.66	-429.13	831.96	2.06740E+08	-23.95	114.66	2.50E+08	-15.01	77.32	2.157	3.7429	53.7	36.6	6.00	32.258	0.168	5.158	4:14:36 AM	982.3	-791.2	791.2	5491.135258
11/29/99 13:31	61.65	205	79.38	100.77	1145.80	49	0.26	0.10	92.92	0.20	99.15	693.31	-1484.60	317.27	-427.89	844.48	2.06740E+08	-23.96	114.72	2.50E+08	-15.04	77.39	2.141	3.7359	55.5	38.6	6.95	32.305	0.203	5.193	4:14:33 AM	999.2	-799.6	799.6	5424.779926
11/29/99 15:39	61.74	206	74.71	96.15	1102.50	50	0.38	0.14	92.97	0.24	98.75	698.93	-1489.10	327.33	-427.66	857.31	2.06740E+08	-23.96	114.78	2.50E+08	-15.07	77.45	2.122	3.7318	69.1	43.3	4.17	32.352	0.235	5.225	4:14:30 AM	1019.2	-809.58039	809.6	5341.238135
11/29/99 17:46	61.82	207	73.33	94.82	1045.90	50	0.41	0.15	92.98	0.27	98.33	659.55	-1495.30	342.45	-439.95	878.52	2.06740E+08	-23.97	114.84	2.50E+08	-15.09	77.52	2.099	3.7225	83.2	56.6	9.24	32.398	0.270	5.260	4:14:27 AM	1047.1	-823.56806	823.6	5237.845265
11/29/99 19:52	61.91	208	73.61	95.16	984.19	50	0.38	0.14	92.93	0.30	97.71	713.39	-1506.20	352.34	-444.17	898.39	2.06740E+08	-23.98	114.90	2.50E+08	-15.12	77.58	2.075	3.7109	87.8	61.7	11.66	32.444	0.304	5.294	4:14:24 AM	1080.4	-840.18639	840.2	5122.510212
11/29/99 21:56	62.00	209	74.94	96.55	925.01	50	0.33	0.12	92.89	0.36	97.06	733.72	-1516.20	362.49	-443.97	917.80	2.06740E+08	-23.99	114.96	2.50E+08	-15.14	77.64	2.052	3.6987	82.4	59.2	12.20	32.489	0.355	5.345	4:14:25 AM	1115.4	-857.7	857.7	5012.626573
11/29/99 23:59	62.08	210	74.86	96.53	871.88	50	0.32	0.12	92.89	0.41	96.47	685.36	-1526.60	372.10	-440.66	937.00	2.06740E+08	-24.00	115.02	2.50E+08	-15.17	77.71	2.031	3.6885	75.5	53.1	10.15	32.534	0.411	5.401	4:14:28 AM	1149.8	-874.9	874.9	4909.51284
11/30/99 2:01	62.17	211	73.16	94.88	817.20	50	0.36	0.13	92.92	0.47	95.91	1047.80	-1535.50	382.46	-441.14	959.96	2.06740E+08	-24.00	115.08	2.50E+08	-15.19	77.77	2.009	3.6791	79.7	54.7	9.38	32.578	0.466	5.456	4:14:31 AM	1188.7	-894.3	894.3	4801.435634
11/30/99 4:01	62.25	212	71.06	92.815	751.96	50	0.41	0.15	92.95	0.51	95.26	1090.10	-1545.50	396.19	-446.17	986.60	2.06740E+08	-24.01	115.13	2.50E+08	-15.22	77.83	1.982	3.6678	94.8	65.2	11.37	32.622	0.510	5.500	4:14:31 AM	1240.6	-920.3	920.3	4670.627606
11/30/99 5:59	62.33	213	76.69	98.506	685.53	51	0.25	0.09	92.98	0.55	94.39	669.23	-1557.80	411.57	-453.54	1021.50	2.06740E+08	-24.02	115.19	2.50E+08	-15.24	77.89	1.959	3.6499	85.3	66.4	17.84	32.665	0.551	5.541	4:14:30 AM	1301.0	-950.5	950.5	4542.875111
11/30/99 7:57	62.414	214	84.039	105.89	647.48	52	0.13	0.05	92.95	0.59	93.799	1147.7	-1573.4	421.65	-442.05	1045.2	2.06740E+08	-24.027	115.25	250260000	-15.264	77.947	1.947	3.6364	42.9	38.1	13.49	32.707	0.590	5.580	4:14:29 AM	1339.7	-969.9	969.9	4464.977421
11/30/99 9:55	62.496	215	83.555	105.43	625.02	52	0.14	0.05	92.88	0.64	93.216	1146.1	-1582.7	420.58	-422.49	1053.3	2.06740E+08	-24.035	115.3	250330000	-15.288	78.006	1.938	3.6321	32.0	22.5	4.32	32.750	0.641	5.631	4:14:31 AM	1364.2	-982.1	982.1	4411.391214
11/30/99 11:50	62.576	216	82.694	104.6	600.38	52	0.14	0.05	92.86	0.69	92.475	1125.7	-1583.1	429.74	-418.49	1068	2.06740E+08	-24.042	115.36	250390000	-15.311	78.065	1.928	3.6276	35.5	24.6	4.52	32.792	0.689	5.679	4:14:33 AM	1392.7	-996.4	996.4	4361.212064
11/30/99 13:47	62.66	217	88.88	110.81	577.45	53	0.09	0.03	92.89	0.73	91.65	1173.50	-1582.40	443.92	-415.08	1087.90	2.06740E+08	-24.05	115.41	2.50E+08	-15.34	78.124	1.921	3.6180	23.3	22.9	9.58	32.835	0.729	5.719	4:14:32 AM	1420.9	-1010.4	1010.4	4324.544258
11/30/99 15:42	62.74	218	88.73	110.66	560.34	53	0.09	0.03	92.95	0.76	91.13	1543.80	-1582.70	447.97	-394.38	1096.70	2.06740E+08	-24.06	115.47	2.51E+08	-15.36	78.183	1.915	3.6145	24.0	17.1	3.53	32.877	0.765	5.755	4:14:31 AM	1443.0	-1021.5	1021.5	4289.180543
11/30/99 17:38	62.82	219	87.60	109.54	543.70	53	0.09	0.03	92.99	0.80	90.85	1516.10	-1583.50	454.78	-393.68	1112.10	2.06740E+08	-24.07	115.52	2.51E+08	-15.38	78.241	1.908	3.6118	24.7	16.6	2.71	32.919	0.800	5.790	4:14:29 AM	1465.5	-1032.8	1032.8	4252.455733
11/30/99 19:32	62.90	220	86.78	108.72	526.29	53	0.10	0.04	92.95	0.84	90.37	1384.80	-1587.00	463.34	-397.22	1126.70	2.06740E+08	-24.07	115.58	2.51E+08	-15.40	78.3	1.901	3.6086	25.3	17.4	3.13	32.961	0.838	5.828	4:14:28 AM	1490.2	-1045.1	1045.1	4211.31393
11/30/99 21:27	62.98	221	88.35	110.29	507.02	53	0.09	0.03	92.90	0.88	89.76	1628.00	-1587.50	474.15	-395.90	1141.10	2.06740E+08	-24.08	115.63	2.51E+08	-15.43	78.358	1.894	3.6033	24.5	19.3	5.37	33.003	0.880	5.870	4:14:28 AM	1519.1	-1059.5	1059.5	4171.877106
11/30/99 23:21	63.06	222	89.42	111.36	489.40	53	0.08	0.03	92.88	0.93	89.22	1719.90	-1588.20	482.71	-385.52	1155.30	2.06740E+08	-24.09	115.69	2.51E+08	-15.45	78.415	1.888	3.5986	22.9	17.6	4.66	33.044	0.934	5.924	4:14:31 AM	1721.7	-1160.9	1160.9	4046.972841
12/1/99 1:15	63.14	223	88.77	110.71	472.88	53	0.08	0.03	92.90	0.99	88.81	1458.10	-1588.50	489.98	-377.70	1169.50	2.06740E+08	-24.09	115.74	2.51E+08	-15.47	78.473	1.881	3.5955	23.7	16.5	3.13	33.085	0.990	5.980	4:14:35 AM	1759.0	-1179.5	1179.5	4004.292715
12/1/99 3:09	63.21	224	86.58	108.50	454.59	53	0.10	0.04	92.93	1.04	88.47	1555.50	-1590.60	498.77	-377.87	1186.30	2.06740E+08	-24.10	115.79	2.51E+08	-15.50	78.531	1.873	3.5931	28.3	18.3	2.37	33.127	1.044	6.034	4:14:38 AM	1802.9	-1201.4	1201.4	3951.985016
12/1/99 5:01	63.29	225	84.74	106.85	431.05	53	0.12	0.04	92.97	1.09	88.03	2072.30	-1594.50	509.98	-383.49	1205.20	2.06740E+08	-24.11	115.85	2.51E+08	-15.52	78.588	1.864	3.5893	35.0	23.5	3.84	33.168	1.087	6.077	4:14:38 AM	#N/A	#N/A	#N/A	#N/A
12/1/99 6:53	63.37	226	84.59	106.50	402.80	53	0.12	0.04	93.00	1.13	87.70	2095.60	-1597.30	522.86	-388.80	1230.30	2.06740E+08	-24.12	115.90	2.51E+08	-15.54	78.645	1.853	3.5830	39.1	28.3	6.23	33.208	1.129	6.119	4:14:39 AM	#N/A	#N/A	#N/A	#N/A
12/1/99 8:44	63.45	227	85.36	107.26	374.50	53	0.11	0.04	92.94	1.17	87.42	2145.00	-1607.00	533.45	-390.48	1255.30	2.06740E+08	-24.12	115.95	2.5108E+08	-15.56	78.701	1.842	3.5760	37.8	28.3	7.00	33.249	1.171	6.161	4:14:39 AM	#N/A	#N/A	#N/A	#N/A

6/24/97

Tracking Schedule - open LP

period	Start	Periapse	End	Start	Track 1 duration	End	Off 1 duration	Start	Track 2 duration	End	Off 2 duration	Start	Track3 duration	End	Off 3 duration
h	Aeropass		Aeropass	Track 1 [post peri]	h	Track 1	h	Track 2	h	Track 2	h	Track 3	h	Track 3	h
25.81	9/29/99 10:53	9/29/99 11:01	9/29/99 11:09	9/29/99 11:27	4.00	9/29/99 15:27	5.00	9/29/99 20:27	4.00	9/30/99 0:27	5.00	9/30/99 5:27	3.30	9/30/99 8:44	4.12
25.20	9/30/99 12:18	9/30/99 12:26	9/30/99 12:33	9/30/99 12:51	4.00	9/30/99 16:51	5.00	9/30/99 21:51	4.00	10/1/99 1:51	5.00	10/1/99 6:51	3.02	10/1/99 9:53	3.78
24.59	10/1/99 13:06	10/1/99 13:14	10/1/99 13:21	10/1/99 13:39	4.00	10/1/99 17:39	5.00	10/1/99 22:39	4.00	10/2/99 2:39	5.00	10/2/99 7:39	2.75	10/2/99 10:25	3.44
23.98	10/2/99 13:18	10/2/99 13:26	10/2/99 13:33	10/2/99 13:51	4.00	10/2/99 17:51	5.00	10/2/99 22:51	4.00	10/3/99 2:51	5.00	10/3/99 7:51	2.49	10/3/99 10:20	3.11
23.37	10/3/99 12:54	10/3/99 13:01	10/3/99 13:09	10/3/99 13:27	4.00	10/3/99 17:27	5.00	10/3/99 22:27	4.00	10/4/99 2:27	5.00	10/4/99 7:27	2.23	10/4/99 9:41	2.78
22.81	10/4/99 11:54	10/4/99 12:02	10/4/99 12:10	10/4/99 12:28	4.00	10/4/99 16:28	5.00	10/4/99 21:28	4.00	10/5/99 1:28	5.00	10/5/99 6:28	1.98	10/5/99 8:27	2.48
22.31	10/5/99 10:22	10/5/99 10:30	10/5/99 10:37	10/5/99 10:55	4.00	10/5/99 14:55	5.00	10/5/99 19:55	4.00	10/5/99 23:55	5.00	10/6/99 4:55	1.75	10/6/99 6:40	2.18
21.79	10/6/99 8:18	10/6/99 8:25	10/6/99 8:33	10/6/99 8:51	4.00	10/6/99 12:51	5.00	10/6/99 17:51	4.00	10/6/99 21:51	5.00	10/7/99 2:51	1.49	10/7/99 4:20	1.86
21.21	10/7/99 5:39	10/7/99 5:46	10/7/99 5:54	10/7/99 6:12	4.00	10/7/99 10:12	5.00	10/7/99 15:12	4.00	10/7/99 19:12	5.00	10/8/99 0:12	1.25	10/8/99 1:27	1.56
20.60	10/8/99 2:27	10/8/99 2:34	10/8/99 2:42	10/8/99 3:00	4.00	10/8/99 7:00	5.00	10/8/99 12:00	4.00	10/8/99 16:00	5.00	10/8/99 21:00	1.03	10/8/99 22:02	1.29
20.21	10/8/99 22:46	10/8/99 22:54	10/8/99 23:01	10/8/99 23:19	4.00	10/9/99 3:19	5.00	10/9/99 8:19	4.00	10/9/99 12:19	5.00	10/9/99 17:19	0.81	10/9/99 18:08	1.01
19.64	10/9/99 18:36	10/9/99 18:43	10/9/99 18:51	10/9/99 19:09	4.00	10/9/99 23:09	5.00	10/10/99 4:09	4.00	10/10/99 8:09	5.00				
19.21	10/10/99 13:56	10/10/99 14:04	10/10/99 14:12	10/10/99 14:30	4.00	10/10/99 18:30	5.00	10/10/99 23:30	4.00	10/11/99 3:30	5.00				
18.79	10/11/99 8:51	10/11/99 8:59	10/11/99 9:06	10/11/99 9:24	4.00	10/11/99 13:24	5.00	10/11/99 18:24	4.00	10/11/99 22:24	5.00				
18.29	10/12/99 3:18	10/12/99 3:26	10/12/99 3:34	10/12/99 3:52	4.00	10/12/99 7:52	5.00	10/12/99 12:52	4.00	10/12/99 16:52	5.00				
17.92	10/12/99 21:21	10/12/99 21:29	10/12/99 21:36	10/12/99 21:54	4.00	10/13/99 1:54	5.00	10/13/99 6:54	3.85	10/13/99 10:46	4.81				
17.52	10/13/99 15:01	10/13/99 15:09	10/13/99 15:16	10/13/99 15:34	4.00	10/13/99 19:34	5.00	10/14/99 0:34	3.67	10/14/99 4:14	4.59				
17.13	10/14/99 8:16	10/14/99 8:24	10/14/99 8:32	10/14/99 8:50	4.00	10/14/99 12:50	5.00	10/14/99 17:50	3.51	10/14/99 21:20	4.39				
16.82	10/15/99 1:10	10/15/99 1:18	10/15/99 1:25	10/15/99 1:43	4.00	10/15/99 5:43	5.00	10/15/99 10:43	3.35	10/15/99 14:04	4.19				
16.41	10/15/99 17:42	10/15/99 17:50	10/15/99 17:58	10/15/99 18:16	4.00	10/15/99 22:16	5.00	10/16/99 3:16	3.21	10/16/99 6:28	4.01				
16.12	10/16/99 9:56	10/16/99 10:03	10/16/99 10:11	10/16/99 10:29	4.00	10/16/99 14:29	5.00	10/16/99 19:29	3.07	10/16/99 22:33	3.84				
15.82	10/17/99 1:50	10/17/99 1:58	10/17/99 2:06	10/17/99 2:24	4.00	10/17/99 6:24	5.00	10/17/99 11:24	2.90	10/17/99 14:18	3.63				
15.43	10/17/99 17:22	10/17/99 17:30	10/17/99 17:37	10/17/99 17:55	4.00	10/17/99 21:55	5.00	10/18/99 2:55	2.77	10/18/99 5:42	3.47				
15.09	10/18/99 8:36	10/18/99 8:44	10/18/99 8:52	10/18/99 9:10	4.00	10/18/99 13:10	5.00	10/18/99 18:10	2.63	10/18/99 20:48	3.29				
14.81	10/18/99 23:32	10/18/99 23:40	10/18/99 23:48	10/19/99 0:06	4.00	10/19/99 4:06	5.00	10/19/99 9:06	2.52	10/19/99 11:37	3.15				
14.57	10/19/99 14:12	10/19/99 14:20	10/19/99 14:27	10/19/99 14:45	4.00	10/19/99 18:45	5.00	10/19/99 23:45	2.38	10/20/99 2:08	2.97				
14.30	10/20/99 4:33	10/20/99 4:41	10/20/99 4:49	10/20/99 5:07	4.00	10/20/99 9:07	5.00	10/20/99 14:07	2.27	10/20/99 16:23	2.84				
14.04	10/20/99 18:40	10/20/99 18:48	10/20/99 18:55	10/20/99 19:13	4.00	10/20/99 23:13	5.00	10/21/99 4:13	2.18	10/21/99 6:24	2.72				
13.76	10/21/99 8:34	10/21/99 8:41	10/21/99 8:49	10/21/99 9:07	4.00	10/21/99 13:07	5.00	10/21/99 18:07	2.05	10/21/99 20:10	2.56				
13.52	10/21/99 22:10	10/21/99 22:18	10/21/99 22:26	10/21/99 22:44	4.00	10/22/99 2:44	5.00	10/22/99 7:44	1.96	10/22/99 9:41	2.45				
13.30	10/22/99 11:35	10/22/99 11:43	10/22/99 11:50	10/22/99 12:08	4.00	10/22/99 16:08	5.00	10/22/99 21:08	1.85	10/22/99 22:59	2.31				
13.06	10/23/99 0:44	10/23/99 0:52	10/23/99 1:00	10/23/99 1:18	4.00	10/23/99 5:18	5.00	10/23/99 10:18	1.76	10/23/99 12:03	2.20				
12.85	10/23/99 13:42	10/23/99 13:49	10/23/99 13:57	10/23/99 14:15	4.00	10/23/99 18:15	5.00	10/23/99 23:15	1.65	10/24/99 0:54	2.07				
12.64	10/24/99 2:25	10/24/99 2:33	10/24/99 2:40	10/24/99 2:58	4.00	10/24/99 6:58	5.00	10/24/99 11:58	1.58	10/24/99 13:33	1.97				
12.44	10/24/99 14:58	10/24/99 15:06	10/24/99 15:14	10/24/99 15:32	4.00	10/24/99 19:32	5.00	10/25/99 0:32	1.46	10/25/99 1:59	1.83				
12.18	10/25/99 3:15	10/25/99 3:23	10/25/99 3:31	10/25/99 3:49	4.00	10/25/99 7:49	5.00	10/25/99 12:49	1.37	10/25/99 14:11	1.71				
11.98	10/25/99 15:20	10/25/99 15:27	10/25/99 15:35	10/25/99 15:53	4.00	10/25/99 19:53	5.00	10/26/99 0:53	1.27	10/26/99 2:09	1.59				
11.76	10/26/99 3:11	10/26/99 3:19	10/26/99 3:27	10/26/99 3:45	4.00	10/26/99 7:45	5.00	10/26/99 12:45	1.18	10/26/99 13:56	1.48				
11.58	10/26/99 14:51	10/26/99 14:59	10/26/99 15:06	10/26/99 15:24	4.00	10/26/99 19:24	5.00	10/27/99 0:24	1.11	10/27/99 1:31	1.39				
11.39	10/27/99 2:21	10/27/99 2:28	10/27/99 2:36	10/27/99 2:54	4.00	10/27/99 6:54	5.00	10/27/99 11:54	1.02	10/27/99 12:56	1.28				
11.18	10/27/99 13:39	10/27/99 13:47	10/27/99 13:54	10/27/99 14:12	4.00	10/27/99 18:12	5.00	10/27/99 23:12	0.93	10/28/99 0:08	1.16				
11.01	10/28/99 0:44	10/28/99 0:52	10/28/99 1:00	10/28/99 1:18	4.00	10/28/99 5:18	5.00	10/28/99 10:18	0.84	10/28/99 11:08	1.05				
10.82	10/28/99 11:38	10/28/99 11:46	10/28/99 11:53	10/28/99 12:11	4.00	10/28/99 16:11	5.00	10/28/99 21:11	0.77	10/28/99 21:58	0.96				
10.64	10/28/99 22:21	10/28/99 22:29	10/28/99 22:37	10/28/99 22:55	4.00	10/29/99 2:55	5.00	10/29/99 7:55	0.50	10/29/99 8:25	0.63				
10.47	10/29/99 8:52	10/29/99 9:00	10/29/99 9:08	10/29/99 9:26	4.00	10/29/99 13:26	5.00								
10.32	10/29/99 19:16	10/29/99 19:24	10/29/99 19:31	10/29/99 19:49	4.00	10/29/99 23:49	5.00								
10.15	10/30/99 5:29	10/30/99 5:37	10/30/99 5:45	10/30/99 6:03	4.00	10/30/99 10:03	5.00								
10.00	10/30/99 15:34	10/30/99 15:42	10/30/99 15:50	10/30/99 16:08	4.00	10/30/99 20:08	5.00								
9.87	10/31/99 1:30	10/31/99 1:38	10/31/99 1:46	10/31/99 2:04	4.00	10/31/99 6:04	5.00								
9.74	10/31/99 11:18	10/31/99 11:25	10/31/99 11:33	10/31/99 11:51	4.00	10/31/99 15:51	5.00								

6/24/97

Tracking Schedule - open LP

period	Start	Periapse	End	Start	Track 1 duration	End	Off 1 duration	Start	Track 2 duration	End	Off 2 duration	Start	Track3 duration	End	Off 3 duration
h	Aeropass		Aeropass	Track 1 [post peri]	h	Track 1	h	Track 2	h	Track 2	h	Track 3	h	Track 3	h
9.58	10/31/99 20:56	10/31/99 21:04	10/31/99 21:12	10/31/99 21:30	4.00	11/1/99 1:30	5.00								
9.43	11/1/99 6:25	11/1/99 6:33	11/1/99 6:41	11/1/99 6:59	4.00	11/1/99 10:59	5.00								
9.29	11/1/99 15:48	11/1/99 15:56	11/1/99 16:04	11/1/99 16:22	4.00	11/1/99 20:22	5.00								
9.16	11/2/99 1:03	11/2/99 1:11	11/2/99 1:19	11/2/99 1:37	4.00	11/2/99 5:36	4.99								
9.00	11/2/99 10:06	11/2/99 10:13	11/2/99 10:21	11/2/99 10:39	3.94	11/2/99 14:36	4.92								
8.87	11/2/99 19:03	11/2/99 19:11	11/2/99 19:19	11/2/99 19:37	3.89	11/2/99 23:30	4.86								
8.76	11/3/99 3:51	11/3/99 3:59	11/3/99 4:07	11/3/99 4:25	3.83	11/3/99 8:15	4.79								
8.63	11/3/99 12:32	11/3/99 12:40	11/3/99 12:48	11/3/99 13:06	3.77	11/3/99 16:52	4.71								
8.49	11/3/99 21:06	11/3/99 21:14	11/3/99 21:22	11/3/99 21:40	3.72	11/4/99 1:24	4.65								
8.38	11/4/99 5:32	11/4/99 5:40	11/4/99 5:48	11/4/99 6:06	3.68	11/4/99 9:46	4.59								
8.28	11/4/99 13:52	11/4/99 14:00	11/4/99 14:08	11/4/99 14:26	3.62	11/4/99 18:03	4.52								
8.15	11/4/99 22:04	11/4/99 22:12	11/4/99 22:20	11/4/99 22:38	3.57	11/5/99 2:12	4.47								
8.05	11/5/99 6:11	11/5/99 6:19	11/5/99 6:27	11/5/99 6:45	3.53	11/5/99 10:17	4.41								
7.95	11/5/99 14:10	11/5/99 14:18	11/5/99 14:26	11/5/99 14:44	3.47	11/5/99 18:13	4.34								
7.82	11/5/99 22:03	11/5/99 22:11	11/5/99 22:19	11/5/99 22:37	3.43	11/6/99 2:03	4.29								
7.73	11/6/99 5:51	11/6/99 5:59	11/6/99 6:07	11/6/99 6:25	3.39	11/6/99 9:48	4.24								
7.64	11/6/99 13:31	11/6/99 13:39	11/6/99 13:47	11/6/99 14:05	3.34	11/6/99 17:26	4.18								
7.53	11/6/99 21:06	11/6/99 21:14	11/6/99 21:22	11/6/99 21:40	3.30	11/7/99 0:59	4.13								
7.44	11/7/99 4:36	11/7/99 4:44	11/7/99 4:52	11/7/99 5:10	3.25	11/7/99 8:25	4.06								
7.32	11/7/99 11:59	11/7/99 12:07	11/7/99 12:15	11/7/99 12:33	3.21	11/7/99 15:46	4.01								
7.23	11/7/99 19:17	11/7/99 19:25	11/7/99 19:33	11/7/99 19:51	3.18	11/7/99 23:02	3.97								
7.16	11/8/99 2:29	11/8/99 2:37	11/8/99 2:45	11/8/99 3:03	3.13	11/8/99 6:11	3.92								
7.06	11/8/99 9:35	11/8/99 9:43	11/8/99 9:51	11/8/99 10:09	3.10	11/8/99 13:15	3.87								
6.98	11/8/99 16:37	11/8/99 16:45	11/8/99 16:53	11/8/99 17:11	3.05	11/8/99 20:14	3.82								
6.88	11/8/99 23:33	11/8/99 23:41	11/8/99 23:49	11/9/99 0:07	3.02	11/9/99 3:09	3.78								
6.81	11/9/99 6:24	11/9/99 6:32	11/9/99 6:40	11/9/99 6:58	2.98	11/9/99 9:57	3.73								
6.71	11/9/99 13:10	11/9/99 13:18	11/9/99 13:26	11/9/99 13:44	2.94	11/9/99 16:41	3.68								
6.63	11/9/99 19:51	11/9/99 20:00	11/9/99 20:08	11/9/99 20:26	2.91	11/9/99 23:20	3.64								
6.56	11/10/99 2:27	11/10/99 2:36	11/10/99 2:44	11/10/99 3:02	2.87	11/10/99 5:54	3.59								
6.47	11/10/99 8:59	11/10/99 9:07	11/10/99 9:15	11/10/99 9:33	2.84	11/10/99 12:24	3.55								
6.40	11/10/99 15:25	11/10/99 15:33	11/10/99 15:41	11/10/99 15:59	2.81	11/10/99 18:48	3.51								
6.32	11/10/99 21:48	11/10/99 21:56	11/10/99 22:04	11/10/99 22:22	2.78	11/11/99 1:09	3.48								
6.26	11/11/99 4:05	11/11/99 4:13	11/11/99 4:22	11/11/99 4:40	2.75	11/11/99 7:24	3.43								
6.18	11/11/99 10:20	11/11/99 10:28	11/11/99 10:36	11/11/99 10:54	2.72	11/11/99 13:37	3.39								
6.12	11/11/99 16:30	11/11/99 16:38	11/11/99 16:46	11/11/99 17:04	2.68	11/11/99 19:45	3.35								
6.03	11/11/99 22:34	11/11/99 22:42	11/11/99 22:51	11/11/99 23:09	2.65	11/12/99 1:48	3.32								
5.97	11/12/99 4:35	11/12/99 4:44	11/12/99 4:52	11/12/99 5:10	2.62	11/12/99 7:47	3.27								
5.89	11/12/99 10:31	11/12/99 10:39	11/12/99 10:48	11/12/99 11:06	2.59	11/12/99 13:41	3.24								
5.83	11/12/99 16:24	11/12/99 16:32	11/12/99 16:41	11/12/99 16:59	2.56	11/12/99 19:32	3.20								
5.76	11/12/99 22:12	11/12/99 22:21	11/12/99 22:29	11/12/99 22:47	2.53	11/13/99 1:19	3.16								
5.69	11/13/99 3:56	11/13/99 4:05	11/13/99 4:13	11/13/99 4:31	2.50	11/13/99 7:01	3.12								
5.62	11/13/99 9:36	11/13/99 9:45	11/13/99 9:53	11/13/99 10:11	2.47	11/13/99 12:39	3.08								
5.55	11/13/99 15:12	11/13/99 15:20	11/13/99 15:29	11/13/99 15:47	2.44	11/13/99 18:13	3.05								
5.50	11/13/99 20:44	11/13/99 20:53	11/13/99 21:01	11/13/99 21:19	2.41	11/13/99 23:44	3.01								
5.43	11/14/99 2:13	11/14/99 2:21	11/14/99 2:30	11/14/99 2:48	2.39	11/14/99 5:11	2.99								
5.38	11/14/99 7:38	11/14/99 7:47	11/14/99 7:55	11/14/99 8:13	2.36	11/14/99 10:35	2.95								
5.32	11/14/99 12:59	11/14/99 13:08	11/14/99 13:16	11/14/99 13:34	2.34	11/14/99 15:54	2.92								
5.26	11/14/99 18:17	11/14/99 18:26	11/14/99 18:34	11/14/99 18:52	2.31	11/14/99 21:11	2.88								
5.19	11/14/99 23:31	11/14/99 23:40	11/14/99 23:48	11/15/99 0:06	2.28	11/15/99 2:23	2.85								
5.14	11/15/99 4:42	11/15/99 4:51	11/15/99 4:59	11/15/99 5:17	2.25	11/15/99 7:33	2.82								

6/24/97

Tracking Schedule - open LP

period	Start	Periapse	End	Start	Track 1 duration	End	Off 1 duration	Start	Track 2 duration	End	Off 2 duration	Start	Track3 duration	End	Off 3 duration
h	Aeropass		Aeropass	Track 1 [post peri]	h	Track 1	h	Track 2	h	Track 2	h	Track 3	h	Track 3	h
5.08	11/15/99 9:49	11/15/99 9:58	11/15/99 10:06	11/15/99 10:24	2.22	11/15/99 12:38	2.78								
5.01	11/15/99 14:53	11/15/99 15:01	11/15/99 15:10	11/15/99 15:28	2.20	11/15/99 17:40	2.75								
4.96	11/15/99 19:52	11/15/99 20:01	11/15/99 20:10	11/15/99 20:28	2.17	11/15/99 22:38	2.72								
4.89	11/16/99 0:49	11/16/99 0:58	11/16/99 1:06	11/16/99 1:24	2.15	11/16/99 3:33	2.69								
4.85	11/16/99 5:41	11/16/99 5:50	11/16/99 5:59	11/16/99 6:17	2.13	11/16/99 8:24	2.66								
4.79	11/16/99 10:31	11/16/99 10:39	11/16/99 10:48	11/16/99 11:06	2.10	11/16/99 13:12	2.63								
4.74	11/16/99 15:17	11/16/99 15:26	11/16/99 15:35	11/16/99 15:53	2.08	11/16/99 17:58	2.60								
4.69	11/16/99 20:01	11/16/99 20:10	11/16/99 20:18	11/16/99 20:36	2.06	11/16/99 22:40	2.58								
4.64	11/17/99 0:42	11/17/99 0:50	11/17/99 0:59	11/17/99 1:17	2.04	11/17/99 3:20	2.55								
4.60	11/17/99 5:20	11/17/99 5:28	11/17/99 5:37	11/17/99 5:55	2.02	11/17/99 7:56	2.53								
4.55	11/17/99 9:56	11/17/99 10:05	11/17/99 10:13	11/17/99 10:31	2.00	11/17/99 12:31	2.50								
4.50	11/17/99 14:27	11/17/99 14:36	11/17/99 14:44	11/17/99 15:02	1.98	11/17/99 17:01	2.47								
4.45	11/17/99 18:56	11/17/99 19:05	11/17/99 19:14	11/17/99 19:32	1.95	11/17/99 21:29	2.44								
4.40	11/17/99 23:23	11/17/99 23:31	11/17/99 23:40	11/17/99 23:58	1.93	11/18/99 1:54	2.41								
4.35	11/18/99 3:46	11/18/99 3:55	11/18/99 4:03	11/18/99 4:21	1.91	11/18/99 6:16	2.39								
4.31	11/18/99 8:07	11/18/99 8:15	11/18/99 8:24	11/18/99 8:42	1.89	11/18/99 10:36	2.36								
4.26	11/18/99 12:24	11/18/99 12:33	11/18/99 12:42	11/18/99 13:00	1.87	11/18/99 14:52	2.34								
4.21	11/18/99 16:39	11/18/99 16:48	11/18/99 16:57	11/18/99 17:15	1.85	11/18/99 19:06	2.31								
4.17	11/18/99 20:51	11/18/99 21:00	11/18/99 21:09	11/18/99 21:27	1.83	11/18/99 23:17	2.29								
4.12	11/19/99 1:00	11/19/99 1:09	11/19/99 1:18	11/19/99 1:36	1.81	11/19/99 3:25	2.26								
4.08	11/19/99 5:07	11/19/99 5:15	11/19/99 5:24	11/19/99 5:42	1.79	11/19/99 7:30	2.24								
4.04	11/19/99 9:11	11/19/99 9:20	11/19/99 9:29	11/19/99 9:47	1.77	11/19/99 11:33	2.22								
3.99	11/19/99 13:13	11/19/99 13:22	11/19/99 13:31	11/19/99 13:49	1.75	11/19/99 15:34	2.19								
3.95	11/19/99 17:12	11/19/99 17:21	11/19/99 17:30	11/19/99 17:48	1.73	11/19/99 19:32	2.17								
3.91	11/19/99 21:08	11/19/99 21:17	11/19/99 21:26	11/19/99 21:44	1.71	11/19/99 23:27	2.14								
3.86	11/20/99 1:01	11/20/99 1:11	11/20/99 1:20	11/20/99 1:38	1.70	11/20/99 3:19	2.12								
3.82	11/20/99 4:53	11/20/99 5:02	11/20/99 5:12	11/20/99 5:30	1.68	11/20/99 7:10	2.10								
3.79	11/20/99 8:42	11/20/99 8:51	11/20/99 9:01	11/20/99 9:19	1.66	11/20/99 10:58	2.08								
3.75	11/20/99 12:28	11/20/99 12:37	11/20/99 12:47	11/20/99 13:05	1.65	11/20/99 14:43	2.06								
3.71	11/20/99 16:13	11/20/99 16:22	11/20/99 16:31	11/20/99 16:49	1.63	11/20/99 18:27	2.04								
3.67	11/20/99 19:55	11/20/99 20:04	11/20/99 20:13	11/20/99 20:31	1.61	11/20/99 22:08	2.02								
3.63	11/20/99 23:35	11/20/99 23:44	11/20/99 23:53	11/21/99 0:11	1.59	11/21/99 1:47	1.99								
3.59	11/21/99 3:12	11/21/99 3:22	11/21/99 3:31	11/21/99 3:49	1.58	11/21/99 5:24	1.97								
3.55	11/21/99 6:47	11/21/99 6:56	11/21/99 7:06	11/21/99 7:24	1.56	11/21/99 8:57	1.95								
3.52	11/21/99 10:20	11/21/99 10:29	11/21/99 10:39	11/21/99 10:57	1.55	11/21/99 12:30	1.93								
3.48	11/21/99 13:50	11/21/99 14:00	11/21/99 14:09	11/21/99 14:27	1.53	11/21/99 15:59	1.91								
3.45	11/21/99 17:19	11/21/99 17:28	11/21/99 17:38	11/21/99 17:56	1.52	11/21/99 19:27	1.90								
3.41	11/21/99 20:46	11/21/99 20:56	11/21/99 21:05	11/21/99 21:23	1.50	11/21/99 22:53	1.87								
3.38	11/22/99 0:11	11/22/99 0:20	11/22/99 0:30	11/22/99 0:48	1.49	11/22/99 2:17	1.86								
3.35	11/22/99 3:32	11/22/99 3:42	11/22/99 3:51	11/22/99 4:09	1.48	11/22/99 5:38	1.85								
3.33	11/22/99 6:54	11/22/99 7:03	11/22/99 7:13	11/22/99 7:31	1.47	11/22/99 8:59	1.84								
3.31	11/22/99 10:13	11/22/99 10:22	11/22/99 10:32	11/22/99 10:50	1.46	11/22/99 12:17	1.83								
3.29	11/22/99 13:33	11/22/99 13:42	11/22/99 13:52	11/22/99 14:10	1.45	11/22/99 15:37	1.82								
3.28	11/22/99 16:50	11/22/99 17:00	11/22/99 17:09	11/22/99 17:27	1.45	11/22/99 18:54	1.81								
3.26	11/22/99 20:07	11/22/99 20:17	11/22/99 20:26	11/22/99 20:44	1.44	11/22/99 22:11	1.80								
3.24	11/22/99 23:23	11/22/99 23:33	11/22/99 23:42	11/23/99 0:00	1.43	11/23/99 1:26	1.78								
3.21	11/23/99 2:37	11/23/99 2:47	11/23/99 2:57	11/23/99 3:15	1.42	11/23/99 4:40	1.77								
3.20	11/23/99 5:50	11/23/99 6:00	11/23/99 6:10	11/23/99 6:28	1.41	11/23/99 7:52	1.76								
3.18	11/23/99 9:02	11/23/99 9:12	11/23/99 9:21	11/23/99 9:39	1.40	11/23/99 11:03	1.75								
3.15	11/23/99 12:13	11/23/99 12:23	11/23/99 12:33	11/23/99 12:51	1.39	11/23/99 14:14	1.74								

6/24/97

Tracking Schedule - open LP

period	Start	Periapse	End	Start	Track 1 duration	End	Off 1 duration	Start	Track 2 duration	End	Off 2 duration	Start	Track3 duration	End	Off 3 duration
h	Aeropass		Aeropass	Track 1 [post peri]	h	Track 1	h	Track 2	h	Track 2	h	Track 3	h	Track 3	h
3.13	11/23/99 15:22	11/23/99 15:32	11/23/99 15:42	11/23/99 16:00	1.38	11/23/99 17:22	1.72								
3.10	11/23/99 18:29	11/23/99 18:39	11/23/99 18:49	11/23/99 19:07	1.37	11/23/99 20:29	1.71								
3.08	11/23/99 21:36	11/23/99 21:46	11/23/99 21:56	11/23/99 22:14	1.36	11/23/99 23:35	1.70								
3.06	11/24/99 0:41	11/24/99 0:50	11/24/99 1:00	11/24/99 1:18	1.35	11/24/99 2:39	1.68								
3.03	11/24/99 3:45	11/24/99 3:55	11/24/99 4:05	11/24/99 4:23	1.34	11/24/99 5:43	1.67								
3.01	11/24/99 6:46	11/24/99 6:56	11/24/99 7:06	11/24/99 7:24	1.33	11/24/99 8:44	1.66								
2.99	11/24/99 9:48	11/24/99 9:58	11/24/99 10:08	11/24/99 10:26	1.32	11/24/99 11:45	1.65								
2.97	11/24/99 12:48	11/24/99 12:58	11/24/99 13:08	11/24/99 13:26	1.31	11/24/99 14:44	1.64								
2.95	11/24/99 15:46	11/24/99 15:56	11/24/99 16:06	11/24/99 16:24	1.30	11/24/99 17:42	1.63								
2.94	11/24/99 18:43	11/24/99 18:53	11/24/99 19:03	11/24/99 19:21	1.30	11/24/99 20:39	1.62								
2.92	11/24/99 21:39	11/24/99 21:49	11/24/99 21:59	11/24/99 22:17	1.29	11/24/99 23:34	1.61								
2.90	11/25/99 0:35	11/25/99 0:45	11/25/99 0:55	11/25/99 1:13	1.28	11/25/99 2:30	1.60								
2.88	11/25/99 3:29	11/25/99 3:39	11/25/99 3:49	11/25/99 4:07	1.27	11/25/99 5:23	1.59								
2.86	11/25/99 6:23	11/25/99 6:33	11/25/99 6:43	11/25/99 7:01	1.27	11/25/99 8:17	1.58								
2.85	11/25/99 9:14	11/25/99 9:25	11/25/99 9:35	11/25/99 9:53	1.26	11/25/99 11:08	1.57								
2.83	11/25/99 12:06	11/25/99 12:16	11/25/99 12:26	11/25/99 12:44	1.25	11/25/99 13:59	1.56								
2.82	11/25/99 14:57	11/25/99 15:07	11/25/99 15:17	11/25/99 15:35	1.24	11/25/99 16:50	1.56								
2.80	11/25/99 17:45	11/25/99 17:56	11/25/99 18:06	11/25/99 18:24	1.24	11/25/99 19:38	1.55								
2.79	11/25/99 20:34	11/25/99 20:44	11/25/99 20:54	11/25/99 21:12	1.23	11/25/99 22:26	1.54								
2.77	11/25/99 23:22	11/25/99 23:33	11/25/99 23:43	11/26/99 0:01	1.22	11/26/99 1:14	1.52								
2.75	11/26/99 2:08	11/26/99 2:18	11/26/99 2:29	11/26/99 2:47	1.21	11/26/99 3:59	1.51								
2.72	11/26/99 4:53	11/26/99 5:04	11/26/99 5:14	11/26/99 5:32	1.20	11/26/99 6:44	1.50								
2.70	11/26/99 7:36	11/26/99 7:47	11/26/99 7:57	11/26/99 8:15	1.19	11/26/99 9:27	1.49								
2.68	11/26/99 10:19	11/26/99 10:29	11/26/99 10:40	11/26/99 10:58	1.18	11/26/99 12:09	1.48								
2.66	11/26/99 13:00	11/26/99 13:11	11/26/99 13:21	11/26/99 13:39	1.17	11/26/99 14:50	1.47								
2.64	11/26/99 15:40	11/26/99 15:50	11/26/99 16:01	11/26/99 16:19	1.16	11/26/99 17:29	1.46								
2.62	11/26/99 18:18	11/26/99 18:29	11/26/99 18:39	11/26/99 18:57	1.16	11/26/99 20:07	1.45								
2.61	11/26/99 20:57	11/26/99 21:07	11/26/99 21:18	11/26/99 21:36	1.15	11/26/99 22:45	1.44								
2.59	11/26/99 23:32	11/26/99 23:43	11/26/99 23:53	11/27/99 0:11	1.14	11/27/99 1:20	1.43								
2.57	11/27/99 2:08	11/27/99 2:18	11/27/99 2:29	11/27/99 2:47	1.13	11/27/99 3:55	1.42								
2.55	11/27/99 4:43	11/27/99 4:54	11/27/99 5:05	11/27/99 5:23	1.13	11/27/99 6:30	1.41								
2.54	11/27/99 7:16	11/27/99 7:26	11/27/99 7:37	11/27/99 7:55	1.12	11/27/99 9:02	1.40								
2.52	11/27/99 9:48	11/27/99 9:59	11/27/99 10:10	11/27/99 10:28	1.11	11/27/99 11:35	1.39								
2.51	11/27/99 12:21	11/27/99 12:32	11/27/99 12:43	11/27/99 13:01	1.11	11/27/99 14:07	1.38								
2.49	11/27/99 14:50	11/27/99 15:01	11/27/99 15:13	11/27/99 15:31	1.10	11/27/99 16:37	1.38								
2.48	11/27/99 17:20	11/27/99 17:31	11/27/99 17:43	11/27/99 18:01	1.09	11/27/99 19:06	1.37								
2.46	11/27/99 19:50	11/27/99 20:01	11/27/99 20:12	11/27/99 20:30	1.09	11/27/99 21:36	1.36								
2.45	11/27/99 22:18	11/27/99 22:29	11/27/99 22:41	11/27/99 22:59	1.08	11/28/99 0:03	1.35								
2.43	11/28/99 0:45	11/28/99 0:56	11/28/99 1:08	11/28/99 1:26	1.07	11/28/99 2:30	1.33								
2.40	11/28/99 3:10	11/28/99 3:22	11/28/99 3:33	11/28/99 3:51	1.06	11/28/99 4:55	1.32								
2.38	11/28/99 5:34	11/28/99 5:46	11/28/99 5:57	11/28/99 6:15	1.05	11/28/99 7:18	1.31								
2.36	11/28/99 7:56	11/28/99 8:08	11/28/99 8:20	11/28/99 8:38	1.04	11/28/99 9:40	1.30								
2.34	11/28/99 10:19	11/28/99 10:31	11/28/99 10:43	11/28/99 11:01	1.03	11/28/99 12:03	1.29								
2.33	11/28/99 12:40	11/28/99 12:52	11/28/99 13:04	11/28/99 13:22	1.02	11/28/99 14:23	1.28								
2.31	11/28/99 14:59	11/28/99 15:12	11/28/99 15:24	11/28/99 15:42	1.02	11/28/99 16:43	1.27								
2.29	11/28/99 17:18	11/28/99 17:30	11/28/99 17:42	11/28/99 18:00	1.01	11/28/99 19:00	1.26								
2.27	11/28/99 19:34	11/28/99 19:47	11/28/99 19:59	11/28/99 20:17	1.00	11/28/99 21:17	1.25								
2.25	11/28/99 21:51	11/28/99 22:03	11/28/99 22:16	11/28/99 22:34	0.99	11/28/99 23:33	1.24								
2.24	11/29/99 0:06	11/29/99 0:19	11/29/99 0:31	11/29/99 0:49	0.99	11/29/99 1:49	1.23								
2.22	11/29/99 2:20	11/29/99 2:33	11/29/99 2:45	11/29/99 3:03	0.98	11/29/99 4:02	1.22								

6/24/97

Tracking Schedule - open LP

period	Start	Periapse	End	Start	Track 1 duration	End	Off 1 duration	Start	Track 2 duration	End	Off 2 duration	Start	Track3 duration	End	Off 3 duration
h	Aeropass		Aeropass	Track 1 [post peri]	h	Track 1	h	Track 2	h	Track 2	h	Track 3	h	Track 3	h
2.20	11/29/99 4:34	11/29/99 4:47	11/29/99 4:59	11/29/99 5:17	0.97	11/29/99 6:16	1.21								
2.19	11/29/99 6:46	11/29/99 6:59	11/29/99 7:12	11/29/99 7:30	0.96	11/29/99 8:28	1.21								
2.17	11/29/99 8:57	11/29/99 9:10	11/29/99 9:23	11/29/99 9:41	0.50	11/29/99 10:11	0.63								
2.16	11/29/99 11:08	11/29/99 11:21	11/29/99 11:34	11/29/99 11:52	0.50	11/29/99 12:22	0.63								
2.14	11/29/99 13:17	11/29/99 13:31	11/29/99 13:44	11/29/99 14:02	0.50	11/29/99 14:32	0.63								
2.12	11/29/99 15:25	11/29/99 15:39	11/29/99 15:52	11/29/99 16:10	0.50	11/29/99 16:40	0.63								
2.10	11/29/99 17:32	11/29/99 17:46	11/29/99 17:59	11/29/99 18:17	0.50	11/29/99 18:47	0.63								
2.07	11/29/99 19:38	11/29/99 19:52	11/29/99 20:06	11/29/99 20:24	0.50	11/29/99 20:54	0.63								
2.05	11/29/99 21:42	11/29/99 21:56	11/29/99 22:10	11/29/99 22:28	0.50	11/29/99 22:58	0.63								
2.03	11/29/99 23:44	11/29/99 23:59	11/30/99 0:13	11/30/99 0:31	0.50	11/30/99 1:01	0.63								
2.01	11/30/99 1:46	11/30/99 2:01	11/30/99 2:16	11/30/99 2:34	0.50	11/30/99 3:04	0.63								
1.98	11/30/99 3:45	11/30/99 4:01	11/30/99 4:16	11/30/99 4:34	0.50	11/30/99 5:04	0.63								
1.96	11/30/99 5:43	11/30/99 5:59	11/30/99 6:14	11/30/99 6:32	0.50	11/30/99 7:02	0.63								
1.95	11/30/99 7:41	11/30/99 7:57	11/30/99 8:13	11/30/99 8:31	0.50	11/30/99 9:01	0.63								
1.94	11/30/99 9:38	11/30/99 9:55	11/30/99 10:11	11/30/99 10:29	0.50	11/30/99 10:59	0.63								
1.93	11/30/99 11:33	11/30/99 11:50	11/30/99 12:07	11/30/99 12:25	0.50	11/30/99 12:55	0.63								
1.92	11/30/99 13:30	11/30/99 13:47	11/30/99 14:03	11/30/99 14:21	0.50	11/30/99 14:51	0.63								
1.91	11/30/99 15:25	11/30/99 15:42	11/30/99 15:59	11/30/99 16:17	0.50	11/30/99 16:47	0.63								
1.91	11/30/99 17:21	11/30/99 17:38	11/30/99 17:56	11/30/99 18:14	0.50	11/30/99 18:44	0.63								
1.90	11/30/99 19:15	11/30/99 19:32	11/30/99 19:50	11/30/99 20:08	0.50	11/30/99 20:38	0.63								
1.89	11/30/99 21:10	11/30/99 21:27	11/30/99 21:45	11/30/99 22:03	0.50	11/30/99 22:33	0.63								
1.89	11/30/99 23:02	11/30/99 23:21	11/30/99 23:40	11/30/99 23:58	0.50	12/1/99 0:28	0.63								
1.88	12/1/99 0:55	12/1/99 1:15	12/1/99 1:35	12/1/99 1:53	0.50	12/1/99 2:23	0.63								
1.87	12/1/99 2:49	12/1/99 3:09	12/1/99 3:29	12/1/99 3:47	0.50	12/1/99 4:17	0.63								
1.86	12/1/99 4:39	12/1/99 5:01	12/1/99 5:23	12/1/99 5:41	0.50	12/1/99 6:11	0.63								
1.85	12/1/99 6:31	12/1/99 6:53	12/1/99 7:15	12/1/99 7:33	0.50	12/1/99 8:03	0.63								
1.84	12/1/99 8:22	12/1/99 8:44	12/1/99 9:06	12/1/99 9:24	0.50	12/1/99 9:54	0.63								

Close of Primary MSP Peer Review 11/96, End of L/W, Min Mass Config, Data written at periapsis point

Starting Time for Simulation: Oct 3, 1999; 06:30 ET (Apoapsis, Last Walkin Maneuver)

10/3/99 6:30	DAY#	REV#	PERIAPS ALT	PER WRT ELLIPSOID	APOAPSIS ALT	NBURN	QDYN	QHTDYN	INCLIN	ASC NODE	ARGPER	(DO NOT USE) DYNAMIC DRAGDUR	SUN ECLIPSE BEGIN	SUN ECLIPSE END	EARTH OCCULT BEGIN	EARTH OCCULT END
10/3/99 20:58	0.60	1	108.19	112.61	38284.00	0	0.66	0.31	92.94	355.63	153.44	0.00	0.00	0.00	0.00	0.00
10/5/99 0:54	1.77	2	110.17	114.64	37478.00	1	0.51	0.25	92.96	355.64	153.29	286.52	-248.36	75.95	-394.98	852.44
10/6/99 4:02	2.90	3	109.96	114.47	36622.00	1	0.55	0.26	92.98	355.66	153.17	310.76	-235.86	54.74	-394.57	837.98
10/7/99 6:25	4.00	4	109.80	114.35	35645.00	1	0.55	0.26	92.96	355.67	153.04	250.18	-213.96	40.10	-394.97	825.19
10/8/99 8:05	5.07	5	109.50	114.10	34808.00	1	0.56	0.27	92.96	355.67	152.85	315.57	-192.05	23.29	-395.18	811.80
10/9/99 9:00	6.10	6	109.28	113.94	34010.00	1	0.57	0.27	92.96	355.68	152.66	307.31	-170.15	5.92	-394.66	799.68
10/10/99 9:13	7.11	7	109.05	113.78	33226.00	1	0.60	0.28	92.97	355.69	152.48	272.21	-148.24	-17.34	-394.18	788.87
10/11/99 8:45	8.09	8	108.65	113.43	32477.00	1	0.64	0.30	92.96	355.71	152.29	304.08	-126.34	-53.46	-393.81	776.58
10/12/99 7:34	9.04	9	108.01	112.84	31766.00	1	0.72	0.34	92.95	355.72	152.13	254.38	-122.44	-109.31	-393.61	765.66
10/13/99 5:38	9.96	10	110.12	114.99	31010.00	2	0.52	0.24	92.95	355.73	152.01	258.33	0.00	0.00	-393.38	755.98
10/14/99 3:11	10.86	11	110.48	115.40	30285.00	2	0.49	0.23	92.97	355.74	151.87	293.28	0.00	0.00	-392.67	745.77
10/15/99 0:14	11.74	12	108.11	113.08	29662.00	3	0.67	0.31	92.98	355.76	151.70	280.73	0.00	0.00	-392.69	734.40
10/15/99 20:39	12.59	13	109.89	114.91	29067.00	4	0.54	0.26	92.98	355.77	151.55	289.76	*0.00*	0.00	-393.06	724.92
10/16/99 16:36	13.42	14	110.28	115.35	28461.00	4	0.49	0.23	92.99	355.78	151.40	322.40	*0.00*	0.00	-392.69	714.68
10/17/99 12:06	14.23	15	108.04	113.16	27863.00	5	0.70	0.33	92.99	355.80	151.24	172.43	*0.00*	0.00	-393.13	704.88
10/18/99 7:03	15.02	16	109.93	115.10	27263.00	6	0.51	0.24	92.98	355.81	151.06	267.99	*0.00*	0.00	-393.20	696.43
10/19/99 1:34	15.80	17	109.89	115.12	26767.00	6	0.51	0.24	93.00	355.83	150.90	199.26	0.00	0.00	-391.82	686.85
10/19/99 19:42	16.55	18	110.04	115.31	26305.00	6	0.51	0.24	93.00	355.84	150.76	309.25	0.00	0.00	-391.51	678.09
10/20/99 13:26	17.29	19	110.06	115.38	25825.00	6	0.53	0.25	93.00	355.86	150.61	241.27	*0.00*	0.00	-390.54	671.22
10/21/99 6:48	18.01	20	110.23	115.61	25315.00	6	0.51	0.24	92.98	355.88	150.44	242.90	0.00	0.00	-391.37	660.95
10/21/99 23:49	18.72	21	107.54	112.97	24873.00	7	0.72	0.34	92.99	355.90	150.28	416.49	0.00	0.00	-390.42	653.74
10/22/99 16:21	19.41	22	110.48	115.97	24275.00	8	0.48	0.23	92.98	355.91	150.11	297.76	0.00	0.00	-391.37	645.39
10/23/99 8:35	20.09	23	107.80	113.35	23829.00	9	0.68	0.32	92.98	355.93	149.92	316.47	0.00	0.00	-389.59	637.60
10/24/99 0:24	20.75	24	109.89	115.49	23406.00	10	0.53	0.25	92.99	355.95	149.75	279.31	0.00	0.00	-389.83	630.89
10/24/99 15:53	21.39	25	109.90	115.56	22990.00	10	0.53	0.25	92.99	355.97	149.60	298.66	0.00	0.00	-389.81	623.32
10/25/99 7:04	22.02	26	110.21	115.93	22581.00	10	0.49	0.23	92.96	355.99	149.43	263.88	0.00	0.00	-387.47	616.88
10/25/99 22:00	22.65	27	108.06	113.83	22199.00	11	0.62	0.29	92.96	355.99	149.26	224.40	0.00	0.00	-388.59	608.09
10/26/99 12:34	23.25	28	108.03	113.86	21764.00	11	0.62	0.29	92.97	356.01	149.10	249.48	0.00	0.00	-386.66	602.47
10/27/99 2:49	23.85	29	107.71	113.59	21329.00	11	0.68	0.32	92.99	356.03	148.95	247.13	0.00	0.00	-387.27	597.31
10/27/99 16:43	24.43	30	109.95	115.88	20934.00	12	0.52	0.24	92.99	356.05	148.80	227.93	0.00	0.00	-388.18	590.58
10/28/99 6:22	25.00	31	109.99	115.97	20585.00	12	0.49	0.22	92.97	356.07	148.66	321.78	0.00	0.00	-388.04	582.34
10/28/99 19:47	25.55	32	107.83	113.86	20194.00	13	0.65	0.30	92.95	356.08	148.49	308.00	0.00	0.00	-387.43	576.51
10/29/99 8:55	26.10	33	110.24	116.34	19857.00	14	0.47	0.22	92.94	356.10	148.29	245.13	0.00	0.00	-387.52	571.44
10/29/99 21:50	26.64	34	108.28	114.44	19517.00	15	0.60	0.27	92.93	356.11	148.11	328.62	0.00	0.00	-385.09	564.54
10/30/99 10:30	27.17	35	108.57	114.81	19184.00	15	0.58	0.27	92.92	356.14	147.91	277.68	0.00	0.00	-385.05	559.69
10/30/99 22:54	27.68	36	108.91	115.22	18848.00	15	0.54	0.25	92.92	356.14	147.71	312.65	0.00	0.00	-384.19	554.53
10/31/99 11:07	28.19	37	109.26	115.63	18558.00	15	0.52	0.24	92.92	356.17	147.51	279.65	0.00	0.00	-383.18	549.10
10/31/99 23:06	28.69	38	109.53	115.98	18262.00	15	0.49	0.23	92.91	356.18	147.31	315.50	0.00	0.00	-382.44	544.37
11/1/99 10:54	29.18	39	107.58	114.09	17986.00	16	0.63	0.29	92.90	356.20	147.11	334.56	0.00	0.00	-381.56	539.85
11/1/99 22:29	29.67	40	107.70	114.28	17644.00	16	0.62	0.29	92.89	356.21	146.92	310.74	0.00	0.00	-382.53	535.08
11/2/99 9:50	30.14	41	107.34	113.99	17355.00	16	0.63	0.29	92.87	356.23	146.73	307.83	0.00	0.00	-381.78	531.09
11/2/99 20:56	30.60	42	107.17	113.88	17045.00	16	0.67	0.31	92.85	356.25	146.56	314.95	0.00	0.00	-380.76	526.40
11/3/99 7:50	31.06	43	108.89	115.65	16750.00	17	0.52	0.24	92.84	356.27	146.44	239.82	0.00	0.00	-381.41	522.70
11/3/99 18:34	31.50	44	108.66	115.47	16499.00	17	0.53	0.24	92.84	356.29	146.29	242.14	0.00	0.00	-380.01	518.11
11/4/99 5:07	31.94	45	109.19	116.05	16241.00	17	0.49	0.23	92.86	356.30	146.15	251.45	0.00	0.00	-380.80	513.73
11/4/99 15:31	32.38	46	107.80	114.72	15957.00	18	0.58	0.27	92.87	356.32	145.97	296.19	0.00	0.00	-381.80	507.69
11/5/99 1:43	32.80	47	107.97	114.97	15687.00	18	0.56	0.25	92.87	356.34	145.75	247.84	0.00	0.00	-383.25	504.59
11/5/99 11:45	33.22	48	107.74	114.81	15466.00	18	0.57	0.26	92.86	356.36	145.55	238.86	0.00	0.00	-382.28	499.71
11/5/99 21:38	33.63	49	107.40	114.52	15241.00	18	0.61	0.28	92.85	356.38	145.40	257.70	0.00	0.00	-379.44	497.10
11/6/99 7:20	34.04	50	107.78	114.94	14971.00	18	0.57	0.26	92.85	356.39	145.29	317.42	0.00	0.00	-379.95	491.88
11/6/99 16:52	34.43	51	108.38	115.61	14704.00	18	0.52	0.23	92.85	356.42	145.11	314.07	0.00	0.00	-379.49	487.22
11/7/99 2:16	34.82	52	108.43	115.74	14485.00	18	0.51	0.23	92.85	356.43	144.88	315.96	0.00	0.00	-378.80	483.09
11/7/99 11:32	35.21	53	107.63	115.01	14307.00	18	0.55	0.25	92.85	356.45	144.69	261.52	0.00	0.00	-378.04	479.56
11/7/99 20:39	35.59	54	107.38	114.82	14084.00	18	0.56	0.26	92.85	356.47	144.53	308.70	0.00	0.00	-378.54	476.41
11/8/99 5:38	35.96	55	108.23	115.73	13849.00	18	0.49	0.22	92.87	356.48	144.35	281.35	0.00	0.00	-377.95	472.84
11/8/99 14:28	36.33	56	106.82	114.39	13648.00	19	0.59	0.27	92.87	356.50	144.16	215.91	0.00	0.00	-377.55	469.16
11/8/99 23:10	36.70	57	106.36	114.00	13449.00	19	0.64	0.29	92.86	356.52	143.99	320.75	0.00	0.00	-378.31	466.27
11/9/99 7:43	37.05	58	107.27	114.95	13203.00	19	0.56	0.25	92.86	356.53	143.86	237.25	0.00	0.00	-378.50	463.62
11/9/99 16:08	37.40	59	108.09	115.84	12992.00	19	0.50	0.22	92.86	356.56	143.67	247.88	0.00	0.00	-378.22	459.61
11/10/99 0:27	37.75	60	105.83	113.64	12824.00	20	0.67	0.30	92.85	356.58	143.49	251.61	0.00	0.00	-378.28	457.29
11/10/99 8:38	38.09	61	108.23	116.09	12604.00	21	0.48	0.22	92.83	356.59	143.35	278.39	0.00	0.00	-377.72	455.39
11/10/99 16:42	38.43	62	107.34	115.28	12413.00	22	0.53	0.24	92.83	356.62	143.16	350.08	0.00	0.00	-377.16	450.63
11/11/99 0:38	38.76	63	106.79	114.80	12261.00	22	0.57	0.26	92.82	356.63	142.98	273.45	0.00	0.00	-377.86	449.22
11/11/99 8:28	39.08	64	107.83	115.89	12059.00	22	0.49	0.22	92.82	356.65	142.84	242.02	0.00	0.00	-380.34	445.00
11/11/99 16:11	39.40	65	106.61	114.74	11887.00	23	0.56	0.25	92.82	356.67	142.64	281.84	0.00	0.00	-381.53	443.46
11/11/99 23:49	39.72	66	106.12	114.32	11720.00	23	0.59	0.27	92.81	356.69	142.46	236.79	0.00	0.00	-381.56	440.68
11/12/99 7:18	40.03	67	107.19	115.45	11513.00	23	0.50	0.22	92.83	356.70	142.29	270.53	0.00	0.00	-378.46	438.36
11/12/99 14:43	40.34	68	104.95	113.28	11355.00	24	0.67	0.30	92.83	356.72	142.10	256.13	0.00	0.00	-379.95	436.25
11/12/99 22:00	40.65	69	105.00	113.40	11136.00	24	0.65	0.29	92.83	356.74	141.91	219.90	0.00	0.00	-380.94	434.73
11/13/99 5:10	40.95	70	105.05	113.54	10936.00	24	0.65	0.29	92.84	356.76	141.68	216.88	0.00	0.00	-380.72	432.77
11/13/99 12:14	41.24	71	104.28	112.85	10764.00	24	0.71	0.32	92.83	356.78	141.47	262.13	0.00	0.00	-380.63	431.34
11/13/99 19:08	41.53	72	106.82	115.46	10560.00	25	0.51	0.22	92.83	356.81	141.27	260.02	0.00	0.00	-381.36	428.99
11/14/99 1:59	41.81	73	104.56	113.28	10425.00	26	0.67	0.30	92.82	356.83	141.08	261.68	0.00	0.00	-380.01	426.19
11/14/99 8:43	42.09	74	105.86	114.64	10225.00	26	0.54	0.24	92.82	356.84	140.91	294.35	0.00	0.00	-383.19	426.13
11/14/99 15:22	42.37	75	105.13	113.98	10085.00	26	0.60	0.27	92.83	356.86	140.72	526.03	0.00	0.00	-381.88	423.34
11/14/99 21:54	42.64	76	105.59	114.51	9908.30	26	0.56	0.25	92.82	356.89	140.52	248.23	0.00	0.00	-383.62	423.16
11/15/99 4:23	42.91	77	104.96	113.97	9771.90	26	0.61	0.27	92.82	356.91	140.29	253.66	0.00	0.00	-384.26	421.86
11/15/99 10:44	43.18	78	105.76	114.83	9613.90	26	0.53	0.23	92.81	356.93	140.12	263.38	0.00	0.00	-385.91	420.38
11/15/99 17:02	43.44	79	105.52	114.67	9481.50	26	0.54	0.24	92.81	356.95	139.92	233.60	0.00	0.00	-384.26	416.73
11/15/99 23:15	43.70	80	105.69	114.92	9331.70	26	0.52	0.23	92.80	356.97	139.72	265.35	0.00	0.00	-387.38	416.71
11/16/99 5:22	43.95	81	105.22	114.53	9208.30	26	0.56	0.25	92.81	357.00	139.49	275.69	0.00	0.00	-387.53	416.09
11/16/99 11:26	44.21	82	105.84	115.23	9075.20	26	0.50	0.22	92.78	357.02	139.30	256.34	0.00	0.00	-387.75	414.54
11/16/99 17:25	44.46	83	105.51	114.97	8956.90	26	0.51	0.22	92.78	357.04	139.10	515.99	0.00	0.00	-386.98	412.15
11/16/99 23:20	44.70	84	105.85	115.39	8821.20	26	0.48	0.21	92.78	357.06	138.89	253.83	0.00	0.00	-387.50	411.09
11/17/99 5:12	44.95	85	105.15	114.78	8719.10	26	0.53	0.23	92.78	357.09	138.66	246.09	0.00	0.00	-387.48	409.80
11/17/99 10:59	45.19	86	106.12	115.82	8587.50	26	0.45	0.20	92.76	357.10	138.47	537.67	0.00	0.00	-389.82	410.32
11/17/99 16:43	45.43	87	103.23	113.01	8476.70	27	0.65	0.28	92.78	357.12	138.27	298.98	0.00	0.00	-387.85	407.72
11/17/99 22:21	45.66	88	104.11	113.97	8320.80	27	0.57	0.25	92.77	357.15	138.05	495.42	0.00	0.00	*-391.57*	408.25
11/18/99 3:55	45.89	89	103.26	113.20	8203.30	27	0.62	0.27	92.77	357.17	137.83	485.44	0.00	0.00	-388.22	407.71
11/18/99 9:25	46.12	90	104.35	114.36	8050.90	27	0.54	0.23	92.77	357.19	137.64	510.81	0.00	0.00	-388.93	407.28

Note: Earth & Sun positions use table lookup & data interpolation on 10 da[y] AUXILIARY CALCULATIONS

10/3/99 6:30	SUN DIST	SUN LAT	SUN LONG	EARTH DIST	EARTH LAT	EARTH LONG	PERIOD	VPER	DELT PERIOD	DELT APO	DELT V	DELT MEAN SUN	RAAN -180 TO 180°	DELT RAAN	SOLAR TIME	DRAGDUR	DRAGPASS BEGIN (Including 5 min delay segs)	DRAGPASS END	ORBIT PERIOD LESS DRAGP AND SOLAR
10/3/99 20:58	#########	-15.15	78.44	2.05E+08	2.62	39.66	28.641	#####				0.316	-4.370		5:57:00 PM	306.1	-453.0	453.0	102199.858
10/5/99 0:54	#########	-15.41	79.13	2.06E+08	2.27	40.38	27.880	#####	2739.6	806.0	5.07	0.926	-4.360	0.010	5:53:20 PM	306.6	-453.3	453.3	99459.7073
10/6/99 4:02	#########	-15.64	79.82	2.07E+08	1.90	41.10	27.077	#####	2890.3	856.0	3.85	1.519	-4.340	0.030	5:51:03 PM	307.2	-453.6	453.6	96568.8441
10/7/99 6:25	#########	-15.86	80.50	2.08E+08	1.55	41.80	26.170	#####	3264.0	977.0	4.65	2.095	-4.330	0.040	5:48:47 PM	307.9	-453.9	453.9	93304.1757
10/8/99 8:05	#########	-16.08	81.16	2.09E+08	1.20	42.48	25.401	#####	2767.2	837.0	4.05	2.655	-4.330	0.040	5:46:32 PM	308.7	-454.4	454.4	90536.1143
10/9/99 9:00	#########	-16.29	81.80	2.10E+08	0.87	43.14	24.676	#####	2612.3	798.0	4.07	3.199	-4.320	0.050	5:44:24 PM	309.4	-454.7	454.7	87923.1493
10/10/99 9:13	#########	-16.49	82.42	2.10E+08	0.54	43.78	23.970	#####	2541.8	784.0	4.16	3.728	-4.310	0.060	5:42:20 PM	310.1	-455.0	455.0	85380.6597
10/11/99 8:45	#########	-16.69	83.02	2.11E+08	0.22	44.40	23.301	#####	2405.8	749.0	4.01	4.242	-4.290	0.080	5:40:21 PM	310.7	-455.4	455.4	82974.165
10/12/99 7:34	#########	-16.88	83.61	2.12E+08	-0.08	45.01	22.673	#####	2263.5	711.0	3.77	4.740	-4.280	0.090	5:38:24 PM	311.4	-455.7	455.7	80709.9986
10/13/99 5:38	#########	-17.06	84.17	2.13E+08	-0.38	45.59	22.013	#####	2375.3	756.0	6.24	5.222	-4.270	0.100	5:36:31 PM	312.0	-456.0	456.0	78334.0103
10/14/99 3:11	#########	-17.24	84.72	2.13E+08	-0.67	46.16	21.385	#####	2261.0	725.0	4.94	5.692	-4.260	0.110	5:34:40 PM	312.7	-456.4	456.4	76072.3379
10/15/99 0:14	#########	-17.42	85.26	2.14E+08	-0.95	46.72	20.848	#####	1933.6	623.0	2.43	6.152	-4.240	0.130	5:32:55 PM	313.8	-456.9	456.9	74137.6445
10/15/99 20:39	#########	-17.59	85.79	2.15E+08	-1.23	47.26	20.342	#####	1819.0	595.0	5.43	6.598	-4.230	0.140	5:31:10 PM	314.5	-457.2	457.2	72317.9543
10/16/99 16:36	#########	-17.76	86.30	2.15E+08	-1.50	47.79	19.831	#####	1841.6	606.0	4.63	7.033	-4.220	0.150	5:29:28 PM	315.2	-457.6	457.6	70475.6539
10/17/99 12:06	#########	-17.92	86.80	2.16E+08	-1.76	48.31	19.328	#####	1809.8	598.0	2.80	7.459	-4.200	0.170	5:27:51 PM	315.9	-457.9	457.9	68665.1685
10/18/99 7:03	#########	-18.08	87.28	2.17E+08	-2.01	48.81	18.831	#####	1787.9	600.0	6.01	7.873	-4.190	0.180	5:26:14 PM	316.6	-458.3	458.3	66876.5595
10/19/99 1:34	#########	-18.24	87.76	2.17E+08	-2.26	49.30	18.423	#####	1471.0	496.0	3.92	8.277	-4.170	0.200	5:24:41 PM	317.2	-458.6	458.6	65404.9861
10/19/99 19:42	#########	-18.39	88.22	2.18E+08	-2.51	49.78	18.045	#####	1359.9	462.0	3.89	8.673	-4.160	0.210	5:23:09 PM	317.8	-458.9	458.9	64044.5338
10/20/99 13:26	#########	-18.52	88.69	2.19E+08	-2.75	50.27	17.655	#####	1403.3	480.0	4.06	9.060	-4.140	0.230	5:21:41 PM	318.4	-459.2	459.2	62640.6512
10/21/99 6:48	#########	-18.65	89.16	2.19E+08	-2.98	50.75	17.244	#####	1479.3	510.0	4.56	9.440	-4.120	0.250	5:20:15 PM	319.1	-459.6	459.6	61160.6766
10/21/99 23:49	#########	-18.77	89.61	2.20E+08	-3.21	51.21	16.889	#####	1280.8	442.0	1.98	9.811	-4.100	0.270	5:18:50 PM	320.4	-460.2	460.2	59878.5853
10/22/99 16:21	#########	-18.89	90.06	2.20E+08	-3.44	51.67	16.416	#####	1699.9	598.0	7.72	10.172	-4.090	0.280	5:17:26 PM	321.4	-460.7	460.7	58177.7263
10/23/99 8:35	#########	-19.00	90.49	2.21E+08	-3.66	52.12	16.063	#####	1271.1	446.0	2.30	10.526	-4.070	0.300	5:16:06 PM	322.1	-461.1	461.1	56905.9226
10/24/99 0:24	#########	-19.12	90.92	2.21E+08	-3.87	52.55	15.734	#####	1184.0	423.0	5.73	10.872	-4.050	0.320	5:14:48 PM	322.9	-461.4	461.4	55721.2153
10/24/99 15:53	#########	-19.23	91.33	2.22E+08	-4.08	52.98	15.412	#####	1162.1	416.0	4.24	11.210	-4.030	0.340	5:13:31 PM	323.6	-461.8	461.8	54558.3943
10/25/99 7:04	#########	-19.34	91.74	2.22E+08	-4.29	53.40	15.097	#####	1133.9	409.0	4.51	11.541	-4.010	0.360	5:12:16 PM	324.3	-462.2	462.2	53423.8104
10/25/99 22:00	#########	-19.44	92.14	2.23E+08	-4.49	53.81	14.803	#####	1058.6	382.0	2.52	11.867	-4.010	0.360	5:10:58 PM	325.0	-462.5	462.5	52364.483
10/26/99 12:34	#########	-19.55	92.53	2.23E+08	-4.69	54.21	14.472	#####	1190.4	435.0	4.80	12.186	-3.990	0.380	5:09:47 PM	325.8	-462.9	462.9	51173.24
10/27/99 2:49	#########	-19.65	92.91	2.24E+08	-4.88	54.61	14.144	#####	1182.2	435.0	4.74	12.497	-3.970	0.400	5:08:37 PM	326.6	-463.3	463.3	49990.1932
10/27/99 16:43	#########	-19.75	93.28	2.24E+08	-5.07	54.99	13.849	#####	1058.9	395.0	6.32	12.800	-3.950	0.420	5:07:29 PM	327.4	-463.7	463.7	48930.578
10/28/99 6:22	#########	-19.85	93.65	2.25E+08	-5.26	55.37	13.590	#####	934.5	349.0	4.26	13.098	-3.930	0.440	5:06:22 PM	328.1	-464.0	464.0	47995.3626
10/28/99 19:47	#########	-19.94	94.01	2.25E+08	-5.44	55.74	13.299	#####	1045.8	391.0	3.27	13.391	-3.920	0.450	5:05:14 PM	328.9	-464.4	464.4	46948.7652
10/29/99 8:55	#########	-20.04	94.36	2.26E+08	-5.62	56.10	13.054	#####	884.1	337.0	6.11	13.678	-3.900	0.470	5:04:10 PM	330.9	-465.5	465.5	46062.6429
10/29/99 21:50	#########	-20.13	94.70	2.26E+08	-5.79	56.45	12.804	#####	897.8	340.0	3.02	13.960	-3.890	0.480	5:03:05 PM	331.8	-465.9	465.9	45163.9303
10/30/99 10:30	#########	-20.22	95.04	2.26E+08	-5.96	56.80	12.563	#####	868.0	333.0	4.71	14.237	-3.860	0.510	5:02:06 PM	332.7	-466.3	466.3	44295.0638
10/30/99 22:54	#########	-20.31	95.38	2.27E+08	-6.13	57.15	12.322	#####	870.1	336.0	4.91	14.508	-3.860	0.510	5:01:01 PM	333.6	-466.8	466.8	43424.0668
10/31/99 11:07	#########	-20.40	95.70	2.27E+08	-6.30	57.48	12.114	#####	746.3	290.0	4.39	14.774	-3.830	0.540	5:00:04 PM	334.4	-467.2	467.2	42676.9871
10/31/99 23:06	#########	-20.49	96.03	2.28E+08	-6.46	57.81	11.904	#####	757.6	296.0	4.51	15.036	-3.820	0.550	4:59:03 PM	335.2	-467.6	467.6	41918.5783
11/1/99 10:54	#########	-20.57	96.34	2.28E+08	-6.62	58.14	11.707	#####	708.0	276.0	2.66	15.294	-3.800	0.570	4:58:06 PM	335.9	-468.0	468.0	41209.8047
11/1/99 22:29	#########	-20.65	96.65	2.28E+08	-6.78	58.46	11.467	#####	865.4	342.0	5.32	15.546	-3.790	0.580	4:57:08 PM	336.9	-468.5	468.5	40343.3922
11/2/99 9:50	#########	-20.73	96.95	2.29E+08	-6.93	58.77	11.265	#####	727.8	289.0	4.28	15.794	-3.770	0.600	4:56:13 PM	337.8	-468.9	468.9	39614.7544
11/2/99 20:56	#########	-20.81	97.25	2.29E+08	-7.08	59.08	11.049	#####	775.3	310.0	4.87	16.037	-3.750	0.620	4:55:20 PM	338.7	-469.4	469.4	38838.5028
11/3/99 7:50	#########	-20.89	97.54	2.29E+08	-7.23	59.38	10.847	#####	728.5	295.0	6.17	16.275	-3.730	0.640	4:54:28 PM	339.6	-469.8	469.8	38109.1005
11/3/99 18:34	#########	-20.97	97.83	2.30E+08	-7.38	59.67	10.675	#####	620.5	251.0	4.09	16.509	-3.710	0.660	4:53:36 PM	340.4	-470.2	470.2	37487.8488
11/4/99 5:07	#########	-21.04	98.12	2.30E+08	-7.52	59.97	10.499	#####	632.4	258.0	4.87	16.739	-3.700	0.670	4:52:43 PM	341.2	-470.6	470.6	36854.5963
11/4/99 15:31	#########	-21.10	98.41	2.30E+08	-7.66	60.27	10.305	#####	696.9	284.0	4.01	16.966	-3.680	0.690	4:51:54 PM	342.1	-471.1	471.1	36156.7628
11/5/99 1:43	#########	-21.16	98.69	2.31E+08	-7.79	60.56	10.123	#####	654.9	270.0	5.05	17.189	-3.660	0.710	4:51:05 PM	343.0	-471.5	471.5	35500.9424
11/5/99 11:45	#########	-21.21	98.97	2.31E+08	-7.92	60.85	9.975	#####	534.1	221.0	3.95	17.408	-3.640	0.730	4:50:17 PM	343.8	-471.9	471.9	34966.1406
11/5/99 21:38	#########	-21.27	99.25	2.31E+08	-8.05	61.14	9.825	#####	541.3	225.0	4.03	17.624	-3.620	0.750	4:49:30 PM	344.5	-472.3	472.3	34424.0995
11/6/99 7:20	#########	-21.32	99.52	2.32E+08	-8.18	61.42	9.646	#####	644.0	270.0	5.55	17.836	-3.610	0.760	4:48:42 PM	348.5	-474.2	474.2	33776.1393
11/6/99 16:52	#########	-21.38	99.78	2.32E+08	-8.30	61.70	9.470	#####	632.4	267.0	5.79	18.044	-3.580	0.790	4:47:59 PM	349.7	-474.8	474.8	33142.4638
11/7/99 2:16	#########	-21.43	100.04	2.32E+08	-8.43	61.97	9.326	#####	516.9	219.0	4.53	18.249	-3.570	0.800	4:47:12 PM	350.7	-475.4	475.4	32624.5468
11/7/99 11:32	#########	-21.48	100.30	2.33E+08	-8.55	62.24	9.210	#####	420.1	178.0	3.12	18.451	-3.550	0.820	4:46:28 PM	351.6	-475.8	475.8	32203.5499
11/7/99 20:39	#########	-21.53	100.55	2.33E+08	-8.67	62.50	9.065	#####	522.1	223.0	4.57	18.651	-3.530	0.840	4:45:45 PM	352.6	-476.3	476.3	31680.3527
11/8/99 5:38	#########	-21.58	100.80	2.33E+08	-8.79	62.76	8.913	#####	544.6	235.0	5.76	18.847	-3.520	0.850	4:45:01 PM	353.8	-476.9	476.9	31134.5593
11/8/99 14:28	#########	-21.63	101.05	2.34E+08	-8.90	63.01	8.783	#####	468.3	201.0	3.42	19.039	-3.500	0.870	4:44:19 PM	354.8	-477.4	477.4	30665.2107
11/8/99 23:10	#########	-21.68	101.29	2.34E+08	-9.02	63.27	8.656	#####	459.3	199.0	4.18	19.230	-3.480	0.890	4:43:38 PM	355.8	-477.9	477.9	30204.931
11/9/99 7:43	#########	-21.73	101.53	2.34E+08	-9.13	63.51	8.500	#####	561.2	246.0	6.41	19.416	-3.470	0.900	4:42:56 PM	357.1	-478.6	478.6	29642.3969
11/9/99 16:08	#########	-21.78	101.76	2.34E+08	-9.24	63.76	8.367	#####	478.6	211.0	5.65	19.600	-3.440	0.930	4:42:19 PM	358.3	-479.1	479.1	29162.6812
11/10/99 0:27	#########	-21.83	101.99	2.35E+08	-9.35	64.00	8.260	#####	385.8	168.0	2.39	19.781	-3.420	0.950	4:41:40 PM	359.2	-479.6	479.6	28775.9269
11/10/99 8:38	#########	-21.87	102.22	2.35E+08	-9.46	64.23	8.123	#####	490.7	220.0	7.27	19.960	-3.410	0.960	4:41:00 PM	360.4	-480.2	480.2	28284.0067
11/10/99 16:42	#########	-21.92	102.44	2.35E+08	-9.56	64.46	8.004	#####	430.5	191.0	4.18	20.136	-3.380	0.990	4:40:25 PM	361.5	-480.7	480.7	27852.4682
11/11/99 0:38	#########	-21.96	102.67	2.36E+08	-9.67	64.69	7.909	#####	340.7	152.0	3.52	20.310	-3.370	1.000	4:39:46 PM	362.3	-481.2	481.2	27510.907
11/11/99 8:28	#########	-22.01	102.88	2.36E+08	-9.77	64.92	7.785	#####	446.7	202.0	6.12	20.481	-3.350	1.020	4:39:09 PM	363.5	-481.8	481.8	27062.9916
11/11/99 16:11	#########	-22.05	103.10	2.36E+08	-9.87	65.14	7.679	#####	383.2	172.0	3.71	20.649	-3.330	1.040	4:38:34 PM	364.5	-482.3	482.3	26678.7932
11/11/99 23:49	#########	-22.09	103.31	2.36E+08	-9.97	65.36	7.576	#####	368.8	167.0	4.22	20.816	-3.310	1.060	4:37:59 PM	365.6	-482.8	482.8	26308.9583
11/12/99 7:18	#########	-22.14	103.52	2.37E+08	-10.07	65.58	7.451	#####	451.2	207.0	6.62	20.979	-3.300	1.070	4:37:22 PM	366.8	-483.4	483.4	25856.479
11/12/99 14:43	#########	-22.18	103.72	2.37E+08	-10.17	65.80	7.354	#####	349.4	158.0	2.83	21.141	-3.280	1.090	4:36:48 PM	367.8	-483.9	483.9	25506.1321
11/12/99 22:00	#########	-22.22	103.93	2.37E+08	-10.27	66.01	7.222	#####	474.9	219.0	6.45	21.300	-3.260	1.110	4:36:14 PM	369.2	-484.6	484.6	25029.85
11/13/99 5:10	#########	-22.26	104.13	2.37E+08	-10.36	66.21	7.102	#####	431.2	200.0	6.04	21.457	-3.240	1.130	4:35:42 PM	370.5	-485.3	485.3	24597.3795
11/13/99 12:14	#########	-22.30	104.32	2.38E+08	-10.45	66.42	6.999	#####	370.6	172.0	4.69	21.611	-3.220	1.150	4:35:09 PM	371.7	-485.8	485.8	24225.6191
11/13/99 19:08	#########	-22.34	104.52	2.38E+08	-10.54	66.62	6.880	#####	429.9	204.0	8.33	21.762	-3.190	1.180	4:34:40 PM	373.1	-486.5	486.5	23794.3568
11/14/99 1:59	#########	-22.38	104.71	2.38E+08	-10.63	66.81	6.799	#####	291.5	135.0	2.61	21.911	-3.170	1.200	4:34:09 PM	374.0	-487.0	487.0	23501.9514
11/14/99 8:43	#########	-22.42	104.89	2.38E+08	-10.72	67.01	6.682	#####	419.9	200.0	7.53	22.058	-3.160	1.210	4:33:36 PM	375.4	-487.7	487.7	23080.6439
11/14/99 15:22	#########	-22.45	105.08	2.38E+08	-10.81	67.20	6.600	#####	295.9	140.0	4.12	22.204	-3.140	1.230	4:33:06 PM	376.5	-488.2	488.2	22783.7116
11/14/99 21:54	#########	-22.49	105.26	2.39E+08	-10.90	67.39	6.498	#####	368.9	176.7	6.37	22.346	-3.110	1.260	4:32:39 PM	387.5	-493.8	493.8	22403.7685
11/15/99 4:23	#########	-22.53	105.44	2.39E+08	-10.98	67.58	6.418	#####	285.5	136.4	4.26	22.488	-3.090	1.280	4:32:10 PM	389.0	-494.5	494.5	22116.8089
11/15/99 10:44	#########	-22.56	105.62	2.39E+08	-11.07	67.76	6.328	#####	326.0	158.0	6.20	22.627	-3.070	1.300	4:31:42 PM	390.8	-495.4	495.4	21789.0025
11/15/99 17:02	#########	-22.60	105.79	2.39E+08	-11.15	67.94	6.252	#####	273.9	132.4	4.60	22.764	-3.050	1.320	4:31:13 PM	392.3	-496.2	496.2	21513.596
11/15/99 23:15	#########	-22.63	105.96	2.39E+08	-11.23	68.12	6.166	#####	307.7	149.8	5.64	22.900	-3.030	1.340	4:30:46 PM	394.1	-497.0	497.0	21204.203
11/16/99 5:22	#########	-22.67	106.13	2.40E+08	-11.31	68.30	6.096	#####	253.6	123.4	4.26	23.033	-3.000	1.370	4:30:21 PM	395.5	-497.8	497.8	20949.1247
11/16/99 11:26	#########	-22.70	106.30	2.40E+08	-11.39	68.47	6.021	#####	270.2	133.1	5.54	23.166	-2.980	1.390	4:29:54 PM	397.1	-498.6	498.6	20677.352
11/16/99 17:25	#########	-22.74	106.47	2.40E+08	-11.47	68.65	5.954	#####	241.0	118.3	4.33	23.296	-2.960	1.410	4:29:27 PM	398.6	-499.3	499.3	20434.9253
11/16/99 23:20	#########	-22.77	106.63	2.40E+08	-11.55	68.82	5.878	#####	273.9	135.7	5.60	23.426	-2.940	1.430	4:29:01 PM	400.3	-500.1	500.1	20159.3699
11/17/99 5:12	#########	-22.80	106.80	2.40E+08	-11.62	68.99	5.820	#####	207.2	102.1	3.55	23.554	-2.910	1.460	4:28:38 PM	401.6	-500.8	500.8	19950.8732
11/17/99 10:59	#########	-22.84	106.96	2.41E+08	-11.70	69.15	5.747	#####	262.3	131.6	6.09	23.680	-2.900	1.470	4:28:10 PM	403.3	-501.6	501.6	19686.8622
11/17/99 16:43	#########	-22.87	107.12	2.41E+08	-11.77	69.32	5.684	#####	227.4	110.8	2.38	23.805	-2.880	1.490	4:27:44 PM	404.7	-502.4	502.4	19458.0085
11/17/99 22:21	#########	-22.90	107.27	2.41E+08	-11.85	69.48	5.598	#####	308.7	155.9	7.24	23.928	-2.850	1.520	4:27:22 PM	406.8	-503.4	503.4	19147.2067
11/18/99 3:55	#########	-22.93	107.43	2.41E+08	-11.92	69.64	5.533	#####	234.6	117.5	4.40	24.050	-2.830	1.540	4:26:58 PM	408.4	-504.2	504.2	18910.9673
11/18/99 9:25	#########	-22.96	107.58	2.41E+08	-11.99	69.80	5.450	#####	298.6	152.4	7.51	24.170	-2.810	1.560	4:26:34 PM	410.6	-505.3	505.3	18610.199

Close of Primary MSP Peer Review 11/96, End of L/W, Min Mass Config, Data written at periapsis point

Starting Time for Simulation: Oct 3, 1999; 06:30 ET (Apoapsis, Last Walkin Maneuver)

10/3/99 6:30	DAY#	REV#	PERIAPS ALT	PER WRT ELLIPSOID	APOAPSIS ALT	NBURN	QDYN	QHTDYN	INCLIN	ASC NODE	ARGPER
11/18/99 14:51	46.35	91	103.70	113.80	7947.90	27	0.58	0.25	92.78	357.21	137.41
11/18/99 20:12	46.57	92	104.29	114.47	7818.60	27	0.52	0.22	92.77	357.23	137.20
11/19/99 1:30	46.79	93	104.21	114.48	7700.50	27	0.51	0.22	92.76	357.26	136.98
11/19/99 6:44	47.01	94	103.67	114.04	7599.50	27	0.55	0.24	92.77	357.29	136.74
11/19/99 11:55	47.23	95	104.65	115.09	7480.00	27	0.47	0.20	92.75	357.30	136.54
11/19/99 17:02	47.44	96	101.81	112.34	7379.10	28	0.67	0.29	92.77	357.32	136.32
11/19/99 22:06	47.65	97	104.78	115.39	7248.50	29	0.45	0.19	92.75	357.35	136.09
11/20/99 3:05	47.86	98	102.28	112.98	7146.50	30	0.60	0.26	92.75	357.38	135.86
11/20/99 8:02	48.06	99	102.05	112.84	7027.50	30	0.62	0.27	92.76	357.40	135.62
11/20/99 12:54	48.27	100	102.72	113.59	6908.10	30	0.55	0.23	92.73	357.42	135.39
11/20/99 17:42	48.47	101	101.93	112.90	6807.40	30	0.60	0.26	92.75	357.44	135.17
11/20/99 22:29	48.67	102	102.90	113.95	6688.50	30	0.52	0.22	92.73	357.47	134.93
11/21/99 3:11	48.86	103	102.52	113.66	6586.20	30	0.53	0.23	92.73	357.50	134.70
11/21/99 7:49	49.06	104	102.01	113.26	6492.00	30	0.57	0.24	92.74	357.52	134.44
11/21/99 12:25	49.25	105	102.99	114.32	6381.80	30	0.49	0.21	92.71	357.54	134.23
11/21/99 16:57	49.44	106	100.46	111.88	6294.00	31	0.66	0.28	92.73	357.56	133.98
11/21/99 21:27	49.62	107	100.78	112.28	6171.60	31	0.62	0.26	92.72	357.59	133.76
11/22/99 1:53	49.81	108	101.24	112.84	6057.40	31	0.57	0.24	92.71	357.62	133.52
11/22/99 6:15	49.99	109	100.17	111.87	5962.00	31	0.64	0.27	92.72	357.65	133.25
11/22/99 10:36	50.17	110	100.97	112.74	5844.50	31	0.57	0.24	92.72	357.67	133.05
11/22/99 14:52	50.35	111	101.07	112.96	5751.00	31	0.55	0.23	92.71	357.69	132.75
11/22/99 19:06	50.53	112	100.29	112.27	5660.40	31	0.59	0.25	92.72	357.71	132.52
11/22/99 23:15	50.70	113	101.19	113.27	5558.00	31	0.52	0.22	92.70	357.74	132.27
11/23/99 3:22	50.87	114	101.18	113.35	5467.30	31	0.51	0.21	92.70	357.77	132.02
11/23/99 7:29	51.04	115	100.20	112.47	5388.60	31	0.56	0.24	92.71	357.80	131.74
11/23/99 11:30	51.21	116	101.28	113.63	5290.80	31	0.49	0.20	92.70	357.82	131.54
11/23/99 15:31	51.38	117	99.58	112.05	5210.00	32	0.58	0.24	92.69	357.84	131.23
11/23/99 19:29	51.54	118	98.82	111.38	5119.50	32	0.62	0.26	92.71	357.87	130.99
11/23/99 23:22	51.70	119	99.53	112.19	5018.60	32	0.56	0.23	92.69	357.89	130.73
11/24/99 3:14	51.86	120	99.88	112.64	4927.50	32	0.52	0.22	92.68	357.93	130.47
11/24/99 7:04	52.02	121	98.72	111.59	4848.30	32	0.59	0.25	92.69	357.96	130.18
11/24/99 10:50	52.18	122	99.09	112.05	4754.70	32	0.55	0.23	92.70	357.98	129.94
11/24/99 14:35	52.34	123	99.46	112.53	4669.70	32	0.51	0.21	92.66	358.00	129.64
11/24/99 18:17	52.49	124	99.07	112.24	4598.40	32	0.53	0.22	92.69	358.03	129.35
11/24/99 21:55	52.64	125	98.62	111.88	4516.10	32	0.54	0.23	92.69	358.05	129.12
11/25/99 1:33	52.79	126	99.80	113.17	4433.30	32	0.46	0.19	92.67	358.08	128.85
11/25/99 5:09	52.94	127	97.72	111.19	4356.60	33	0.58	0.24	92.67	358.12	128.57
11/25/99 8:41	53.09	128	96.75	110.34	4274.70	33	0.63	0.26	92.68	358.15	128.26
11/25/99 12:11	53.24	129	97.75	111.41	4180.80	33	0.55	0.23	92.67	358.17	128.04
11/25/99 15:40	53.38	130	97.89	111.69	4102.60	33	0.52	0.21	92.65	358.19	127.70
11/25/99 19:06	53.53	131	97.53	111.43	4032.60	33	0.53	0.22	92.68	358.22	127.41
11/25/99 22:29	53.67	132	97.02	111.01	3954.00	33	0.55	0.23	92.68	358.24	127.17
11/26/99 1:50	53.81	133	103.56	117.66	3885.40	34	0.25	0.10	92.65	358.27	126.87
11/26/99 5:10	53.95	134	103.41	117.62	3846.80	34	0.25	0.10	92.65	358.31	126.58
11/26/99 8:30	54.08	135	102.25	116.56	3813.40	34	0.28	0.12	92.67	358.34	126.27
11/26/99 11:48	54.22	136	102.68	117.09	3771.70	34	0.26	0.11	92.68	358.36	126.03
11/26/99 15:05	54.36	137	103.26	117.77	3733.40	34	0.24	0.10	92.63	358.38	125.74
11/26/99 18:22	54.50	138	97.96	112.59	3694.50	35	0.43	0.17	92.65	358.41	125.41
11/26/99 21:37	54.63	139	97.20	111.92	3634.60	35	0.46	0.19	92.68	358.43	125.15
11/27/99 0:50	54.76	140	97.75	112.57	3570.40	35	0.42	0.17	92.65	358.46	124.87
11/27/99 4:00	54.90	141	98.63	113.56	3511.00	35	0.37	0.15	92.64	358.50	124.57
11/27/99 7:10	55.03	142	97.68	112.72	3458.70	35	0.40	0.16	92.64	358.53	124.26
11/27/99 10:18	55.16	143	96.89	112.05	3404.90	35	0.43	0.17	92.67	358.56	123.93
11/27/99 13:26	55.29	144	97.98	113.22	3345.70	35	0.37	0.15	92.65	358.58	123.70
11/27/99 16:30	55.42	145	98.06	113.42	3296.10	35	0.36	0.14	92.62	358.61	123.34
11/27/99 19:34	55.55	146	97.94	113.43	3251.30	35	0.35	0.14	92.65	358.63	122.99
11/27/99 22:37	55.67	147	97.16	112.74	3203.30	35	0.37	0.15	92.67	358.65	122.74
11/28/99 1:39	55.80	148	97.92	113.60	3152.60	35	0.33	0.13	92.64	358.68	122.44
11/28/99 4:39	55.92	149	98.81	114.60	3106.10	35	0.29	0.12	92.62	358.72	122.12
11/28/99 7:37	56.05	150	97.86	113.76	3065.20	35	0.32	0.13	92.63	358.76	121.80
11/28/99 10:36	56.17	151	96.96	112.97	3023.00	35	0.34	0.14	92.66	358.79	121.45
11/28/99 13:31	56.29	152	97.95	114.04	2976.40	35	0.30	0.12	92.65	358.81	121.22
11/28/99 16:27	56.42	153	98.07	114.29	2936.60	35	0.29	0.11	92.60	358.84	120.86
11/28/99 19:21	56.54	154	98.09	114.43	2900.40	35	0.28	0.11	92.62	358.86	120.47
11/28/99 22:16	56.66	155	97.41	113.85	2863.80	35	0.29	0.12	92.66	358.89	120.18
11/29/99 1:08	56.78	156	97.31	113.84	2824.70	35	0.29	0.11	92.64	358.91	119.90
11/29/99 4:00	56.90	157	98.66	115.30	2784.70	35	0.24	0.10	92.61	358.95	119.58
11/29/99 6:50	57.01	158	93.60	110.34	2743.90	36	0.41	0.16	92.61	358.99	119.26
11/29/99 9:40	57.13	159	92.17	109.04	2688.80	36	0.46	0.18	92.63	359.03	118.89
11/29/99 12:27	57.25	160	91.95	108.92	2627.20	36	0.46	0.18	92.66	359.05	118.56
11/29/99 15:12	57.36	161	92.86	109.93	2567.80	36	0.40	0.16	92.62	359.08	118.27
11/29/99 17:56	57.48	162	92.74	109.94	2515.90	36	0.39	0.16	92.59	359.11	117.83
11/29/99 20:39	57.59	163	92.74	110.07	2465.60	36	0.38	0.15	92.62	359.13	117.44
11/29/99 23:22	57.70	164	91.98	109.40	2415.10	36	0.40	0.16	92.65	359.16	117.14
11/30/99 2:02	57.81	165	91.97	109.49	2363.10	36	0.39	0.15	92.63	359.19	116.81
11/30/99 4:40	57.92	166	93.34	110.98	2311.40	36	0.32	0.13	92.60	359.23	116.44
11/30/99 7:18	58.03	167	93.18	110.93	2267.60	36	0.32	0.13	92.60	359.27	116.08
11/30/99 9:55	58.14	168	91.67	109.53	2224.20	36	0.36	0.14	92.62	359.31	115.69
11/30/99 12:31	58.25	169	91.15	109.12	2175.40	36	0.37	0.14	92.65	359.34	115.31
11/30/99 15:05	58.36	170	92.31	110.36	2127.30	36	0.32	0.12	92.62	359.36	115.04
11/30/99 17:39	58.47	171	92.19	110.38	2086.20	36	0.31	0.12	92.58	359.40	114.60
11/30/99 20:10	58.57	172	92.24	110.55	2045.70	36	0.30	0.12	92.59	359.43	114.13
11/30/99 22:42	58.68	173	91.84	110.26	2006.10	36	0.30	0.12	92.64	359.45	113.76
12/1/99 1:11	58.78	174	90.96	109.46	1966.10	36	0.32	0.12	92.64	359.48	113.46
12/1/99 3:41	58.88	175	92.01	110.62	1923.90	36	0.28	0.11	92.60	359.51	113.07
12/1/99 6:09	58.99	176	93.11	111.82	1885.70	36	0.24	0.09	92.58	359.55	112.68
12/1/99 8:36	59.09	177	87.86	106.68	1846.80	37	0.40	0.15	92.59	359.60	112.31
12/1/99 11:02	59.19	178	86.30	105.24	1791.70	37	0.45	0.17	92.62	359.64	111.86
12/1/99 13:26	59.29	179	86.06	105.10	1730.30	37	0.44	0.17	92.64	359.66	111.45
12/1/99 15:48	59.39	180	87.11	106.24	1672.20	37	0.38	0.15	92.60	359.69	111.10

Note: Earth & Sun positions use table lookup & data interpolation on 10 day centers

10/3/99 6:30	(DO NOT USE) DYNAMIC DRAGDUR	SUN ECLIPSE BEGIN	SUN ECLIPSE END	EARTH OCCULT BEGIN	EARTH OCCULT END	SUN DIST	SUN LAT	SUN LONG	EARTH DIST	EARTH LAT	EARTH LONG	PERIOD	VPER
11/18/99 14:51	535.28	0.00	0.00	-389.00	407.88	#########	-22.99	107.73	2.42E+08	-12.07	69.96	5.394	#####
11/18/99 20:12	460.43	0.00	0.00	-394.59	406.48	#########	-23.02	107.88	2.42E+08	-12.14	70.11	5.324	#####
11/19/99 1:30	492.37	0.00	0.00	-390.94	405.10	#########	-23.05	108.03	2.42E+08	-12.21	70.27	5.260	#####
11/19/99 6:44	512.87	0.00	0.00	-392.12	405.98	#########	-23.07	108.18	2.42E+08	-12.27	70.43	5.205	#####
11/19/99 11:55	467.24	0.00	0.00	-393.97	406.05	#########	-23.09	108.33	2.42E+08	-12.33	70.59	5.141	#####
11/19/99 17:02	452.29	0.00	0.00	-396.64	402.51	#########	-23.11	108.47	2.42E+08	-12.39	70.74	5.086	#####
11/19/99 22:06	370.94	0.00	0.00	-399.30	403.47	#########	-23.13	108.62	2.43E+08	-12.45	70.89	5.018	#####
11/20/99 3:05	378.91	0.00	0.00	-396.84	401.55	#########	-23.15	108.76	2.43E+08	-12.52	71.05	4.962	#####
11/20/99 8:02	391.95	0.00	0.00	-398.94	402.84	#########	-23.17	108.90	2.43E+08	-12.58	71.20	4.899	#####
11/20/99 12:54	400.61	0.00	0.00	-397.68	404.10	#########	-23.19	109.04	2.43E+08	-12.63	71.35	4.837	#####
11/20/99 17:42	399.16	0.00	0.00	-396.62	403.04	#########	-23.21	109.18	2.43E+08	-12.69	71.49	4.783	#####
11/20/99 22:29	442.58	0.00	0.00	-397.10	404.73	#########	-23.23	109.31	2.43E+08	-12.75	71.64	4.722	#####
11/21/99 3:11	432.33	0.00	0.00	-397.57	403.32	#########	-23.24	109.45	2.44E+08	-12.81	71.78	4.668	#####
11/21/99 7:49	391.86	0.00	0.00	-398.19	403.20	#########	-23.26	109.58	2.44E+08	-12.86	71.92	4.619	#####
11/21/99 12:25	388.81	0.00	0.00	-399.56	403.54	#########	-23.28	109.71	2.44E+08	-12.92	72.06	4.563	#####
11/21/99 16:57	392.91	0.00	0.00	-398.91	402.99	#########	-23.30	109.84	2.44E+08	-12.97	72.20	4.516	#####
11/21/99 21:27	241.35	0.00	0.00	-402.82	404.80	#########	-23.31	109.97	2.44E+08	-13.03	72.34	4.454	#####
11/22/99 1:53	538.92	0.00	0.00	-403.64	406.08	#########	-23.33	110.10	2.44E+08	-13.08	72.47	4.396	#####
11/22/99 6:15	406.69	0.00	0.00	-404.23	403.88	#########	-23.35	110.22	2.44E+08	-13.14	72.60	4.347	#####
11/22/99 10:36	326.51	0.00	0.00	-406.79	405.88	#########	-23.37	110.35	2.45E+08	-13.19	72.74	4.288	#####
11/22/99 14:52	350.92	0.00	0.00	-407.70	405.49	#########	-23.38	110.47	2.45E+08	-13.24	72.86	4.241	#####
11/22/99 19:06	380.28	-588.25	-423.36	-409.16	406.33	#########	-23.40	110.59	2.45E+08	-13.29	72.99	4.195	#####
11/22/99 23:15	285.39	-650.76	-375.30	-411.11	408.27	#########	-23.41	110.71	2.45E+08	-13.34	73.12	4.144	#####
11/23/99 3:22	342.94	-690.63	-359.42	-412.56	407.18	#########	-23.43	110.83	2.45E+08	-13.39	73.25	4.099	#####
11/23/99 7:29	306.60	*-713.62*	-339.06	-414.31	407.02	#########	-23.45	110.94	2.45E+08	-13.44	73.37	4.059	#####
11/23/99 11:30	438.64	-753.04	-310.23	-415.95	411.40	#########	-23.46	111.06	2.45E+08	-13.49	73.49	4.011	#####
11/23/99 15:31	371.74	-787.78	-304.06	-415.40	409.80	#########	-23.48	111.17	2.46E+08	-13.54	73.61	3.971	#####
11/23/99 19:29	327.80	-812.14	-276.57	-418.45	411.98	#########	-23.49	111.29	2.46E+08	-13.59	73.74	3.926	#####
11/23/99 23:22	395.11	-840.16	-262.04	-417.66	414.05	#########	-23.51	111.40	2.46E+08	-13.63	73.85	3.877	#####
11/24/99 3:14	400.04	-864.95	-256.40	-416.83	413.86	#########	-23.52	111.51	2.46E+08	-13.68	73.97	3.833	#####
11/24/99 7:04	425.22	-892.58	-247.72	-417.48	415.17	#########	-23.54	111.62	2.46E+08	-13.73	74.09	3.794	#####
11/24/99 10:50	406.73	-917.25	-230.56	-420.04	417.99	#########	-23.55	111.73	2.46E+08	-13.77	74.20	3.748	#####
11/24/99 14:35	387.99	-934.83	-223.56	-424.64	419.07	#########	-23.57	111.83	2.46E+08	-13.82	74.32	3.708	#####
11/24/99 18:17	437.44	-957.14	-217.14	-423.10	419.00	#########	-23.58	111.94	2.46E+08	-13.86	74.43	3.673	#####
11/24/99 21:55	422.99	-979.96	-204.75	-424.01	421.16	#########	-23.60	112.04	2.47E+08	-13.91	74.54	3.634	#####
11/25/99 1:33	416.42	-1003.40	-197.04	-429.07	423.20	#########	-23.61	112.15	2.47E+08	-13.95	74.65	3.595	#####
11/25/99 5:09	417.96	-1022.00	-194.51	-427.75	423.78	#########	-23.62	112.25	2.47E+08	-13.99	74.76	3.557	#####
11/25/99 8:41	370.97	-1037.80	-179.02	-430.12	429.12	#########	-23.64	112.35	2.47E+08	-14.04	74.87	3.518	#####
11/25/99 12:11	410.58	-1056.90	-166.60	-431.87	432.26	#########	-23.65	112.45	2.47E+08	-14.08	74.97	3.474	#####
11/25/99 15:40	464.79	-1075.80	-165.16	-432.13	431.54	#########	-23.66	112.55	2.47E+08	-14.12	75.08	3.438	#####
11/25/99 19:06	505.80	-1096.30	-158.34	-431.99	432.84	#########	-23.68	112.65	2.47E+08	-14.16	75.18	3.405	#####
11/25/99 22:29	390.94	-1123.80	-149.20	-435.08	436.57	#########	-23.69	112.74	2.47E+08	-14.20	75.29	3.368	#####
11/26/99 1:50	375.70	-1139.40	-142.21	-437.38	438.43	#########	-23.70	112.84	2.47E+08	-14.25	75.39	3.339	#####
11/26/99 5:10	363.90	-1144.50	-157.45	-430.91	431.40	#########	-23.72	112.94	2.48E+08	-14.29	75.49	3.321	#####
11/26/99 8:30	433.41	-1159.00	-150.81	-431.29	433.83	#########	-23.73	113.03	2.48E+08	-14.33	75.59	3.305	#####
11/26/99 11:48	513.48	-1171.15	-139.76	-434.40	437.76	#########	-23.74	113.13	2.48E+08	-14.37	75.69	3.286	#####
11/26/99 15:05	474.94	-1183.30	-135.91	-434.09	438.04	#########	-23.75	113.22	2.48E+08	-14.41	75.79	3.268	#####
11/26/99 18:22	495.93	-1188.30	-133.16	-432.28	438.70	#########	-23.77	113.31	2.48E+08	-14.45	75.89	3.248	#####
11/26/99 21:37	571.90	-1201.60	-110.53	-439.79	445.87	#########	-23.78	113.41	2.48E+08	-14.48	75.99	3.220	#####
11/27/99 0:50	507.71	*-1215.90*	-102.80	-443.82	448.54	#########	-23.79	113.50	2.48E+08	-14.52	76.09	3.191	#####
11/27/99 4:00	525.28	-1227.70	-99.79	-444.77	449.89	#########	-23.80	113.59	2.48E+08	-14.56	76.18	3.164	#####
11/27/99 7:10	539.61	-1239.90	-97.05	-446.23	452.00	#########	-23.82	113.68	2.48E+08	-14.60	76.28	3.140	#####
11/27/99 10:18	562.01	-1251.50	-88.65	-446.65	455.52	#########	-23.83	113.77	2.49E+08	-14.64	76.38	3.115	#####
11/27/99 13:26	489.94	*-1268.60*	-80.16	-450.10	458.63	#########	-23.84	113.86	2.49E+08	-14.68	76.47	3.089	#####
11/27/99 16:30	620.55	*-1284.10*	-80.44	-448.64	457.86	#########	-23.85	113.95	2.49E+08	-14.71	76.57	3.066	#####
11/27/99 19:34	541.91	*-1295.00*	-75.01	-448.09	460.39	#########	-23.86	114.03	2.49E+08	-14.75	76.66	3.046	#####
11/27/99 22:37	478.32	-1301.00	-68.38	-449.48	463.35	#########	-23.88	114.12	2.49E+08	-14.79	76.75	3.024	#####
11/28/99 1:39	506.52	*-1311.50*	-61.26	-452.45	467.50	#########	-23.89	114.21	2.49E+08	-14.82	76.84	3.002	#####
11/28/99 4:39	557.16	-1322.10	-59.12	-451.30	468.21	#########	-23.90	114.29	2.49E+08	-14.86	76.93	2.981	#####
11/28/99 7:37	615.87	-1329.40	-56.34	-450.08	468.14	#########	-23.91	114.38	2.49E+08	-14.90	77.03	2.963	#####
11/28/99 10:36	594.61	-1337.60	-48.32	-452.27	472.67	#########	-23.92	114.46	2.49E+08	-14.93	77.12	2.943	#####
11/28/99 13:31	545.03	-1350.30	-39.96	-456.19	477.09	#########	-23.93	114.55	2.49E+08	-14.97	77.20	2.923	#####
11/28/99 16:27	595.67	-1361.10	-39.25	-455.04	475.91	#########	-23.94	114.63	2.50E+08	-15.00	77.29	2.906	#####
11/28/99 19:21	518.49	*-1368.80*	-34.62	-455.80	478.05	#########	-23.96	114.71	2.50E+08	-15.04	77.38	2.890	#####
11/28/99 22:16	681.35	-1379.40	-28.38	-456.40	479.01	#########	-23.97	114.80	2.50E+08	-15.07	77.47	2.873	#####
11/29/99 1:08	633.58	-1383.20	-21.43	-457.30	483.87	#########	-23.98	114.88	2.50E+08	-15.11	77.56	2.856	#####
11/29/99 4:00	644.30	-1394.20	-17.63	-460.54	486.65	#########	-23.99	114.96	2.50E+08	-15.14	77.64	2.839	#####
11/29/99 6:50	618.58	-1398.50	-17.07	-459.38	485.90	#########	-24.00	115.04	2.50E+08	-15.18	77.73	2.819	#####
11/29/99 9:40	604.26	-1404.20	0.02	-467.72	496.92	#########	-24.01	115.12	2.50E+08	-15.21	77.82	2.794	#####
11/29/99 12:27	525.06	-1413.74	8.16	-470.69	503.96	#########	-24.02	115.20	2.50E+08	-15.25	77.90	2.767	#####
11/29/99 15:12	610.46	-1423.28	13.97	-471.16	508.91	#########	-24.03	115.28	2.50E+08	-15.28	77.99	2.741	#####
11/29/99 17:56	525.00	-1432.81	15.33	-473.06	510.37	#########	-24.04	115.36	2.50E+08	-15.31	78.07	2.719	#####
11/29/99 20:39	532.22	-1442.35	21.56	-473.50	514.71	#########	-24.05	115.44	2.50E+08	-15.35	78.15	2.697	#####
11/29/99 23:22	490.45	-1451.89	28.02	-475.98	519.07	#########	-24.06	115.51	2.51E+08	-15.38	78.23	2.675	#####
11/30/99 2:02	549.54	-1461.43	34.13	-480.26	524.03	#########	-24.07	115.59	2.51E+08	-15.41	78.31	2.652	#####
11/30/99 4:40	396.07	-1470.96	37.69	-480.73	526.23	#########	-24.08	115.67	2.51E+08	-15.44	78.40	2.631	#####
11/30/99 7:18	588.10	-1480.50	40.51	-476.43	530.06	#########	-24.09	115.74	2.51E+08	-15.47	78.48	2.612	#####
11/30/99 9:55	395.41	-1488.80	44.92	-479.90	532.42	#########	-24.11	115.82	2.51E+08	-15.51	78.55	2.593	#####
11/30/99 12:31	434.87	-1497.10	55.20	-482.74	541.42	#########	-24.12	115.89	2.51E+08	-15.54	78.63	2.572	#####
11/30/99 15:05	424.86	-1506.30	61.76	-485.53	546.93	#########	-24.12	115.96	2.51E+08	-15.57	78.71	2.552	#####
11/30/99 17:39	510.33	-1512.15	62.88	-485.44	549.10	#########	-24.13	116.04	2.51E+08	-15.60	78.79	2.534	#####
11/30/99 20:10	458.61	-1518.00	68.18	-485.05	552.82	#########	-24.14	116.11	2.51E+08	-15.63	78.87	2.517	#####
11/30/99 22:42	567.12	-1524.20	74.91	-486.49	558.35	#########	-24.15	116.18	2.51E+08	-15.66	78.94	2.500	#####
12/1/99 1:11	450.16	-1529.40	81.80	-488.44	564.46	#########	-24.16	116.25	2.51E+08	-15.69	79.02	2.483	#####
12/1/99 3:41	557.31	-1537.70	87.04	-492.75	570.36	#########	-24.17	116.32	2.52E+08	-15.72	79.10	2.466	#####
12/1/99 6:09	461.17	-1542.20	90.09	-490.79	572.85	#########	-24.18	116.39	2.52E+08	-15.75	79.17	2.450	#####
12/1/99 8:36	550.73	-1546.70	93.09	-489.55	576.29	#########	-24.19	116.46	2.52E+08	-15.78	79.24	2.432	#####
12/1/99 11:02	511.55	-1550.50	107.55	-497.56	588.48	#########	-24.20	116.53	2.52E+08	-15.81	79.32	2.408	#####
12/1/99 13:26	691.54	-1558.20	118.52	-502.02	599.57	#########	-24.21	116.60	2.52E+08	-15.84	79.39	2.382	#####
12/1/99 15:48	651.45	-1568.90	125.35	-506.32	607.97	#########	-24.22	116.67	2.52E+08	-15.87	79.46	2.359	#####

AUXILIARY CALCULATIONS

10/3/99 6:30	DELT PERIOD	DELT APO	DELT V	DELT MEAN SUN	RAAN -180 TO 180	DELT RAAN	SOLAR TIME	DRAGDUR	DRAGPASS BEGIN (Including 5 min delay segs)	DRAGPASS END	ORBIT PERIOD LESS DRAGP AND SOLAR
11/18/99 14:51	203.7	103.0	4.10	24.288	-2.790	1.580	4:26:10 PM	412.0	-506.0	506.0	18405.0271
11/18/99 20:12	252.0	129.3	6.32	24.405	-2.770	1.600	4:25:47 PM	413.9	-507.0	507.0	18151.1831
11/19/99 1:30	230.4	118.1	5.39	24.521	-2.740	1.630	4:25:26 PM	415.7	-507.8	507.8	17919.0486
11/19/99 6:44	197.2	101.0	4.33	24.635	-2.710	1.660	4:25:06 PM	417.2	-508.6	508.6	17720.3217
11/19/99 11:55	229.3	119.5	6.45	24.748	-2.700	1.670	4:24:41 PM	419.0	-509.5	509.5	17489.1767
11/19/99 17:02	199.9	100.9	2.73	24.860	-2.680	1.690	4:24:19 PM	420.6	-510.3	510.3	17287.6579
11/19/99 22:06	245.0	130.6	8.72	24.971	-2.650	1.720	4:24:00 PM	422.7	-511.4	511.4	17040.5839
11/20/99 3:05	199.8	102.0	3.22	25.080	-2.620	1.750	4:23:41 PM	424.4	-512.2	512.2	16839.1523
11/20/99 8:02	227.0	119.0	5.91	25.188	-2.600	1.770	4:23:20 PM	426.4	-513.2	513.2	16610.152
11/20/99 12:54	225.1	119.4	6.73	25.294	-2.580	1.790	4:22:59 PM	428.4	-514.2	514.2	16383.0172
11/20/99 17:42	191.6	100.7	4.73	25.399	-2.560	1.810	4:22:39 PM	430.2	-515.1	515.1	16189.6166
11/20/99 22:29	221.8	118.9	7.15	25.503	-2.530	1.840	4:22:21 PM	432.3	-516.1	516.1	15965.7017
11/21/99 3:11	192.3	102.3	5.32	25.606	-2.500	1.870	4:22:03 PM	434.1	-517.1	517.1	15771.5074
11/21/99 7:49	176.8	94.2	4.86	25.707	-2.480	1.890	4:21:44 PM	435.9	-517.9	517.9	15593.0043
11/21/99 12:25	203.1	110.2	7.00	25.807	-2.460	1.910	4:21:25 PM	437.9	-519.0	519.0	15387.8584
11/21/99 16:57	167.3	87.8	3.12	25.906	-2.440	1.930	4:21:06 PM	439.6	-519.8	519.8	15218.8526
11/21/99 21:27	225.2	122.4	7.42	26.004	-2.410	1.960	4:20:49 PM	442.0	-521.0	521.0	14991.2295
11/22/99 1:53	208.9	114.2	7.18	26.101	-2.380	1.990	4:20:33 PM	444.3	-522.2	522.2	14780.0423
11/22/99 6:15	176.5	95.4	4.99	26.197	-2.350	2.020	4:20:18 PM	446.3	-523.2	523.2	14601.6248
11/22/99 10:36	212.6	117.5	7.90	26.292	-2.330	2.040	4:20:00 PM	448.8	-524.4	524.4	14386.5771
11/22/99 14:52	169.4	93.5	5.98	26.385	-2.310	2.060	4:19:42 PM	450.8	-525.4	525.4	14215.1302
11/22/99 19:06	165.2	90.6	5.21	26.477	-2.290	2.080	4:19:25 PM	452.8	-526.4	526.4	13986.1219
11/22/99 23:15	182.7	102.4	7.37	26.568	-2.260	2.110	4:19:10 PM	455.1	-527.5	527.5	13739.7106
11/23/99 3:22	162.7	90.7	6.01	26.658	-2.230	2.140	4:18:56 PM	457.2	-528.6	528.6	13536.104
11/23/99 7:29	142.4	78.7	4.55	26.748	-2.200	2.170	4:18:41 PM	459.0	-529.5	529.5	13369.7718
11/23/99 11:30	172.3	97.8	7.52	26.836	-2.180	2.190	4:18:25 PM	461.4	-530.7	530.7	13156.9239
11/23/99 15:31	146.4	80.8	4.31	26.923	-2.160	2.210	4:18:09 PM	463.4	-531.7	531.7	12974.8067
11/23/99 19:29	161.4	90.5	5.80	27.010	-2.130	2.240	4:17:55 PM	465.6	-532.8	532.8	12787.9474
11/23/99 23:22	176.4	100.9	7.80	27.094	-2.110	2.260	4:17:40 PM	468.2	-534.1	534.1	12582.2044
11/24/99 3:14	159.2	91.1	6.94	27.179	-2.070	2.300	4:17:29 PM	499.5	-549.8	549.8	12382.5677
11/24/99 7:04	140.4	79.2	4.99	27.263	-2.040	2.330	4:17:16 PM	502.8	-551.4	551.4	12212.8771
11/24/99 10:50	162.3	93.6	7.36	27.345	-2.020	2.350	4:17:01 PM	506.7	-553.3	553.3	12023.9172
11/24/99 14:35	146.8	85.0	6.82	27.427	-2.000	2.370	4:16:46 PM	510.3	-555.2	555.2	11857.7122
11/24/99 18:17	123.9	71.3	5.26	27.507	-1.970	2.400	4:16:34 PM	513.5	-556.7	556.7	11709.9034
11/24/99 21:55	142.6	82.3	6.17	27.587	-1.950	2.420	4:16:20 PM	517.2	-558.6	558.6	11542.6639
11/25/99 1:33	140.1	82.8	7.57	27.666	-1.920	2.450	4:16:08 PM	521.0	-560.5	560.5	11377.1975
11/25/99 5:09	134.8	76.7	4.66	27.745	-1.880	2.490	4:15:59 PM	524.6	-562.3	562.3	11222.0117
11/25/99 8:41	141.3	81.9	6.05	27.822	-1.850	2.520	4:15:48 PM	528.6	-564.3	564.3	11062.9717
11/25/99 12:11	157.7	93.9	8.70	27.898	-1.830	2.540	4:15:34 PM	533.3	-566.6	566.6	10883.7929
11/25/99 15:40	132.0	78.2	6.84	27.974	-1.810	2.560	4:15:21 PM	537.3	-568.6	568.6	10730.8709
11/25/99 19:06	118.6	70.0	5.83	28.049	-1.780	2.590	4:15:10 PM	541.0	-570.5	570.5	10589.9273
11/25/99 22:29	132.9	78.6	6.57	28.123	-1.760	2.610	4:14:57 PM	545.2	-572.6	572.6	10427.4045
11/26/99 1:50	103.9	68.6	11.21	28.197	-1.730	2.640	4:14:46 PM	549.0	-574.5	574.5	10305.9867
11/26/99 5:10	64.7	38.6	3.40	28.269	-1.690	2.680	4:14:39 PM	551.2	-575.6	575.6	10235.0636
11/26/99 8:30	57.6	33.4	2.17	28.342	-1.660	2.710	4:14:28 PM	553.1	-576.6	576.6	10161.9728
11/26/99 11:48	68.7	41.7	4.18	28.414	-1.640	2.730	4:14:16 PM	555.5	-577.8	577.8	10079.9095
11/26/99 15:05	62.7	38.3	4.01	28.486	-1.620	2.750	4:14:03 PM	557.8	-578.9	578.9	10003.9541
11/26/99 18:22	73.3	38.9	-0.43	28.558	-1.590	2.780	4:13:53 PM	560.1	-580.1	580.1	9924.49178
11/26/99 21:37	100.3	59.9	5.10	28.628	-1.570	2.800	4:13:41 PM	563.8	-581.9	581.9	9809.01713
11/27/99 0:50	105.0	64.2	6.60	28.699	-1.540	2.830	4:13:32 PM	567.8	-583.9	583.9	9687.71836
11/27/99 4:00	96.2	59.4	6.47	28.768	-1.500	2.870	4:13:25 PM	571.6	-585.8	585.8	9577.77855
11/27/99 7:10	87.3	52.3	4.42	28.837	-1.470	2.900	4:13:15 PM	575.0	-587.5	587.5	9476.52041
11/27/99 10:18	89.3	53.8	4.76	28.906	-1.440	2.930	4:13:06 PM	578.6	-589.3	589.3	9373.82164
11/27/99 13:26	94.8	59.2	6.82	28.974	-1.420	2.950	4:12:54 PM	582.6	-591.3	591.3	9259.88594
11/27/99 16:30	80.6	49.6	5.13	29.041	-1.390	2.980	4:12:45 PM	586.1	-593.0	593.0	9162.07247
11/27/99 19:34	72.9	44.8	4.54	29.108	-1.370	3.000	4:12:34 PM	589.3	-594.6	594.6	9076.65923
11/27/99 22:37	79.0	48.0	4.41	29.174	-1.350	3.020	4:12:23 PM	592.8	-596.4	596.4	8989.90381
11/28/99 1:39	80.7	50.7	5.94	29.240	-1.320	3.050	4:12:14 PM	596.5	-598.3	598.3	8896.83026
11/28/99 4:39	73.5	46.5	5.65	29.306	-1.280	3.090	4:12:08 PM	600.1	-600.0	600.0	8810.94321
11/28/99 7:37	67.3	40.9	3.68	29.371	-1.240	3.130	4:12:02 PM	603.2	-601.6	601.6	8734.75098
11/28/99 10:36	69.2	42.2	3.89	29.436	-1.210	3.160	4:11:54 PM	606.6	-603.3	603.3	8655.6999
11/28/99 13:31	73.0	46.6	5.89	29.500	-1.190	3.180	4:11:43 PM	610.3	-605.2	605.2	8568.0833
11/28/99 16:27	63.4	39.8	4.51	29.564	-1.160	3.210	4:11:35 PM	613.6	-606.8	606.8	8492.24437
11/28/99 19:21	57.7	36.2	4.07	29.627	-1.140	3.230	4:11:25 PM	616.6	-608.3	608.3	8425.32249
11/28/99 22:16	59.3	36.6	3.61	29.691	-1.110	3.260	4:11:17 PM	619.8	-609.9	609.9	8353.82657
11/29/99 1:08	62.3	39.1	4.38	29.753	-1.090	3.280	4:11:06 PM	623.2	-611.6	611.6	8286.04456
11/29/99 4:00	61.3	40.0	5.64	29.816	-1.050	3.320	4:11:01 PM	626.7	-613.3	613.3	8211.99537
11/29/99 6:50	72.6	40.8	0.84	29.878	-1.010	3.360	4:10:56 PM	630.4	-615.2	615.2	8133.29419
11/29/99 9:40	89.2	55.1	5.37	29.940	-0.970	3.400	4:10:51 PM	635.5	-617.7	617.7	8035.85287
11/29/99 12:27	97.2	61.6	7.17	30.000	-0.950	3.420	4:10:41 PM	641.4	-620.7	620.7	7926.12812
11/29/99 15:12	91.7	59.4	7.89	30.061	-0.920	3.450	4:10:33 PM	647.2	-623.6	623.6	7821.95523
11/29/99 17:56	81.3	51.9	6.26	30.120	-0.890	3.480	4:10:26 PM	652.5	-626.2	626.2	7728.43481
11/29/99 20:39	78.4	50.3	6.25	30.180	-0.870	3.500	4:10:17 PM	657.7	-628.9	628.9	7637.85151
11/29/99 23:22	79.7	50.5	5.76	30.239	-0.840	3.530	4:10:10 PM	663.2	-631.6	631.6	7545.89017
11/30/99 2:02	80.7	52.0	6.61	30.297	-0.810	3.560	4:10:03 PM	668.9	-634.5	634.5	7452.81879
11/30/99 4:40	77.8	51.7	7.72	30.355	-0.770	3.600	4:09:59 PM	674.8	-637.4	637.4	7362.49563
11/30/99 7:18	67.8	43.8	5.59	30.412	-0.730	3.640	4:09:55 PM	680.0	-640.0	640.0	7282.57824
11/30/99 9:55	69.1	43.4	4.55	30.469	-0.690	3.680	4:09:51 PM	685.2	-642.6	642.6	7202.54572
11/30/99 12:31	75.7	48.8	6.11	30.526	-0.660	3.710	4:09:44 PM	691.3	-645.7	645.7	7115.5153
11/30/99 15:05	71.9	48.1	7.39	30.582	-0.640	3.730	4:09:36 PM	697.5	-648.7	648.7	7031.3792
11/30/99 17:39	62.9	41.1	5.53	30.638	-0.600	3.770	4:09:32 PM	702.9	-651.4	651.4	6959.887
11/30/99 20:10	61.6	40.5	5.62	30.693	-0.570	3.800	4:09:26 PM	708.4	-654.2	654.2	6889.65359
11/30/99 22:42	60.8	39.6	5.22	30.748	-0.550	3.820	4:09:17 PM	713.9	-657.0	657.0	6819.89002
12/1/99 1:11	62.0	40.0	4.96	30.803	-0.520	3.850	4:09:11 PM	757.1	-678.6	678.6	6731.09491
12/1/99 3:41	62.3	42.2	6.83	30.857	-0.490	3.880	4:09:05 PM	765.6	-682.8	682.8	6656.29671
12/1/99 6:09	56.0	38.2	6.34	30.911	-0.450	3.920	4:09:02 PM	773.5	-686.8	686.8	6591.81327
12/1/99 8:36	66.5	38.9	1.62	30.965	-0.400	3.970	4:09:01 PM	781.9	-690.9	690.9	6516.65592
12/1/99 11:02	85.1	55.1	6.92	31.017	-0.360	4.010	4:08:58 PM	794.1	-697.1	697.1	6421.63161
12/1/99 13:26	92.3	61.4	9.00	31.070	-0.340	4.030	4:08:50 PM	808.5	-704.2	704.2	6314.48466
12/1/99 15:48	85.1	58.1	9.65	31.122	-0.310	4.060	4:08:45 PM	822.8	-711.4	711.4	6211.52614

CLOSE LAUNCH PERIOD - AEROBRAKING TIMELINE

Close of Primary MSP Peer Review 11/96, End of L/W, Min Mass Config, Data written at periapsis point

Starting Time for Simulation: Oct 3, 1999; 06:30 ET (Apoapsis, Last Walkin Maneuver)

(DO NOT USE) DYNAMIC DRAGDUR | SUN ECLIPSE BEGIN | SUN ECLIPSE END | EARTH OCCULT BEGIN | EARTH OCCULT END

Note: Earth & Sun positions use table lookup & data interpolation on 10 day AUXILIARY CALCULATIONS

DRAGPASS BEGIN | DRAGPASS END | ORBIT PERIOD LESS DRAGP

10/3/99 6:30	DAY#	REV#	PERIAPS ALT	PER WRT ELLIPSOID	APOAPSIS ALT	NRURN	QDYN	QHTDYN	INCLIN	ASC NODE	ARGPER	DRAGDUR	BEGIN	END	BEGIN	END	SUN DIST	SUN LAT	SUN LONG	EARTH DIST	EARTH LAT	EARTH LONG	PERIOD	VPER	DELT PERIOD	DELT APO	DELT V	DELT M	EAN SUN -180 TO 180	RAAN	DELT RAAN	SOLAR TIME	DRAGDUR	(Including 5 min delay seg	MD SOLAR
12/1/99 18:11	59.49	181	86.81	106.08	1621.50	37	0.38	0.14	92.56	359.73	110.58	599.75	-1579.20	127.70	-507.91	613.16	#########	-24.23	116.74	2.52E+08	-15.90	79.54	2.338	#####	75.8	50.7	7.60	31.174	-0.270	4.100	4:08:42 PM	835.9	-718.0	718.0	6118.84496
12/1/99 20:30	59.58	182	86.78	106.18	1570.50	37	0.36	0.14	92.57	359.76	110.02	574.25	-1586.60	134.16	-508.32	621.28	#########	-24.24	116.80	2.52E+08	-15.93	79.61	2.317	#####	75.7	51.0	7.96	31.224	-0.240	4.130	4:08:37 PM	849.7	-724.9	724.9	6028.86739
12/1/99 22:49	59.68	183	86.61	106.13	1520.40	37	0.35	0.13	92.61	359.79	109.56	815.07	-1592.10	143.39	-510.36	630.14	#########	-24.25	116.87	2.52E+08	-15.95	79.68	2.296	#####	74.3	50.1	7.83	31.275	-0.210	4.160	4:08:32 PM	864.0	-732.0	732.0	5941.93696
12/2/99 1:07	59.78	184	85.52	105.12	1470.80	37	0.38	0.14	92.64	359.82	109.18	542.44	-1600.60	151.16	-513.15	639.85	#########	-24.26	116.94	2.52E+08	-15.98	79.75	2.275	#####	74.7	49.6	7.15	31.325	-0.180	4.190	4:08:28 PM	878.9	-739.4	739.4	5851.31177
12/2/99 3:24	59.87	185	85.48	105.20	1418.80	37	0.37	0.14	92.60	359.85	108.72	713.17	-1609.40	158.81	-518.86	650.89	#########	-24.27	117.00	2.52E+08	-16.01	79.82	2.254	#####	76.4	52.0	8.47	31.375	-0.150	4.220	4:08:23 PM	895.3	-747.6	747.6	5757.85952
12/2/99 5:38	59.96	186	86.96	106.79	1367.40	37	0.30	0.11	92.56	359.90	108.22	448.29	-1617.70	164.76	-519.35	658.59	#########	-24.27	117.07	2.52E+08	-16.04	79.88	2.234	#####	73.1	51.4	9.66	31.424	-0.100	4.270	4:08:23 PM	912.4	-756.2	756.2	5667.87548
12/2/99 7:52	60.06	187	87.14	107.07	1323.70	37	0.29	0.11	92.56	359.95	107.74	859.10	-1625.30	169.29	-518.85	665.96	#########	-24.28	117.13	2.52E+08	-16.06	79.95	2.216	#####	63.6	43.7	7.48	31.472	-0.050	4.320	4:08:23 PM	927.8	-763.9	763.9	5589.04002
12/2/99 10:06	60.15	188	85.68	105.72	1281.50	37	0.32	0.12	92.58	359.99	107.26	908.31	-1631.10	175.63	-520.95	674.95	#########	-24.29	117.19	2.53E+08	-16.09	80.02	2.199	#####	63.6	42.2	6.06	31.521	-0.010	4.360	4:08:21 PM	943.3	-771.7	771.7	5511.86542
12/2/99 12:17	60.24	189	84.25	104.41	1234.00	37	0.35	0.13	92.61	0.03	106.71	705.03	-1636.90	185.48	-523.79	687.17	#########	-24.30	117.26	2.53E+08	-16.12	80.09	2.179	#####	71.1	47.5	7.09	31.569	0.028	4.398	4:08:19 PM	961.8	-780.9	780.9	5425.75045
12/2/99 14:28	60.33	190	84.43	104.68	1182.20	37	0.33	0.12	92.63	0.06	106.26	724.39	-1643.40	196.42	-528.06	701.60	#########	-24.31	117.32	2.53E+08	-16.14	80.15	2.158	#####	74.7	51.8	9.20	31.616	0.057	4.427	4:08:15 PM	983.3	-791.6	791.6	5333.79653
12/2/99 16:37	60.42	191	85.09	105.44	1134.50	37	0.30	0.11	92.58	0.09	105.79	634.36	-1652.90	204.34	-531.24	712.18	#########	-24.32	117.38	2.53E+08	-16.17	80.22	2.139	#####	67.9	47.7	8.98	31.664	0.091	4.461	4:08:11 PM	1004.3	-802.1	802.1	5245.87765
12/2/99 18:45	60.51	192	84.53	105.00	1091.10	37	0.29	0.11	92.53	0.13	105.13	751.28	-1660.30	208.15	-531.21	721.94	#########	-24.32	117.44	2.53E+08	-16.20	80.28	2.122	#####	63.3	43.4	7.38	31.710	0.132	4.502	4:08:10 PM	1024.6	-812.3	812.3	5165.03525
12/2/99 20:52	60.60	193	84.35	104.95	1046.00	37	0.28	0.11	92.54	0.17	104.43	771.48	-1664.50	217.63	-531.94	735.11	#########	-24.33	117.50	2.53E+08	-16.22	80.35	2.104	#####	65.0	45.1	8.08	31.756	0.168	4.538	4:08:08 PM	1047.1	-823.5	823.5	5084.59712
12/2/99 22:59	60.69	194	84.38	105.09	1000.50	37	0.27	0.10	92.59	0.20	103.82	689.89	-1668.30	228.67	-531.62	748.12	#########	-24.34	117.56	2.53E+08	-16.25	80.41	2.085	#####	65.1	45.5	8.44	31.802	0.202	4.572	4:08:05 PM	1071.3	-835.6	835.6	5003.61625
12/3/99 1:04	60.77	195	83.47	104.27	956.24	37	0.28	0.11	92.63	0.23	103.36	802.10	-1675.90	238.63	-536.08	763.93	#########	-24.35	117.62	2.53E+08	-16.27	80.48	2.068	#####	64.5	44.3	7.60	31.848	0.233	4.603	4:08:01 PM	1096.5	-848.2	848.2	4918.96164
12/3/99 3:08	60.86	196	82.46	103.36	910.32	37	0.30	0.11	92.61	0.27	102.77	804.13	-1683.80	248.91	-540.84	779.51	#########	-24.36	117.68	2.53E+08	-16.30	80.54	2.049	#####	66.8	45.9	7.95	31.893	0.266	4.636	4:07:58 PM	1124.6	-862.3	862.3	4830.23921
12/3/99 5:10	60.95	197	83.78	104.79	861.24	37	0.25	0.09	92.56	0.30	102.08	741.93	-1690.10	261.65	-543.31	796.18	#########	-24.36	117.74	2.53E+08	-16.32	80.60	2.030	#####	67.8	49.1	10.48	31.938	0.303	4.673	4:07:56 PM	1157.0	-878.5	878.5	4739.9422
12/3/99 7:13	61.03	198	80.56	101.66	813.30	38	0.31	0.12	92.53	0.35	101.47	1183.10	-1697.50	268.46	-541.70	810.18	#########	-24.37	117.80	2.53E+08	-16.35	80.66	2.010	#####	72.3	47.9	6.92	31.982	0.352	4.722	4:07:58 PM	1191.6	-895.8	895.8	4642.91512
12/3/99 9:12	61.11	199	79.65	100.85	755.34	38	0.32	0.12	92.54	0.40	100.71	1028.30	-1704.10	285.49	-549.40	835.50	#########	-24.38	117.85	2.53E+08	-16.37	80.72	1.987	#####	83.0	58.0	10.84	32.026	0.404	4.774	4:08:00 PM	1237.7	-918.9	918.9	4530.28464
12/3/99 11:12	61.20	200	83.48	104.81	699.85	39	0.22	0.08	92.57	0.45	99.77	727.26	-1713.80	298.65	-553.75	860.69	#########	-24.39	117.91	2.53E+08	-16.39	80.78	1.967	#####	72.5	55.5	14.18	32.069	0.453	4.823	4:08:01 PM	1287.2	-943.6	943.6	4423.30893
12/3/99 13:10	61.28	201	88.10	109.53	661.42	40	0.15	0.05	92.61	0.49	98.92	1006.90	-1723.10	309.70	-547.53	879.46	#########	-24.40	117.97	2.53E+08	-16.42	80.84	1.954	#####	47.3	38.4	11.44	32.112	0.489	4.859	4:07:59 PM	1325.1	-962.6	962.6	4347.72532
12/3/99 15:06	61.36	202	94.78	116.27	635.93	41	0.09	0.03	92.63	0.52	98.35	1167.40	-1727.70	317.03	-537.94	891.78	#########	-24.40	118.02	2.53E+08	-16.44	80.90	1.946	#####	26.3	25.5	10.38	32.155	0.523	4.893	4:07:57 PM	1352.2	-976.1	976.1	4303.3208
12/3/99 17:03	61.44	203	95.46	117.01	620.38	41	0.08	0.03	92.58	0.56	97.90	1099.90	-1732.40	316.54	-523.54	894.65	#########	-24.41	118.08	2.54E+08	-16.47	80.96	1.941	#####	20.8	15.6	3.77	32.197	0.558	4.928	4:07:55 PM	1369.5	-984.7	984.7	4269.20807
12/3/99 19:01	61.52	204	94.79	116.41	606.61	41	0.08	0.03	92.52	0.60	97.21	1338.90	-1732.60	321.96	-519.59	901.75	#########	-24.42	118.13	2.54E+08	-16.49	81.02	1.935	#####	20.1	13.8	2.39	32.240	0.603	4.973	4:07:56 PM	1385.4	-992.7	992.7	4240.9286
12/3/99 20:58	61.60	205	94.35	116.04	591.10	41	0.08	0.03	92.52	0.64	96.44	1345.80	-1727.90	332.66	-514.28	913.42	#########	-24.43	118.19	2.54E+08	-16.51	81.08	1.929	#####	22.2	15.5	2.94	32.282	0.642	5.012	4:07:55 PM	1403.9	-1002.0	1002.0	4214.12302
12/3/99 22:53	61.68	206	94.74	116.48	573.68	41	0.08	0.03	92.56	0.68	95.76	1601.30	-1723.20	341.38	-510.01	928.51	#########	-24.43	118.24	2.54E+08	-16.54	81.14	1.922	#####	23.7	17.4	4.00	32.324	0.677	5.047	4:07:53 PM	1425.7	-1012.831	1012.8	4184.25472
12/4/99 0:50	61.76	207	94.54	116.31	556.82	41	0.08	0.03	92.62	0.71	95.34	1597.40	-1721.30	354.59	-507.07	943.01	#########	-24.44	118.30	2.54E+08	-16.56	81.20	1.916	#####	23.7	16.9	3.44	32.367	0.708	5.078	4:07:51 PM	1447.7	-1023.841	1023.8	4151.42338
12/4/99 2:45	61.84	208	93.04	114.83	541.19	41	0.09	0.03	92.63	0.74	94.98	1070.30	-1723.00	364.33	-509.60	955.02	#########	-24.44	118.36	2.54E+08	-16.58	81.26	1.909	#####	23.8	15.6	2.21	32.409	0.740	5.110	4:07:48 PM	1469.0	-1034.508	1034.5	4115.26613
12/4/99 4:40	61.92	209	92.66	114.48	523.97	41	0.09	0.03	92.58	0.77	94.42	1638.90	-1724.90	370.67	-513.12	968.48	#########	-24.45	118.41	2.54E+08	-16.60	81.32	1.902	#####	24.4	17.2	3.43	32.451	0.770	5.140	4:07:46 PM	1493.6	-1046.8	1046.8	4076.64901
12/4/99 6:34	62.00	210	94.24	116.11	504.86	41	0.08	0.03	92.54	0.81	93.76	1590.20	-1723.70	379.15	-509.60	980.97	#########	-24.45	118.47	2.54E+08	-16.62	81.38	1.896	#####	24.3	19.1	5.35	32.492	0.814	5.184	4:07:46 PM	1522.4	-1061.2	1061.2	4039.18227
12/4/99 8:28	62.08	211	94.82	116.71	487.67	41	0.07	0.03	92.53	0.86	93.17	1511.00	-1723.50	387.20	-501.30	992.04	#########	-24.46	118.52	2.54E+08	-16.64	81.44	1.889	#####	23.0	17.2	4.19	32.534	0.864	5.234	4:07:48 PM	1725.5	-1162.8	1162.8	3914.83757
12/4/99 10:21	62.16	212	93.68	115.59	471.32	41	0.08	0.03	92.54	0.91	92.69	1536.00	-1723.00	395.01	-496.03	1005.70	#########	-24.46	118.58	2.54E+08	-16.66	81.50	1.882	#####	24.2	16.4	2.72	32.575	0.914	5.284	4:07:50 PM	1762.7	-1181.3	1181.3	3872.59166
12/4/99 12:15	62.24	213	91.51	113.43	452.94	41	0.09	0.03	92.58	0.96	92.18	1505.10	-1723.80	406.37	-497.46	1021.10	#########	-24.46	118.63	2.54E+08	-16.68	81.56	1.875	#####	28.4	18.4	2.41	32.616	0.960	5.330	4:07:51 PM	1807.0	-1203.5	1203.5	3821.26224
12/4/99 14:07	62.32	214	90.086	112.03	430.07	41	0.10	0.04	92.62	1.00	91.555	1505.8	-1724	423.65	-502.76	1041.9	#########	-24.466	118.69	254250000	-16.698	81.624	1.865	#####	33.5	22.9	4.01	32.657	0.997	5.367	4:07:50 PM	#N/A	#N/A	#N/A	#N/A
12/4/99 16:00	62.4	215	90.781	112.73	404.16	41	0.09	0.03	92.63	1.03	91.115	1512.2	-1725.8	436.93	-505.32	1065	#########	-24.469	118.74	254310000	-16.718	81.684	1.856	#####	34.7	25.9	6.34	32.698	1.033	5.403	4:07:49 PM	#N/A	#N/A	#N/A	#N/A
12/4/99 17:52	62.47	216	90.961	112.92	379.78	41	0.09	0.03	92.57	1.07	90.613	1461.3	-1732.8	444.85	-504.61	1083.5	#########	-24.473	118.79	254370000	-16.737	81.744	1.846	#####	33.2	24.4	5.65	32.739	1.069	5.439	4:07:48 PM	#N/A	#N/A	#N/A	#N/A

6/24/97

Tracking Schedule - close LP

period	Start	Periapse	End	Start	Track 1 duration	End	Off 1 duration	Start	Track 2 duration	End	Off 2 duration	Start	Track3 duration	End	Off 3 duration
h	Aeropass		Aeropass	Track 1 [post peri]	h	Track 1	h	Track 2	h	Track 2	h	Track 3	h	Track 3	h
28.64	10/3/99 20:50	10/3/99 20:58	10/3/99 21:06	10/3/99 21:24	4.00	10/4/99 1:24	5.00	10/4/99 6:24	4.00	10/4/99 10:24	5.00	10/4/99 15:24	4.00	10/4/99 19:24	5.00
27.88	10/5/99 0:46	10/5/99 0:54	10/5/99 1:01	10/5/99 1:19	4.00	10/5/99 5:19	5.00	10/5/99 10:19	4.00	10/5/99 14:19	5.00	10/5/99 19:19	4.00	10/5/99 23:19	5.00
27.08	10/6/99 3:55	10/6/99 4:02	10/6/99 4:10	10/6/99 4:28	4.00	10/6/99 8:28	5.00	10/6/99 13:28	4.00	10/6/99 17:28	5.00	10/6/99 22:28	3.73	10/7/99 2:11	4.66
26.17	10/7/99 6:18	10/7/99 6:25	10/7/99 6:33	10/7/99 6:51	4.00	10/7/99 10:51	5.00	10/7/99 15:51	4.00	10/7/99 19:51	5.00	10/8/99 0:51	3.40	10/8/99 4:15	4.25
25.40	10/8/99 7:57	10/8/99 8:05	10/8/99 8:12	10/8/99 8:30	4.00	10/8/99 12:30	5.00	10/8/99 17:30	4.00	10/8/99 21:30	5.00	10/9/99 2:30	3.08	10/9/99 5:35	3.85
24.68	10/9/99 8:53	10/9/99 9:00	10/9/99 9:08	10/9/99 9:26	4.00	10/9/99 13:26	5.00	10/9/99 18:26	4.00	10/9/99 22:26	5.00	10/10/99 3:26	2.76	10/10/99 6:12	3.45
23.97	10/10/99 9:06	10/10/99 9:13	10/10/99 9:21	10/10/99 9:39	4.00	10/10/99 13:39	5.00	10/10/99 18:39	4.00	10/10/99 22:39	5.00	10/11/99 3:39	2.45	10/11/99 6:06	3.07
23.30	10/11/99 8:37	10/11/99 8:45	10/11/99 8:52	10/11/99 9:10	4.00	10/11/99 13:10	5.00	10/11/99 18:10	4.00	10/11/99 22:10	5.00	10/12/99 3:10	2.14	10/12/99 5:19	2.68
22.67	10/12/99 7:26	10/12/99 7:34	10/12/99 7:41	10/12/99 7:59	4.00	10/12/99 11:59	5.00	10/12/99 16:59	4.00	10/12/99 20:59	5.00	10/13/99 1:59	1.81	10/13/99 3:48	2.26
22.01	10/13/99 5:31	10/13/99 5:38	10/13/99 5:46	10/13/99 6:04	4.00	10/13/99 10:04	5.00	10/13/99 15:04	4.00	10/13/99 19:04	5.00	10/14/99 0:04	1.57	10/14/99 1:38	1.97
21.38	10/14/99 3:03	10/14/99 3:11	10/14/99 3:18	10/14/99 3:36	4.00	10/14/99 7:36	5.00	10/14/99 12:36	4.00	10/14/99 16:36	5.00	10/14/99 21:36	1.35	10/14/99 22:58	1.69
20.85	10/15/99 0:06	10/15/99 0:14	10/15/99 0:21	10/15/99 0:39	4.00	10/15/99 4:39	5.00	10/15/99 9:39	4.00	10/15/99 13:39	5.00	10/15/99 18:39	1.08	10/15/99 19:44	1.35
20.34	10/15/99 20:31	10/15/99 20:39	10/15/99 20:47	10/15/99 21:05	4.00	10/16/99 1:05	5.00	10/16/99 6:05	4.00	10/16/99 10:05	5.00	10/16/99 15:05	0.86	10/16/99 15:57	1.08
19.83	10/16/99 16:28	10/16/99 16:36	10/16/99 16:43	10/16/99 17:01	4.00	10/16/99 21:01	5.00	10/17/99 2:01	4.00	10/17/99 6:01	5.00	10/17/99 11:01	0.50	10/17/99 11:31	0.63
19.33	10/17/99 11:59	10/17/99 12:06	10/17/99 12:14	10/17/99 12:32	4.00	10/17/99 16:32	5.00	10/17/99 21:32	4.00	10/18/99 1:32	5.00				
18.83	10/18/99 6:55	10/18/99 7:03	10/18/99 7:10	10/18/99 7:28	4.00	10/18/99 11:28	5.00	10/18/99 16:28	4.00	10/18/99 20:28	5.00				
18.42	10/19/99 1:27	10/19/99 1:34	10/19/99 1:42	10/19/99 2:00	4.00	10/19/99 6:00	5.00	10/19/99 11:00	4.00	10/19/99 15:00	5.00				
18.05	10/19/99 19:34	10/19/99 19:42	10/19/99 19:49	10/19/99 20:07	4.00	10/20/99 0:07	5.00	10/20/99 5:07	3.88	10/20/99 9:00	4.85				
17.66	10/20/99 13:18	10/20/99 13:26	10/20/99 13:33	10/20/99 13:51	4.00	10/20/99 17:51	5.00	10/20/99 22:51	3.72	10/21/99 2:35	4.65				
17.24	10/21/99 6:41	10/21/99 6:48	10/21/99 6:56	10/21/99 7:14	4.00	10/21/99 11:14	5.00	10/21/99 16:14	3.56	10/21/99 19:48	4.45				
16.89	10/21/99 23:42	10/21/99 23:49	10/21/99 23:57	10/22/99 0:15	4.00	10/22/99 4:15	5.00	10/22/99 9:15	3.35	10/22/99 12:36	4.19				
16.42	10/22/99 16:14	10/22/99 16:21	10/22/99 16:29	10/22/99 16:47	4.00	10/22/99 20:47	5.00	10/23/99 1:47	3.21	10/23/99 5:00	4.01				
16.06	10/23/99 8:27	10/23/99 8:35	10/23/99 8:42	10/23/99 9:00	4.00	10/23/99 13:00	5.00	10/23/99 18:00	3.03	10/23/99 21:02	3.79				
15.73	10/24/99 0:16	10/24/99 0:24	10/24/99 0:31	10/24/99 0:49	4.00	10/24/99 4:49	5.00	10/24/99 9:49	2.88	10/24/99 12:42	3.60				
15.41	10/24/99 15:45	10/24/99 15:53	10/24/99 16:00	10/24/99 16:18	4.00	10/24/99 20:18	5.00	10/25/99 1:18	2.75	10/25/99 4:03	3.44				
15.10	10/25/99 6:56	10/25/99 7:04	10/25/99 7:12	10/25/99 7:30	4.00	10/25/99 11:30	5.00	10/25/99 16:30	2.63	10/25/99 19:08	3.29				
14.80	10/25/99 21:52	10/25/99 22:00	10/25/99 22:07	10/25/99 22:25	4.00	10/26/99 2:25	5.00	10/26/99 7:25	2.47	10/26/99 9:54	3.09				
14.47	10/26/99 12:26	10/26/99 12:34	10/26/99 12:42	10/26/99 13:00	4.00	10/26/99 17:00	5.00	10/26/99 22:00	2.34	10/27/99 0:20	2.92				
14.14	10/27/99 2:41	10/27/99 2:49	10/27/99 2:57	10/27/99 3:15	4.00	10/27/99 7:15	5.00	10/27/99 12:15	2.18	10/27/99 14:25	2.72				
13.85	10/27/99 16:35	10/27/99 16:43	10/27/99 16:51	10/27/99 17:09	4.00	10/27/99 21:09	5.00	10/28/99 2:09	2.07	10/28/99 4:13	2.59				
13.59	10/28/99 6:15	10/28/99 6:22	10/28/99 6:30	10/28/99 6:48	4.00	10/28/99 10:48	5.00	10/28/99 15:48	1.96	10/28/99 17:46	2.45				
13.30	10/28/99 19:40	10/28/99 19:47	10/28/99 19:55	10/28/99 20:13	4.00	10/29/99 0:13	5.00	10/29/99 5:13	1.83	10/29/99 7:03	2.29				
13.05	10/29/99 8:47	10/29/99 8:55	10/29/99 9:03	10/29/99 9:21	4.00	10/29/99 13:21	5.00	10/29/99 18:21	1.74	10/29/99 20:05	2.17				
12.80	10/29/99 21:42	10/29/99 21:50	10/29/99 21:57	10/29/99 22:15	4.00	10/30/99 2:15	5.00	10/30/99 7:15	1.63	10/30/99 8:53	2.04				
12.56	10/30/99 10:22	10/30/99 10:30	10/30/99 10:38	10/30/99 10:56	4.00	10/30/99 14:56	5.00	10/30/99 19:56	1.51	10/30/99 21:27	1.89				
12.32	10/30/99 22:47	10/30/99 22:54	10/30/99 23:02	10/30/99 23:20	4.00	10/31/99 3:20	5.00	10/31/99 8:20	1.43	10/31/99 9:46	1.79				
12.11	10/31/99 11:00	10/31/99 11:07	10/31/99 11:15	10/31/99 11:33	4.00	10/31/99 15:33	5.00	10/31/99 20:33	1.32	10/31/99 21:53	1.65				
11.90	10/31/99 22:58	10/31/99 23:06	10/31/99 23:14	10/31/99 23:32	4.00	11/1/99 3:32	5.00	11/1/99 8:32	1.25	11/1/99 9:47	1.56				
11.71	11/1/99 10:47	11/1/99 10:54	11/1/99 11:02	11/1/99 11:20	4.00	11/1/99 15:20	5.00	11/1/99 20:20	1.14	11/1/99 21:29	1.43				
11.47	11/1/99 22:21	11/1/99 22:29	11/1/99 22:36	11/1/99 22:54	4.00	11/2/99 2:54	5.00	11/2/99 7:54	1.05	11/2/99 8:57	1.31				
11.26	11/2/99 9:42	11/2/99 9:50	11/2/99 9:57	11/2/99 10:15	4.00	11/2/99 14:15	5.00	11/2/99 19:15	0.94	11/2/99 20:12	1.17				
11.05	11/2/99 20:49	11/2/99 20:56	11/2/99 21:04	11/2/99 21:22	4.00	11/3/99 1:22	5.00	11/3/99 6:22	0.84	11/3/99 7:13	1.05				
10.85	11/3/99 7:42	11/3/99 7:50	11/3/99 7:58	11/3/99 8:16	4.00	11/3/99 12:16	5.00	11/3/99 17:16	0.77	11/3/99 18:02	0.96				
10.67	11/3/99 18:26	11/3/99 18:34	11/3/99 18:42	11/3/99 19:00	4.00	11/3/99 23:00	5.00	11/4/99 4:00	0.69	11/4/99 4:41	0.87				
10.50	11/4/99 5:00	11/4/99 5:07	11/4/99 5:15	11/4/99 5:33	4.00	11/4/99 9:33	5.00	11/4/99 14:33	0.50	11/4/99 15:03	0.63				
10.31	11/4/99 15:23	11/4/99 15:31	11/4/99 15:39	11/4/99 15:57	4.00	11/4/99 19:57	5.00								
10.12	11/5/99 1:35	11/5/99 1:43	11/5/99 1:51	11/5/99 2:09	4.00	11/5/99 6:09	5.00								
9.97	11/5/99 11:37	11/5/99 11:45	11/5/99 11:53	11/5/99 12:11	4.00	11/5/99 16:11	5.00								
9.82	11/5/99 21:30	11/5/99 21:38	11/5/99 21:46	11/5/99 22:04	4.00	11/6/99 2:04	5.00								
9.65	11/6/99 7:12	11/6/99 7:20	11/6/99 7:28	11/6/99 7:46	4.00	11/6/99 11:46	5.00								

6/24/97

Tracking Schedule - close LP

period	Start	Periapse	End	Start	Track 1 duration	End	Off 1 duration	Start	Track 2 duration	End	Off 2 duration	Start	Track3 duration	End	Off 3 duration
h	Aeropass		Aeropass	Track 1 [post peri]	h	Track 1	h	Track 2	h	Track 2	h	Track 3	h	Track 3	h
9.47	11/6/99 16:44	11/6/99 16:52	11/6/99 17:00	11/6/99 17:18	4.00	11/6/99 21:18	5.00								
9.33	11/7/99 2:08	11/7/99 2:16	11/7/99 2:24	11/7/99 2:42	4.00	11/7/99 6:42	5.00								
9.21	11/7/99 11:24	11/7/99 11:32	11/7/99 11:40	11/7/99 11:58	4.00	11/7/99 15:58	5.00								
9.06	11/7/99 20:31	11/7/99 20:39	11/7/99 20:47	11/7/99 21:05	3.96	11/8/99 1:03	4.95								
8.91	11/8/99 5:30	11/8/99 5:38	11/8/99 5:46	11/8/99 6:04	3.90	11/8/99 9:58	4.87								
8.78	11/8/99 14:20	11/8/99 14:28	11/8/99 14:36	11/8/99 14:54	3.84	11/8/99 18:44	4.80								
8.66	11/8/99 23:02	11/8/99 23:10	11/8/99 23:18	11/8/99 23:36	3.77	11/9/99 3:23	4.72								
8.50	11/9/99 7:35	11/9/99 7:43	11/9/99 7:51	11/9/99 8:09	3.71	11/9/99 11:52	4.64								
8.37	11/9/99 16:00	11/9/99 16:08	11/9/99 16:16	11/9/99 16:34	3.67	11/9/99 20:14	4.58								
8.26	11/10/99 0:19	11/10/99 0:27	11/10/99 0:35	11/10/99 0:53	3.61	11/10/99 4:29	4.51								
8.12	11/10/99 8:30	11/10/99 8:38	11/10/99 8:46	11/10/99 9:04	3.55	11/10/99 12:37	4.44								
8.00	11/10/99 16:33	11/10/99 16:42	11/10/99 16:50	11/10/99 17:08	3.51	11/10/99 20:38	4.39								
7.91	11/11/99 0:30	11/11/99 0:38	11/11/99 0:46	11/11/99 1:04	3.46	11/11/99 4:32	4.32								
7.79	11/11/99 8:20	11/11/99 8:28	11/11/99 8:36	11/11/99 8:54	3.41	11/11/99 12:18	4.26								
7.68	11/11/99 16:03	11/11/99 16:11	11/11/99 16:19	11/11/99 16:37	3.36	11/11/99 19:59	4.20								
7.58	11/11/99 23:41	11/11/99 23:49	11/11/99 23:57	11/12/99 0:15	3.31	11/12/99 3:34	4.14								
7.45	11/12/99 7:10	11/12/99 7:18	11/12/99 7:27	11/12/99 7:45	3.27	11/12/99 11:00	4.08								
7.35	11/12/99 14:35	11/12/99 14:43	11/12/99 14:51	11/12/99 15:09	3.21	11/12/99 18:22	4.01								
7.22	11/12/99 21:52	11/12/99 22:00	11/12/99 22:08	11/12/99 22:26	3.15	11/13/99 1:35	3.94								
7.10	11/13/99 5:02	11/13/99 5:10	11/13/99 5:18	11/13/99 5:36	3.11	11/13/99 8:43	3.88								
7.00	11/13/99 12:06	11/13/99 12:14	11/13/99 12:22	11/13/99 12:40	3.05	11/13/99 15:43	3.82								
6.88	11/13/99 19:00	11/13/99 19:08	11/13/99 19:16	11/13/99 19:34	3.02	11/13/99 22:36	3.77								
6.80	11/14/99 1:51	11/14/99 1:59	11/14/99 2:07	11/14/99 2:25	2.97	11/14/99 5:23	3.71								
6.68	11/14/99 8:35	11/14/99 8:43	11/14/99 8:52	11/14/99 9:10	2.93	11/14/99 12:05	3.66								
6.60	11/14/99 15:14	11/14/99 15:22	11/14/99 15:30	11/14/99 15:48	2.88	11/14/99 18:42	3.61								
6.50	11/14/99 21:46	11/14/99 21:54	11/14/99 22:02	11/14/99 22:20	2.85	11/15/99 1:11	3.56								
6.42	11/15/99 4:15	11/15/99 4:23	11/15/99 4:31	11/15/99 4:49	2.81	11/15/99 7:38	3.51								
6.33	11/15/99 10:36	11/15/99 10:44	11/15/99 10:53	11/15/99 11:11	2.78	11/15/99 13:57	3.47								
6.25	11/15/99 16:53	11/15/99 17:02	11/15/99 17:10	11/15/99 17:28	2.74	11/15/99 20:12	3.42								
6.17	11/15/99 23:06	11/15/99 23:15	11/15/99 23:23	11/15/99 23:41	2.71	11/16/99 2:23	3.38								
6.10	11/16/99 5:14	11/16/99 5:22	11/16/99 5:30	11/16/99 5:48	2.67	11/16/99 8:29	3.34								
6.02	11/16/99 11:18	11/16/99 11:26	11/16/99 11:34	11/16/99 11:52	2.64	11/16/99 14:31	3.30								
5.95	11/16/99 17:16	11/16/99 17:25	11/16/99 17:33	11/16/99 17:51	2.61	11/16/99 20:28	3.26								
5.88	11/16/99 23:12	11/16/99 23:20	11/16/99 23:29	11/16/99 23:47	2.58	11/17/99 2:22	3.23								
5.82	11/17/99 5:03	11/17/99 5:12	11/17/99 5:20	11/17/99 5:38	2.55	11/17/99 8:11	3.19								
5.75	11/17/99 10:50	11/17/99 10:59	11/17/99 11:07	11/17/99 11:25	2.52	11/17/99 13:57	3.15								
5.68	11/17/99 16:35	11/17/99 16:43	11/17/99 16:51	11/17/99 17:09	2.49	11/17/99 19:38	3.11								
5.60	11/17/99 22:13	11/17/99 22:21	11/17/99 22:30	11/17/99 22:48	2.46	11/18/99 1:15	3.07								
5.53	11/18/99 3:47	11/18/99 3:55	11/18/99 4:04	11/18/99 4:22	2.42	11/18/99 6:47	3.02								
5.45	11/18/99 9:17	11/18/99 9:25	11/18/99 9:34	11/18/99 9:52	2.39	11/18/99 12:15	2.99								
5.39	11/18/99 14:42	11/18/99 14:51	11/18/99 14:59	11/18/99 15:17	2.36	11/18/99 17:39	2.95								
5.32	11/18/99 20:03	11/18/99 20:12	11/18/99 20:20	11/18/99 20:38	2.34	11/18/99 22:58	2.92								
5.26	11/19/99 1:22	11/19/99 1:30	11/19/99 1:38	11/19/99 1:56	2.31	11/19/99 4:15	2.89								
5.20	11/19/99 6:35	11/19/99 6:44	11/19/99 6:52	11/19/99 7:10	2.28	11/19/99 9:27	2.85								
5.14	11/19/99 11:46	11/19/99 11:55	11/19/99 12:03	11/19/99 12:21	2.26	11/19/99 14:37	2.82								
5.09	11/19/99 16:53	11/19/99 17:02	11/19/99 17:10	11/19/99 17:28	2.23	11/19/99 19:42	2.78								
5.02	11/19/99 21:57	11/19/99 22:06	11/19/99 22:14	11/19/99 22:32	2.20	11/20/99 0:44	2.75								
4.96	11/20/99 2:56	11/20/99 3:05	11/20/99 3:14	11/20/99 3:32	2.18	11/20/99 5:42	2.72								
4.90	11/20/99 7:53	11/20/99 8:02	11/20/99 8:10	11/20/99 8:28	2.15	11/20/99 10:37	2.68								
4.84	11/20/99 12:45	11/20/99 12:54	11/20/99 13:03	11/20/99 13:21	2.12	11/20/99 15:28	2.65								

6/24/97

Tracking Schedule - close LP

period	Start	Periapse	End	Start	Track 1 duration	End	Off 1 duration	Start	Track 2 duration	End	Off 2 duration	Start	Track3 duration	End	Off 3 duration
h	Aeropass		Aeropass	Track 1 [post peri]	h	Track 1	h	Track 2	h	Track 2	h	Track 3	h	Track 3	h
4.78	11/20/99 17:33	11/20/99 17:42	11/20/99 17:51	11/20/99 18:09	2.10	11/20/99 20:14	2.62								
4.72	11/20/99 22:20	11/20/99 22:29	11/20/99 22:37	11/20/99 22:55	2.07	11/21/99 1:00	2.59								
4.67	11/21/99 3:02	11/21/99 3:11	11/21/99 3:19	11/21/99 3:37	2.05	11/21/99 5:40	2.56								
4.62	11/21/99 7:40	11/21/99 7:49	11/21/99 7:57	11/21/99 8:15	2.03	11/21/99 10:17	2.53								
4.56	11/21/99 12:17	11/21/99 12:25	11/21/99 12:34	11/21/99 12:52	2.01	11/21/99 14:52	2.51								
4.52	11/21/99 16:49	11/21/99 16:57	11/21/99 17:06	11/21/99 17:24	1.98	11/21/99 19:23	2.47								
4.45	11/21/99 21:18	11/21/99 21:27	11/21/99 21:35	11/21/99 21:53	1.95	11/21/99 23:50	2.44								
4.40	11/22/99 1:44	11/22/99 1:53	11/22/99 2:02	11/22/99 2:20	1.93	11/22/99 4:16	2.41								
4.35	11/22/99 6:06	11/22/99 6:15	11/22/99 6:24	11/22/99 6:42	1.90	11/22/99 8:36	2.38								
4.29	11/22/99 10:27	11/22/99 10:36	11/22/99 10:44	11/22/99 11:02	1.88	11/22/99 12:55	2.35								
4.24	11/22/99 14:43	11/22/99 14:52	11/22/99 15:01	11/22/99 15:19	1.86	11/22/99 17:11	2.33								
4.19	11/22/99 18:57	11/22/99 19:06	11/22/99 19:14	11/22/99 19:32	1.84	11/22/99 21:23	2.30								
4.14	11/22/99 23:06	11/22/99 23:15	11/22/99 23:23	11/22/99 23:41	1.82	11/23/99 1:31	2.27								
4.10	11/23/99 3:13	11/23/99 3:22	11/23/99 3:31	11/23/99 3:49	1.80	11/23/99 5:37	2.25								
4.06	11/23/99 7:20	11/23/99 7:29	11/23/99 7:37	11/23/99 7:55	1.78	11/23/99 9:42	2.23								
4.01	11/23/99 11:22	11/23/99 11:30	11/23/99 11:39	11/23/99 11:57	1.76	11/23/99 13:43	2.20								
3.97	11/23/99 15:22	11/23/99 15:31	11/23/99 15:40	11/23/99 15:58	1.74	11/23/99 17:42	2.18								
3.93	11/23/99 19:20	11/23/99 19:29	11/23/99 19:37	11/23/99 19:55	1.72	11/23/99 21:39	2.15								
3.88	11/23/99 23:13	11/23/99 23:22	11/23/99 23:31	11/23/99 23:49	1.70	11/24/99 1:31	2.13								
3.83	11/24/99 3:05	11/24/99 3:14	11/24/99 3:23	11/24/99 3:41	1.68	11/24/99 5:22	2.11								
3.79	11/24/99 6:55	11/24/99 7:04	11/24/99 7:13	11/24/99 7:31	1.66	11/24/99 9:11	2.08								
3.75	11/24/99 10:41	11/24/99 10:50	11/24/99 10:59	11/24/99 11:17	1.65	11/24/99 12:56	2.06								
3.71	11/24/99 14:26	11/24/99 14:35	11/24/99 14:44	11/24/99 15:02	1.63	11/24/99 16:40	2.04								
3.67	11/24/99 18:07	11/24/99 18:17	11/24/99 18:26	11/24/99 18:44	1.61	11/24/99 20:21	2.02								
3.63	11/24/99 21:46	11/24/99 21:55	11/24/99 22:05	11/24/99 22:23	1.60	11/24/99 23:59	2.00								
3.59	11/25/99 1:24	11/25/99 1:33	11/25/99 1:42	11/25/99 2:00	1.58	11/25/99 3:35	1.97								
3.56	11/25/99 4:59	11/25/99 5:09	11/25/99 5:18	11/25/99 5:36	1.56	11/25/99 7:10	1.95								
3.52	11/25/99 8:31	11/25/99 8:41	11/25/99 8:50	11/25/99 9:08	1.54	11/25/99 10:41	1.93								
3.47	11/25/99 12:01	11/25/99 12:11	11/25/99 12:20	11/25/99 12:38	1.53	11/25/99 14:10	1.91								
3.44	11/25/99 15:30	11/25/99 15:40	11/25/99 15:49	11/25/99 16:07	1.51	11/25/99 17:38	1.89								
3.40	11/25/99 18:56	11/25/99 19:06	11/25/99 19:15	11/25/99 19:33	1.50	11/25/99 21:03	1.87								
3.37	11/25/99 22:19	11/25/99 22:29	11/25/99 22:38	11/25/99 22:56	1.48	11/26/99 0:25	1.85								
3.34	11/26/99 1:41	11/26/99 1:50	11/26/99 2:00	11/26/99 2:18	1.47	11/26/99 3:46	1.84								
3.32	11/26/99 5:01	11/26/99 5:10	11/26/99 5:20	11/26/99 5:38	1.47	11/26/99 7:06	1.83								
3.30	11/26/99 8:21	11/26/99 8:30	11/26/99 8:40	11/26/99 8:58	1.46	11/26/99 10:26	1.82								
3.29	11/26/99 11:38	11/26/99 11:48	11/26/99 11:57	11/26/99 12:15	1.45	11/26/99 13:42	1.81								
3.27	11/26/99 14:55	11/26/99 15:05	11/26/99 15:15	11/26/99 15:33	1.44	11/26/99 16:59	1.80								
3.25	11/26/99 18:13	11/26/99 18:22	11/26/99 18:32	11/26/99 18:50	1.43	11/26/99 20:16	1.79								
3.22	11/26/99 21:27	11/26/99 21:37	11/26/99 21:46	11/26/99 22:04	1.42	11/26/99 23:29	1.77								
3.19	11/27/99 0:40	11/27/99 0:50	11/27/99 0:59	11/27/99 1:17	1.40	11/27/99 2:42	1.76								
3.16	11/27/99 3:50	11/27/99 4:00	11/27/99 4:10	11/27/99 4:28	1.39	11/27/99 5:51	1.74								
3.14	11/27/99 7:00	11/27/99 7:10	11/27/99 7:20	11/27/99 7:38	1.38	11/27/99 9:01	1.73								
3.12	11/27/99 10:09	11/27/99 10:18	11/27/99 10:28	11/27/99 10:46	1.37	11/27/99 12:09	1.71								
3.09	11/27/99 13:16	11/27/99 13:26	11/27/99 13:36	11/27/99 13:54	1.36	11/27/99 15:15	1.70								
3.07	11/27/99 16:20	11/27/99 16:30	11/27/99 16:40	11/27/99 16:58	1.35	11/27/99 18:19	1.69								
3.05	11/27/99 19:24	11/27/99 19:34	11/27/99 19:44	11/27/99 20:02	1.34	11/27/99 21:23	1.68								
3.02	11/27/99 22:27	11/27/99 22:37	11/27/99 22:47	11/27/99 23:05	1.33	11/28/99 0:25	1.67								
3.00	11/28/99 1:29	11/28/99 1:39	11/28/99 1:49	11/28/99 2:07	1.32	11/28/99 3:26	1.65								
2.98	11/28/99 4:29	11/28/99 4:39	11/28/99 4:49	11/28/99 5:07	1.32	11/28/99 6:26	1.64								
2.96	11/28/99 7:27	11/28/99 7:37	11/28/99 7:47	11/28/99 8:05	1.31	11/28/99 9:24	1.63								

6/24/97

Tracking Schedule - close LP

period	Start	Periapse	End	Start	Track 1 duration	End	Off 1 duration	Start	Track 2 duration	End	Off 2 duration	Start	Track3 duration	End	Off 3 duration
h	Aeropass		Aeropass	Track 1 [post peri]	h	Track 1	h	Track 2	h	Track 2	h	Track 3	h	Track 3	h
2.94	11/28/99 10:26	11/28/99 10:36	11/28/99 10:46	11/28/99 11:04	1.30	11/28/99 12:22	1.62								
2.92	11/28/99 13:21	11/28/99 13:31	11/28/99 13:42	11/28/99 14:00	1.29	11/28/99 15:17	1.61								
2.91	11/28/99 16:17	11/28/99 16:27	11/28/99 16:37	11/28/99 16:55	1.28	11/28/99 18:12	1.60								
2.89	11/28/99 19:11	11/28/99 19:21	11/28/99 19:31	11/28/99 19:49	1.28	11/28/99 21:06	1.59								
2.87	11/28/99 22:05	11/28/99 22:16	11/28/99 22:26	11/28/99 22:44	1.27	11/29/99 0:00	1.58								
2.86	11/29/99 0:58	11/29/99 1:08	11/29/99 1:19	11/29/99 1:37	1.26	11/29/99 2:52	1.58								
2.84	11/29/99 3:50	11/29/99 4:00	11/29/99 4:10	11/29/99 4:28	1.25	11/29/99 5:43	1.56								
2.82	11/29/99 6:39	11/29/99 6:50	11/29/99 7:00	11/29/99 7:18	1.24	11/29/99 8:32	1.55								
2.79	11/29/99 9:29	11/29/99 9:40	11/29/99 9:50	11/29/99 10:08	1.23	11/29/99 11:22	1.54								
2.77	11/29/99 12:16	11/29/99 12:27	11/29/99 12:37	11/29/99 12:55	1.22	11/29/99 14:08	1.52								
2.74	11/29/99 15:02	11/29/99 15:12	11/29/99 15:23	11/29/99 15:41	1.21	11/29/99 16:53	1.51								
2.72	11/29/99 17:46	11/29/99 17:56	11/29/99 18:07	11/29/99 18:25	1.20	11/29/99 19:37	1.50								
2.70	11/29/99 20:29	11/29/99 20:39	11/29/99 20:50	11/29/99 21:08	1.19	11/29/99 22:19	1.48								
2.67	11/29/99 23:11	11/29/99 23:22	11/29/99 23:32	11/29/99 23:50	1.18	11/30/99 1:01	1.47								
2.65	11/30/99 1:51	11/30/99 2:02	11/30/99 2:12	11/30/99 2:30	1.17	11/30/99 3:40	1.46								
2.63	11/30/99 4:29	11/30/99 4:40	11/30/99 4:51	11/30/99 5:09	1.16	11/30/99 6:18	1.45								
2.61	11/30/99 7:08	11/30/99 7:18	11/30/99 7:29	11/30/99 7:47	1.15	11/30/99 8:56	1.44								
2.59	11/30/99 9:45	11/30/99 9:55	11/30/99 10:06	11/30/99 10:24	1.14	11/30/99 11:33	1.43								
2.57	11/30/99 12:20	11/30/99 12:31	11/30/99 12:42	11/30/99 13:00	1.13	11/30/99 14:08	1.42								
2.55	11/30/99 14:54	11/30/99 15:05	11/30/99 15:16	11/30/99 15:34	1.13	11/30/99 16:41	1.41								
2.53	11/30/99 17:28	11/30/99 17:39	11/30/99 17:50	11/30/99 18:08	1.12	11/30/99 19:15	1.40								
2.52	11/30/99 19:59	11/30/99 20:10	11/30/99 20:21	11/30/99 20:39	1.11	11/30/99 21:46	1.39								
2.50	11/30/99 22:31	11/30/99 22:42	11/30/99 22:52	11/30/99 23:10	1.10	12/1/99 0:17	1.38								
2.48	12/1/99 1:00	12/1/99 1:11	12/1/99 1:23	12/1/99 1:41	1.09	12/1/99 2:46	1.37								
2.47	12/1/99 3:30	12/1/99 3:41	12/1/99 3:52	12/1/99 4:10	1.09	12/1/99 5:16	1.36								
2.45	12/1/99 5:58	12/1/99 6:09	12/1/99 6:21	12/1/99 6:39	1.08	12/1/99 7:44	1.35								
2.43	12/1/99 8:25	12/1/99 8:36	12/1/99 8:48	12/1/99 9:06	1.07	12/1/99 10:10	1.34								
2.41	12/1/99 10:50	12/1/99 11:02	12/1/99 11:13	12/1/99 11:31	1.06	12/1/99 12:35	1.32								
2.38	12/1/99 13:14	12/1/99 13:26	12/1/99 13:37	12/1/99 13:55	1.05	12/1/99 14:58	1.31								
2.36	12/1/99 15:36	12/1/99 15:48	12/1/99 16:00	12/1/99 16:18	1.04	12/1/99 17:20	1.30								
2.34	12/1/99 17:59	12/1/99 18:11	12/1/99 18:23	12/1/99 18:41	1.03	12/1/99 19:42	1.29								
2.32	12/1/99 20:18	12/1/99 20:30	12/1/99 20:43	12/1/99 21:01	1.02	12/1/99 22:02	1.27								
2.30	12/1/99 22:37	12/1/99 22:49	12/1/99 23:01	12/1/99 23:19	1.01	12/2/99 0:20	1.26								
2.28	12/2/99 0:55	12/2/99 1:07	12/2/99 1:19	12/2/99 1:37	1.00	12/2/99 2:37	1.25								
2.25	12/2/99 3:11	12/2/99 3:24	12/2/99 3:36	12/2/99 3:54	0.99	12/2/99 4:54	1.24								
2.23	12/2/99 5:25	12/2/99 5:38	12/2/99 5:50	12/2/99 6:08	0.98	12/2/99 7:07	1.23								
2.22	12/2/99 7:39	12/2/99 7:52	12/2/99 8:04	12/2/99 8:22	0.98	12/2/99 9:21	1.22								
2.20	12/2/99 9:53	12/2/99 10:06	12/2/99 10:18	12/2/99 10:36	0.97	12/2/99 11:34	1.21								
2.18	12/2/99 12:04	12/2/99 12:17	12/2/99 12:30	12/2/99 12:48	0.96	12/2/99 13:45	1.20								
2.16	12/2/99 14:14	12/2/99 14:28	12/2/99 14:41	12/2/99 14:59	0.95	12/2/99 15:56	1.19								
2.14	12/2/99 16:24	12/2/99 16:37	12/2/99 16:51	12/2/99 17:09	0.94	12/2/99 18:05	1.18								
2.12	12/2/99 18:32	12/2/99 18:45	12/2/99 18:59	12/2/99 19:17	0.50	12/2/99 19:47	0.63								
2.10	12/2/99 20:38	12/2/99 20:52	12/2/99 21:06	12/2/99 21:24	0.50	12/2/99 21:54	0.63								
2.09	12/2/99 22:45	12/2/99 22:59	12/2/99 23:13	12/2/99 23:31	0.50	12/3/99 0:01	0.63								
2.07	12/3/99 0:50	12/3/99 1:04	12/3/99 1:18	12/3/99 1:36	0.50	12/3/99 2:06	0.63								
2.05	12/3/99 2:54	12/3/99 3:08	12/3/99 3:22	12/3/99 3:40	0.50	12/3/99 4:10	0.63								
2.03	12/3/99 4:56	12/3/99 5:10	12/3/99 5:25	12/3/99 5:43	0.50	12/3/99 6:13	0.63								
2.01	12/3/99 6:58	12/3/99 7:13	12/3/99 7:28	12/3/99 7:46	0.50	12/3/99 8:16	0.63								
1.99	12/3/99 8:57	12/3/99 9:12	12/3/99 9:28	12/3/99 9:46	0.50	12/3/99 10:16	0.63								
1.97	12/3/99 10:56	12/3/99 11:12	12/3/99 11:27	12/3/99 11:45	0.50	12/3/99 12:15	0.63								

6/24/97

Tracking Schedule - close LP

period	Start	Periapse	End	Start	Track 1 duration	End	Off 1 duration	Start	Track 2 duration	End	Off 2 duration	Start	Track3 duration	End	Off 3 duration
h	Aeropass		Aeropass	Track 1 [post peri]	h	Track 1	h	Track 2	h	Track 2	h	Track 3	h	Track 3	h
1.95	12/3/99 12:54	12/3/99 13:10	12/3/99 13:26	12/3/99 13:44	0.50	12/3/99 14:14	0.63								
1.95	12/3/99 14:50	12/3/99 15:06	12/3/99 15:23	12/3/99 15:41	0.50	12/3/99 16:11	0.63								
1.94	12/3/99 16:47	12/3/99 17:03	12/3/99 17:20	12/3/99 17:38	0.50	12/3/99 18:08	0.63								
1.94	12/3/99 18:45	12/3/99 19:01	12/3/99 19:18	12/3/99 19:36	0.50	12/3/99 20:06	0.63								
1.93	12/3/99 20:41	12/3/99 20:58	12/3/99 21:15	12/3/99 21:33	0.50	12/3/99 22:03	0.63								
1.92	12/3/99 22:36	12/3/99 22:53	12/3/99 23:10	12/3/99 23:28	0.50	12/3/99 23:58	0.63								
1.92	12/4/99 0:33	12/4/99 0:50	12/4/99 1:07	12/4/99 1:25	0.50	12/4/99 1:55	0.63								
1.91	12/4/99 2:28	12/4/99 2:45	12/4/99 3:02	12/4/99 3:20	0.50	12/4/99 3:50	0.63								
1.90	12/4/99 4:23	12/4/99 4:40	12/4/99 4:58	12/4/99 5:16	0.50	12/4/99 5:46	0.63								
1.90	12/4/99 6:16	12/4/99 6:34	12/4/99 6:52	12/4/99 7:10	0.50	12/4/99 7:40	0.63								
1.89	12/4/99 8:08	12/4/99 8:28	12/4/99 8:47	12/4/99 9:05	0.50	12/4/99 9:35	0.63								
1.88	12/4/99 10:02	12/4/99 10:21	12/4/99 10:41	12/4/99 10:59	0.50	12/4/99 11:29	0.63								
1.87	12/4/99 11:55	12/4/99 12:15	12/4/99 12:35	12/4/99 12:53	0.50	12/4/99 13:23	0.63								
1.87	12/4/99 13:45	12/4/99 14:07	12/4/99 14:30	12/4/99 14:48	0.50	12/4/99 15:18	0.63								
1.86	12/4/99 15:38	12/4/99 16:00	12/4/99 16:22	12/4/99 16:40	0.50	12/4/99 17:10	0.63								
1.85	12/4/99 17:30	12/4/99 17:52	12/4/99 18:14	12/4/99 18:32	0.50	12/4/99 19:02	0.63								

A.6 Orbiter Post-Arrival Trajectory Characteristics

A.6.1 Solar Time and Eclipse Durations During Mission

Shown are solar time variations and eclipse durations during the mission, for three different cases.

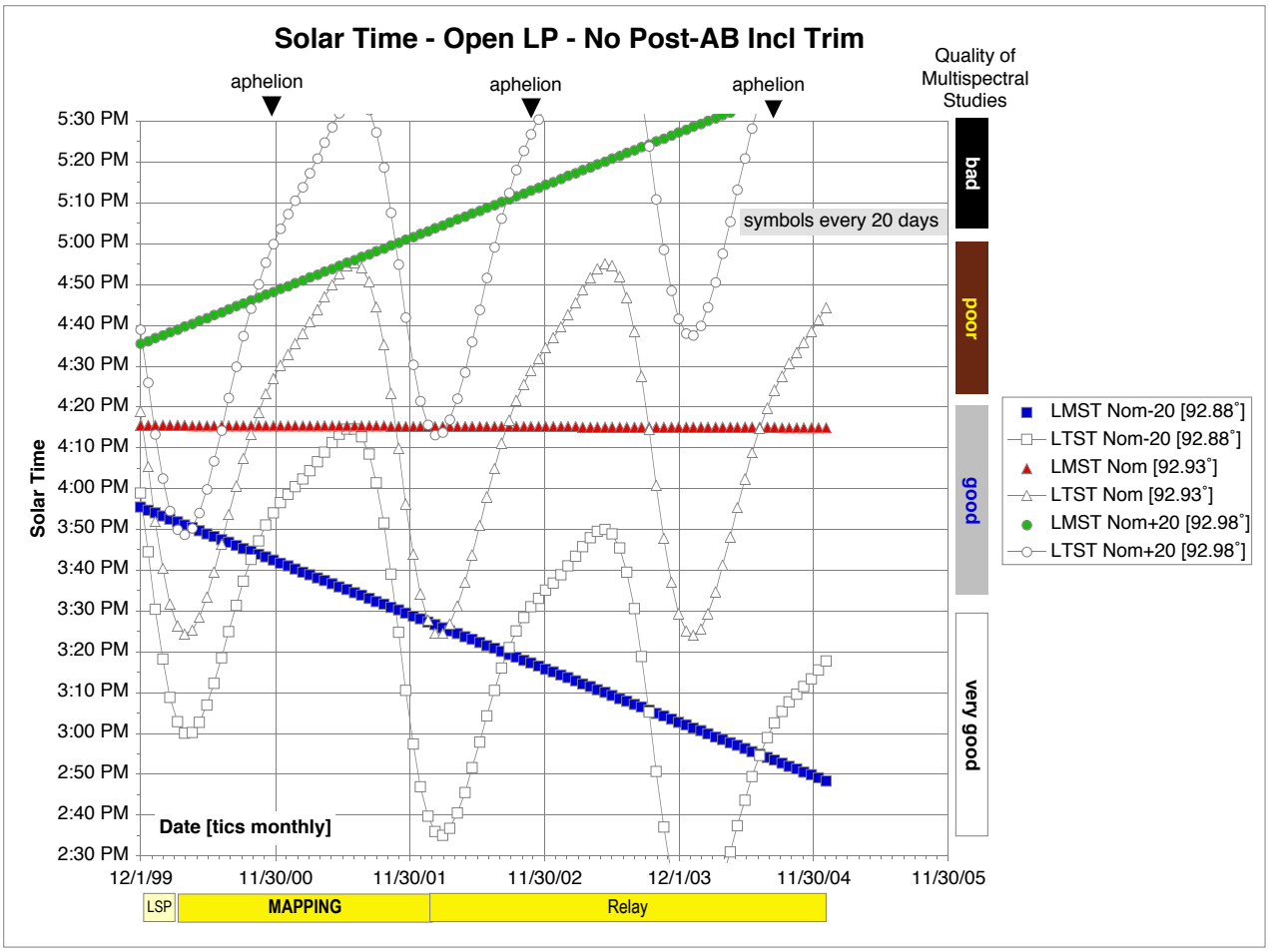
Case 1: No Post-Aerobraking Inclination Trim: assumes that approximately ±0.05˚ in inclination dispersion remains after aerobraking. This is consistent with the currently baselined ΔV budget. The combined effect of this inclination error and the ±20 minute aerobraking end node uncertainty, leads to the "worst case" profiles of solar times and eclipse durations illustrated. As shown, an early final node [Nominal - 20 minutes] combined with a final inclination 0.05˚ less than the targeted 92.93˚ leads to an orbit which drifts later in local mean solar time. The illustrated sun-drifter to early solar times occurs for a late final node [Nominal + 20 minutes], combined with a final inclination 0.05˚ higher than targeted.

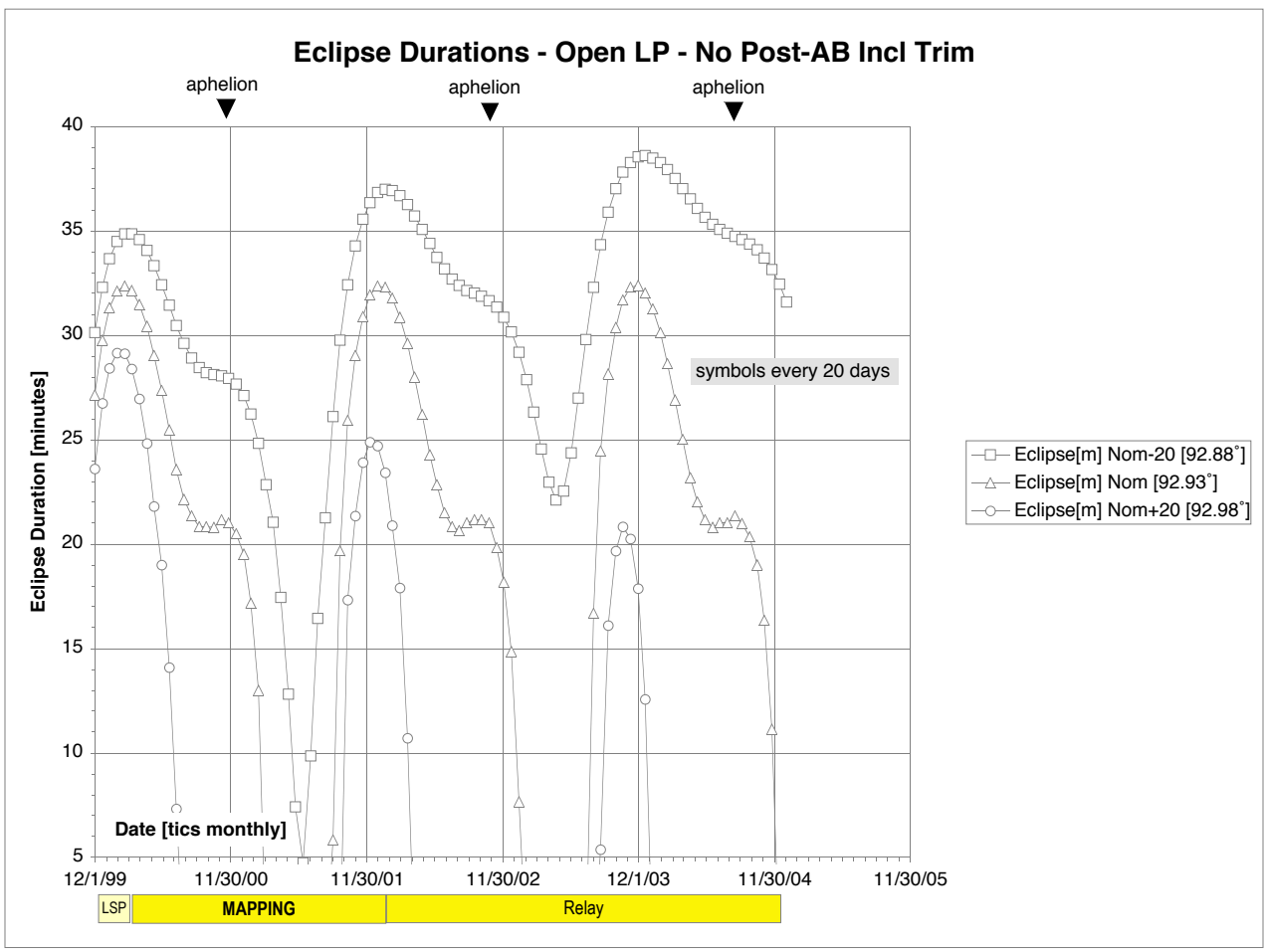
Case 2: Max Post-Aerobraking Inclination Trim of 0.05˚: assumes that additional ΔV has been allocated to adjust the final inclination by as much as 0.05˚. In this case, the orbit is always sun-synchronous, but at different local mean solar times, depending on the aerobraking end node. Maximum ΔV required for this adjustment is approximately 5-7 m/s if done as part of TMO-1, or 3 m/s if done as a separate maneuver at the node.

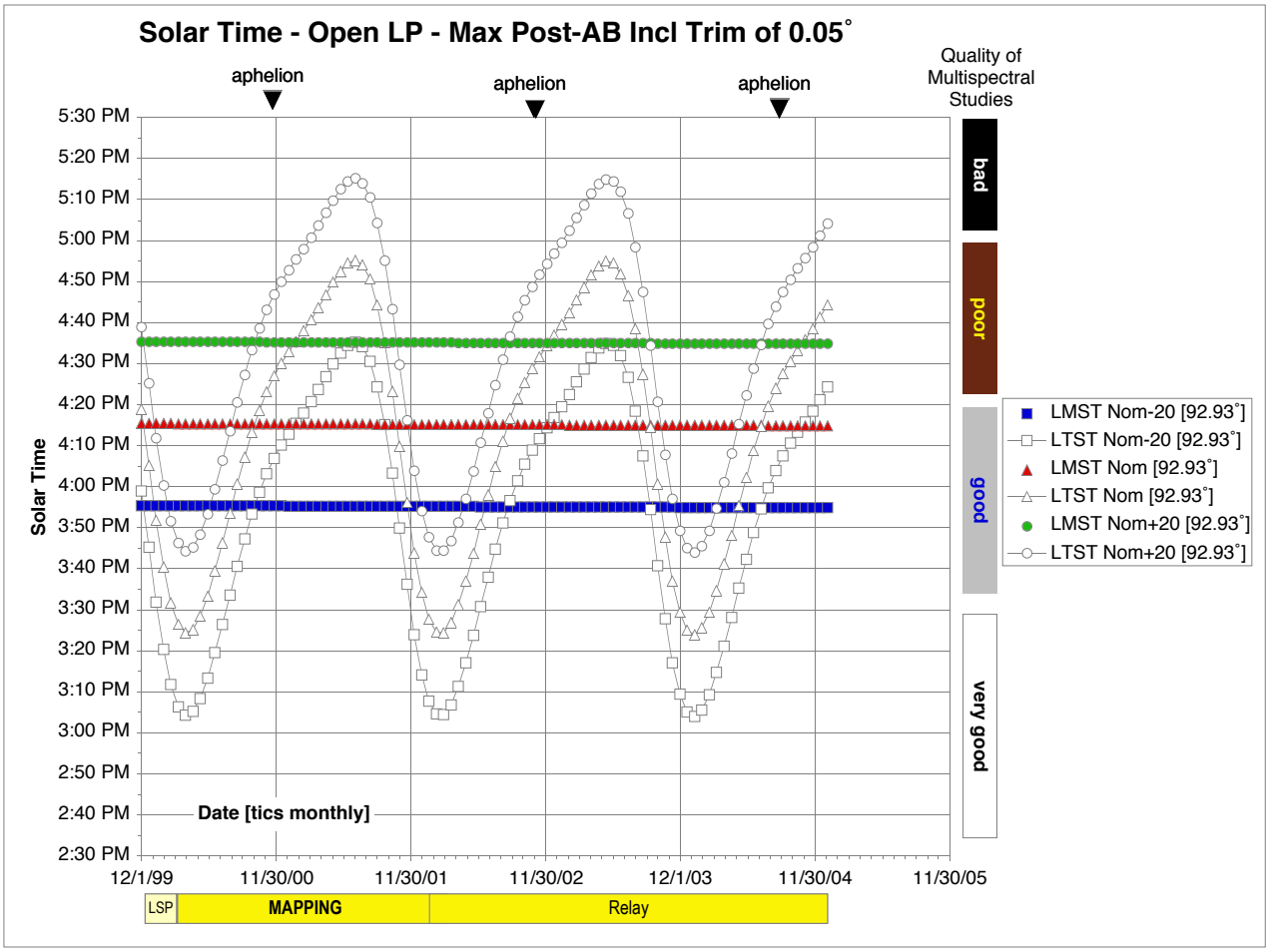
Case 3: Max Post-Aerobraking Inclination Trim of 0.1˚: assumes that additional ΔV has been allocated to adjust the final inclination by as much as 0.1˚. This allows the mapping orbit initial state to be adjusted to prevent very late solar times [bad for science] and very early solar times [bad for energy balance] during the mapping mission. Maximum ΔV required for this adjustment is approximately 6 m/s if done as a separate maneuver at the node.

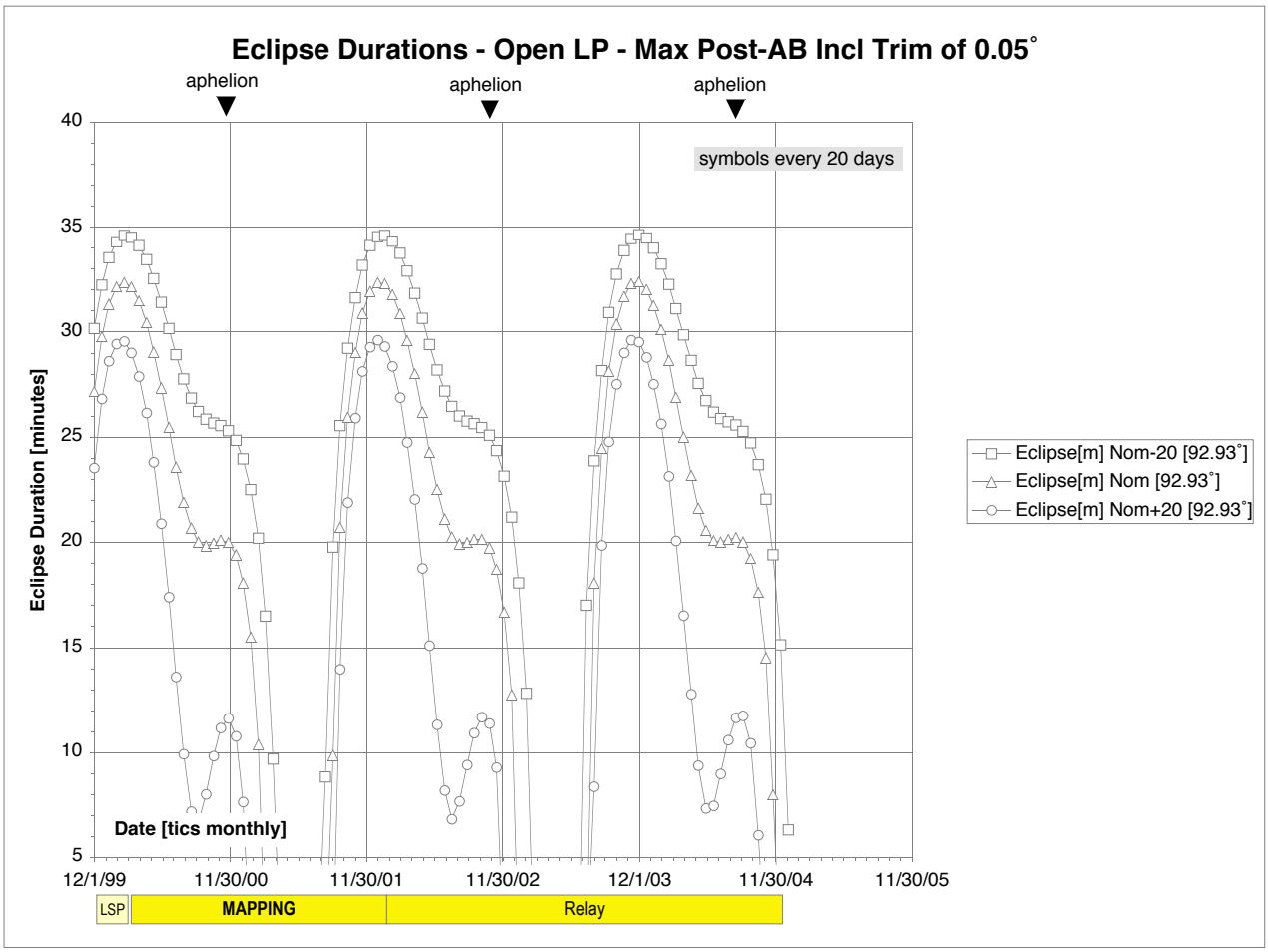
A.6.2 Frozen Orbit Characteristics

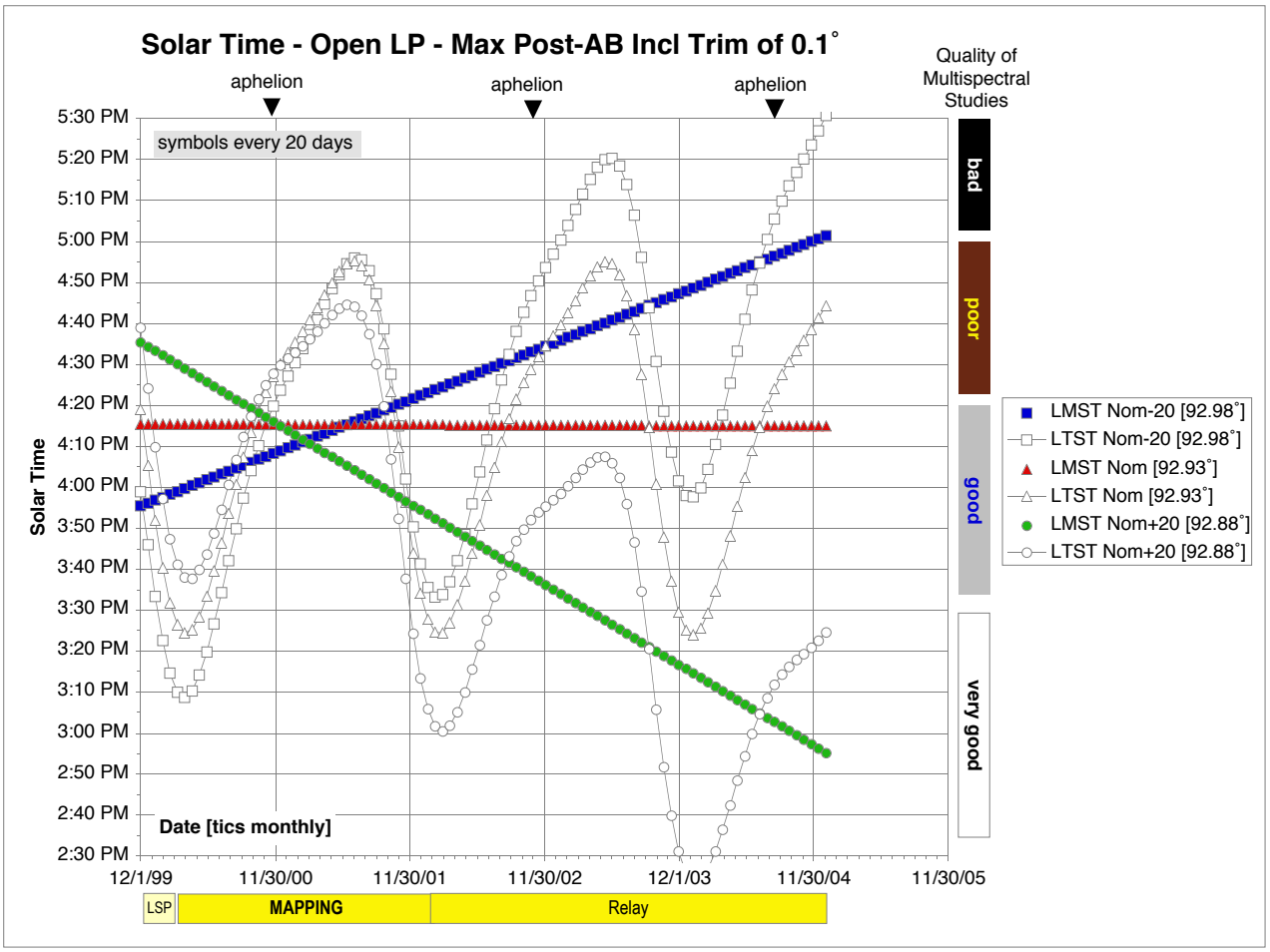
A.6.3 Post-Arrival Planetary Geometry

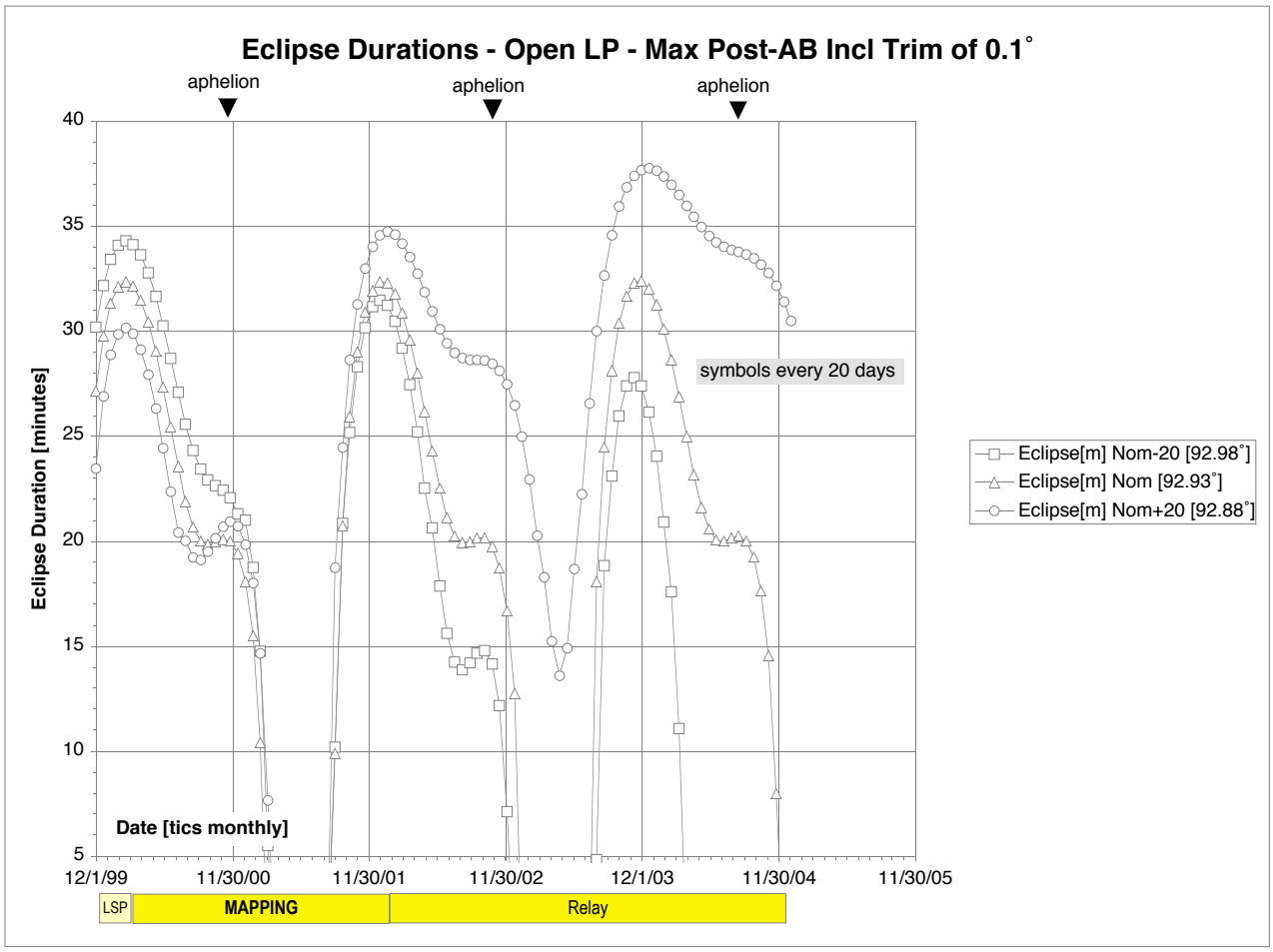

Solar Time - Open LP - No Post-AB Incl Trim
aphelion
aphelion
aphelion
Quality of Multispectral Studies
bad
poor
good
very good
symbols every 20 days
Solar Time
5:30 PM
5:20 PM
5:10 PM
5:00 PM
4:50 PM
4:40 PM
4:30 PM
4:20 PM
4:10 PM
4:00 PM
3:50 PM
3:40 PM
3:30 PM
3:20 PM
3:10 PM
3:00 PM
2:50 PM
2:40 PM
2:30 PM
Date [tics monthly]
12/1/99
11/30/00
11/30/01
11/30/02
12/1/03
11/30/04
11/30/05
LSP
MAPPING
Relay
LMST Nom-20 [92.88˚]
LTST Nom-20 [92.88˚]
LMST Nom [92.93˚]
LTST Nom [92.93˚]
LMST Nom+20 [92.98˚]
LTST Nom+20 [92.98˚]

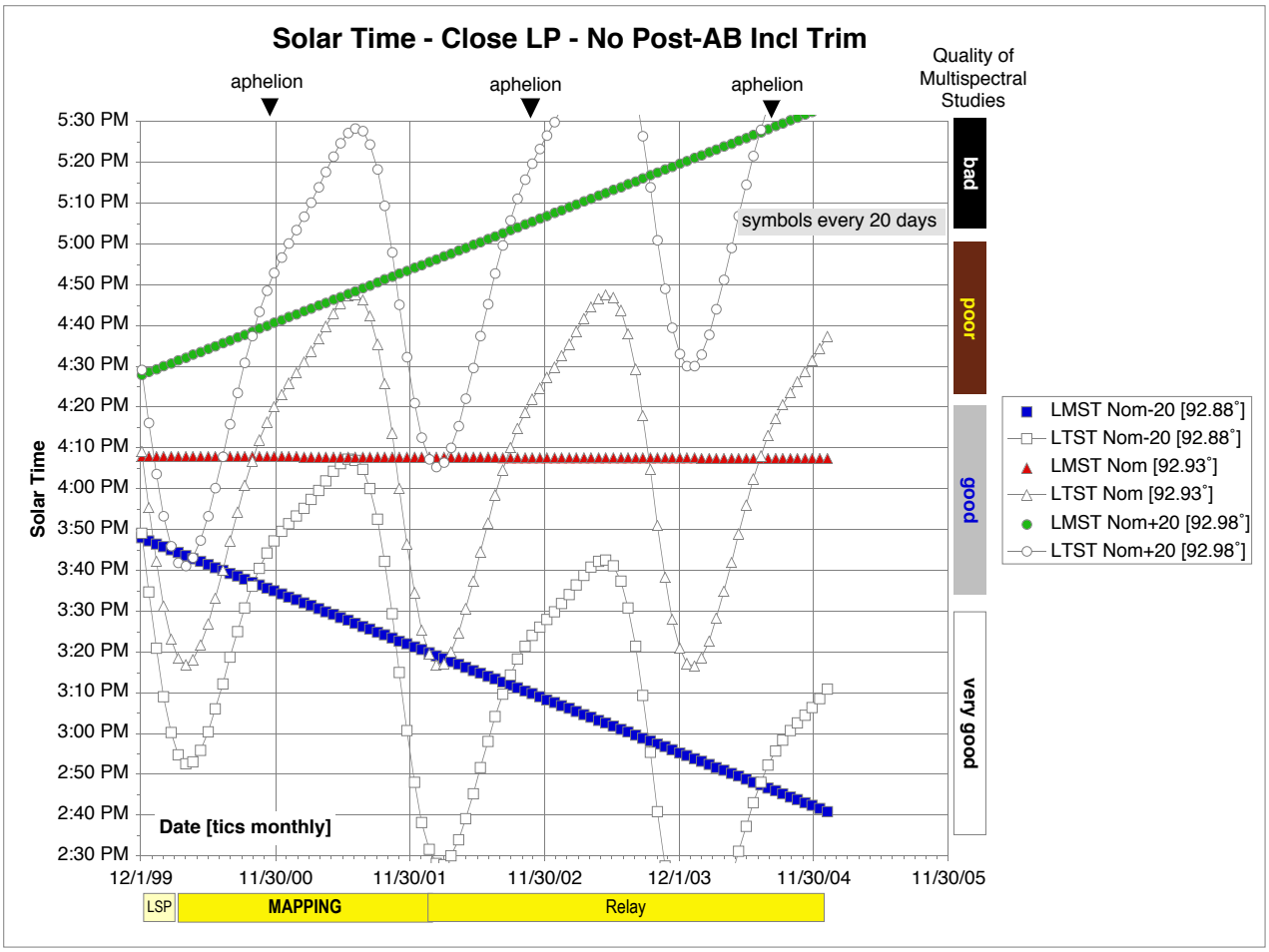

Eclipse Durations - Open LP - No Post-AB Incl Trim
aphelion
aphelion
aphelion
symbols every 20 days
Eclipse Duration [minutes]
40
35
30
25
20
15
10
5
Date [tics monthly]
12/1/99
11/30/00
11/30/01
11/30/02
12/1/03
11/30/04
11/30/05
LSP
MAPPING
Relay
Eclipse[m] Nom-20 [92.88˚]
Eclipse[m] Nom [92.93˚]
Eclipse[m] Nom+20 [92.98˚]

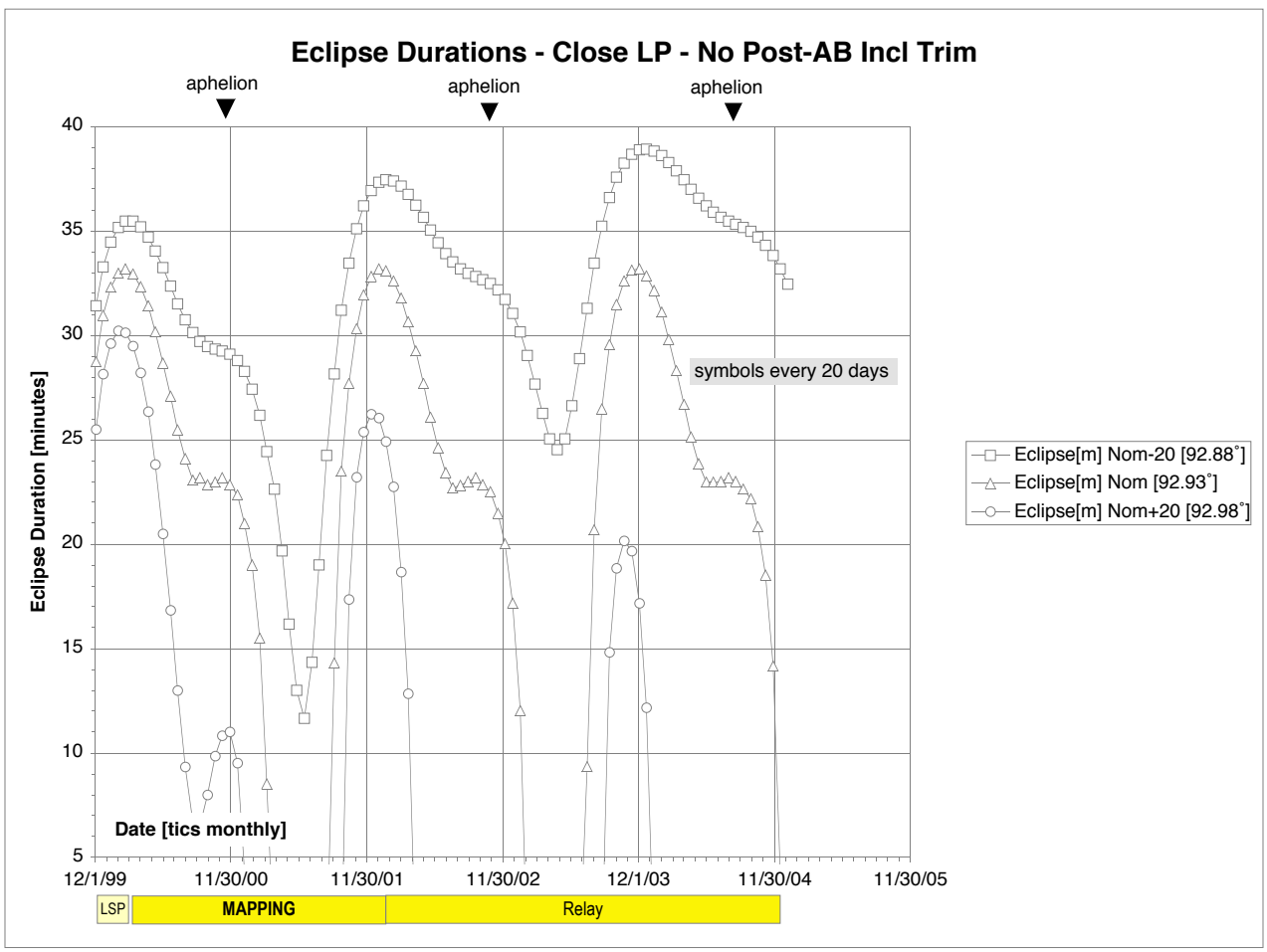

Solar Time - Open LP - Max Post-AB Incl Trim of 0.05˚
aphelion
aphelion
aphelion
Quality of Multispectral Studies
bad
poor
good
very good
5:30 PM
5:20 PM
5:10 PM
5:00 PM
4:50 PM
4:40 PM
4:30 PM
4:20 PM
4:10 PM
4:00 PM
3:50 PM
3:40 PM
3:30 PM
3:20 PM
3:10 PM
3:00 PM
2:50 PM
2:40 PM
2:30 PM
Solar Time
Date [tics monthly]
12/1/99
11/30/00
11/30/01
11/30/02
12/1/03
11/30/04
11/30/05
LSP
MAPPING
Relay
LMST Nom-20 [92.93˚]
LTST Nom-20 [92.93˚]
LMST Nom [92.93˚]
LTST Nom [92.93˚]
LMST Nom+20 [92.93˚]
LTST Nom+20 [92.93˚]

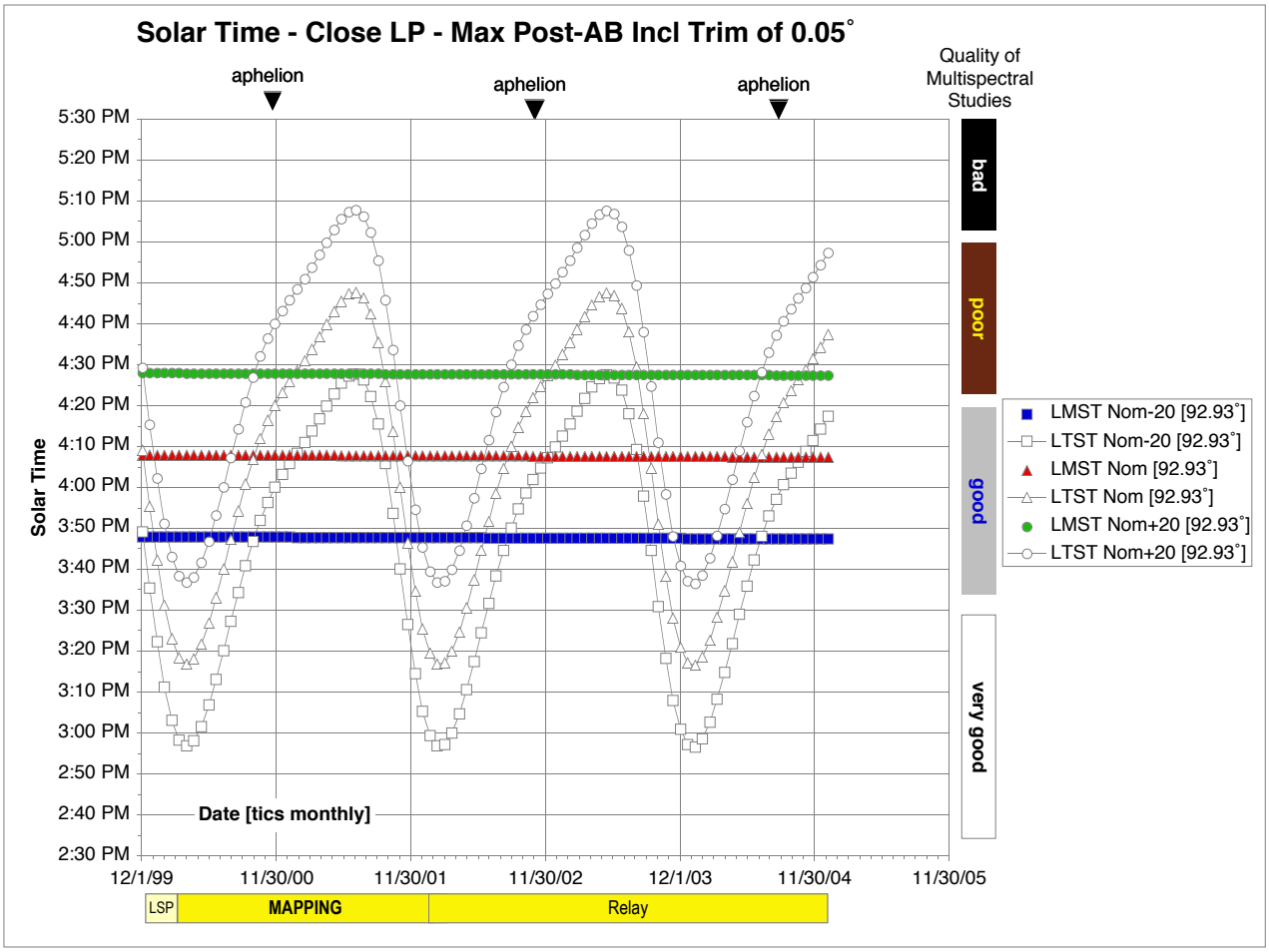

Eclipse Durations - Open LP - Max Post-AB Incl Trim of 0.05˚
aphelion
aphelion
aphelion
symbols every 20 days
40
35
30
25
20
15
10
5
Eclipse Duration [minutes]
Date [tics monthly]
12/1/99
11/30/00
11/30/01
11/30/02
12/1/03
11/30/04
11/30/05
LSP
MAPPING
Relay
Eclipse[m] Nom-20 [92.93˚]
Eclipse[m] Nom [92.93˚]
Eclipse[m] Nom+20 [92.93˚]

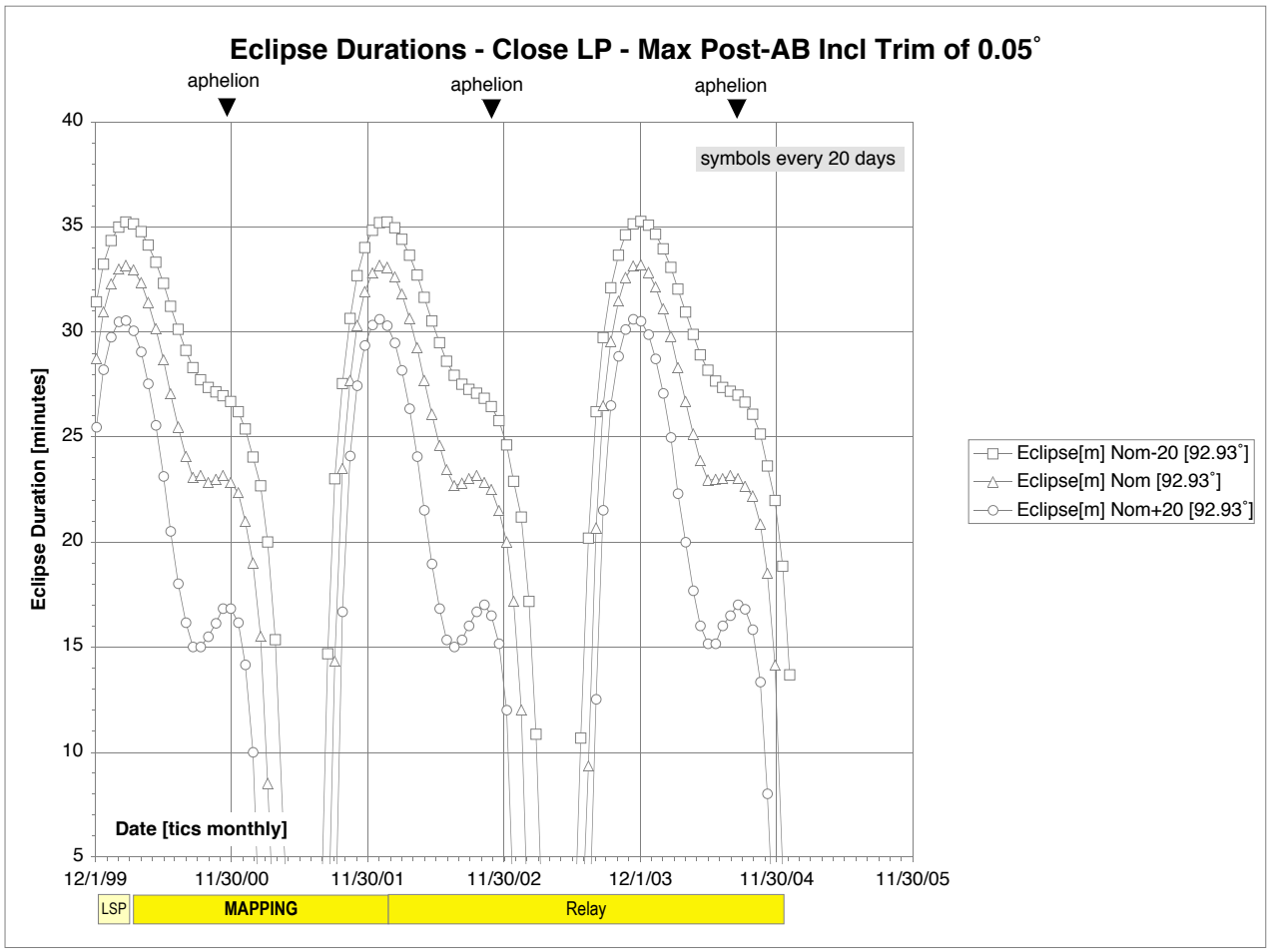

Solar Time - Open LP - Max Post-AB Incl Trim of 0.1˚
aphelion
aphelion
aphelion
Quality of Multispectral Studies
bad
poor
good
very good
symbols every 20 days
Solar Time
5:30 PM
5:20 PM
5:10 PM
5:00 PM
4:50 PM
4:40 PM
4:30 PM
4:20 PM
4:10 PM
4:00 PM
3:50 PM
3:40 PM
3:30 PM
3:20 PM
3:10 PM
3:00 PM
2:50 PM
2:40 PM
2:30 PM
Date [tics monthly]
12/1/99
11/30/00
11/30/01
11/30/02
12/1/03
11/30/04
11/30/05
LSP
MAPPING
Relay
LMST Nom-20 [92.98˚]
LTST Nom-20 [92.98˚]
LMST Nom [92.93˚]
LTST Nom [92.93˚]
LMST Nom+20 [92.88˚]
LTST Nom+20 [92.88˚]

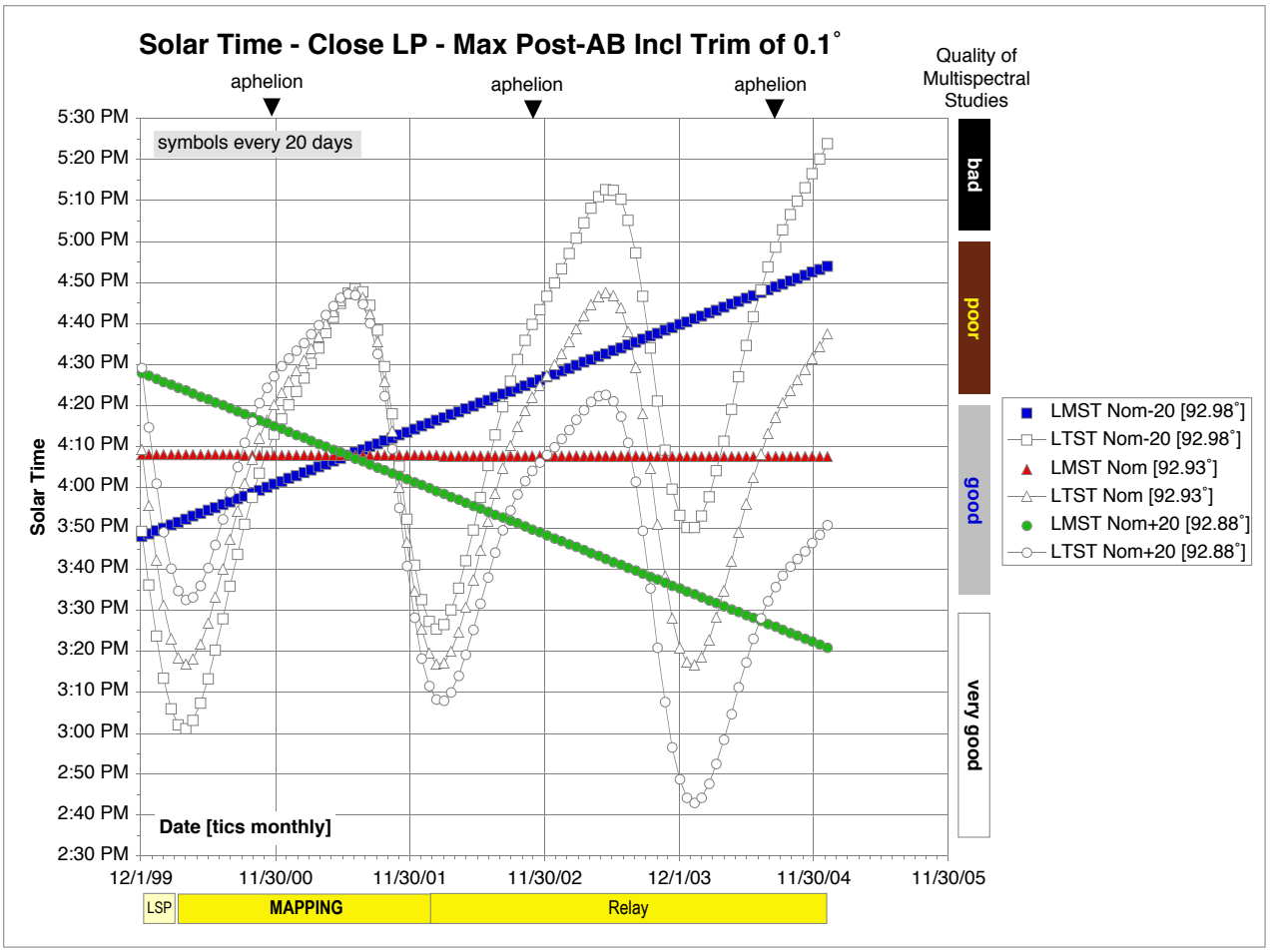

Eclipse Durations - Open LP - Max Post-AB Incl Trim of 0.1˚
aphelion
aphelion
aphelion
symbols every 20 days
Eclipse Duration [minutes]
40
35
30
25
20
15
10
5
Date [tics monthly]
12/1/99
11/30/00
11/30/01
11/30/02
12/1/03
11/30/04
11/30/05
LSP
MAPPING
Relay
Eclipse[m] Nom-20 [92.98˚]
Eclipse[m] Nom [92.93˚]
Eclipse[m] Nom+20 [92.88˚]

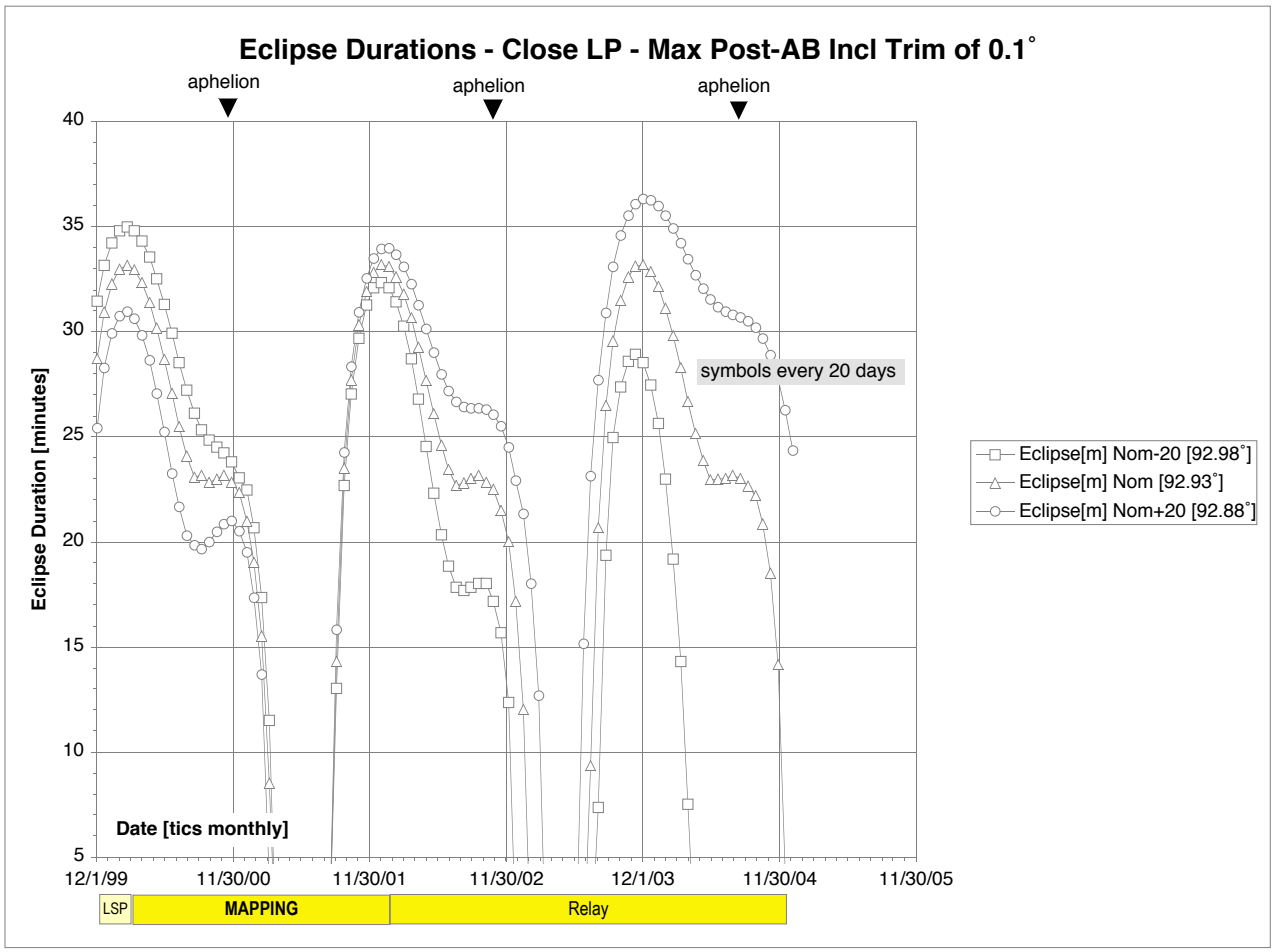

Solar Time - Close LP - No Post-AB Incl Trim
aphelion
aphelion
aphelion
Quality of Multispectral Studies
bad
poor
good
very good
symbols every 20 days
Solar Time
5:30 PM
5:20 PM
5:10 PM
5:00 PM
4:50 PM
4:40 PM
4:30 PM
4:20 PM
4:10 PM
4:00 PM
3:50 PM
3:40 PM
3:30 PM
3:20 PM
3:10 PM
3:00 PM
2:50 PM
2:40 PM
2:30 PM
Date [tics monthly]
12/1/99
11/30/00
11/30/01
11/30/02
12/1/03
11/30/04
11/30/05
LSP
MAPPING
Relay
LMST Nom-20 [92.88˚]
LTST Nom-20 [92.88˚]
LMST Nom [92.93˚]
LTST Nom [92.93˚]
LMST Nom+20 [92.98˚]
LTST Nom+20 [92.98˚]

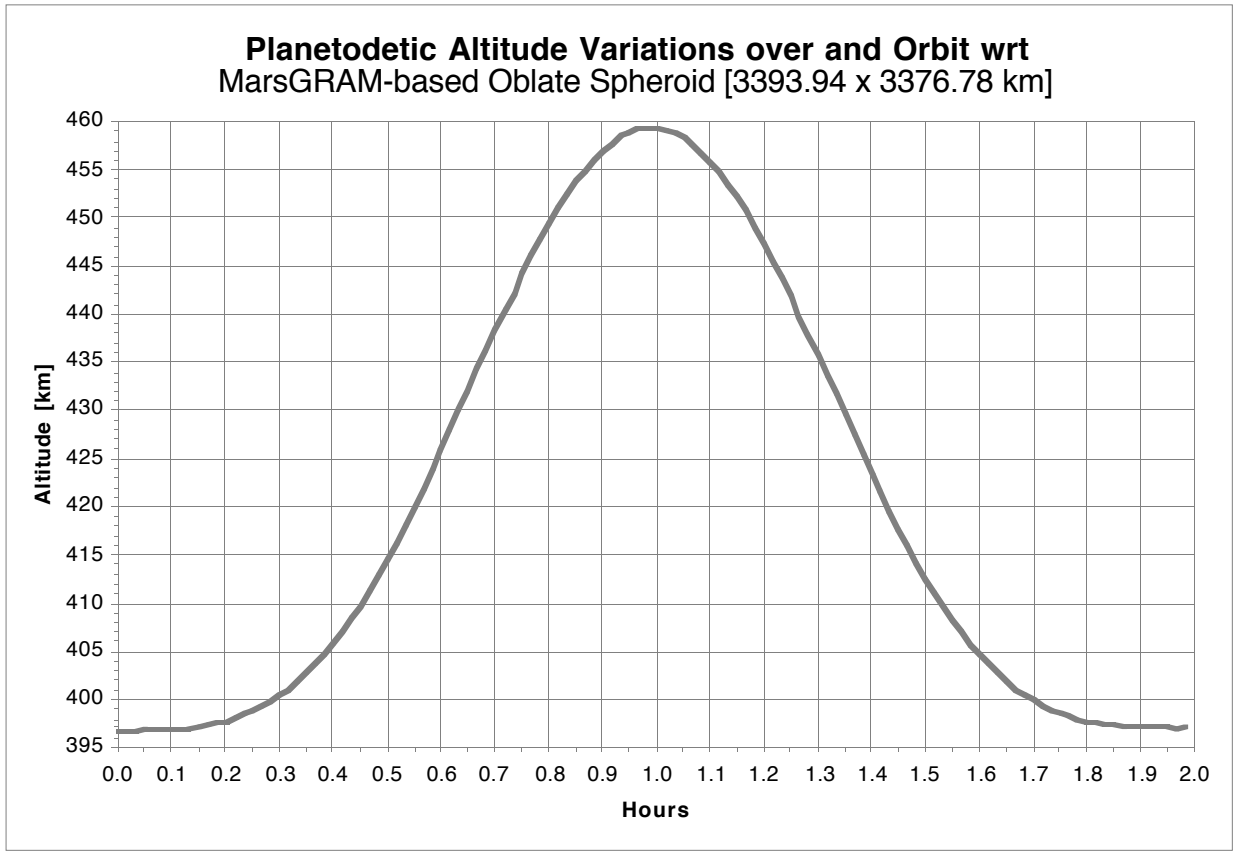

Eclipse Durations - Close LP - No Post-AB Incl Trim
aphelion
aphelion
aphelion
symbols every 20 days
Eclipse Duration [minutes]
40
35
30
25
20
15
10
5
Date [tics monthly]
12/1/99
11/30/00
11/30/01
11/30/02
12/1/03
11/30/04
11/30/05
LSP
MAPPING
Relay
Eclipse[m] Nom-20 [92.88˚]
Eclipse[m] Nom [92.93˚]
Eclipse[m] Nom+20 [92.98˚]


Solar Time - Close LP - Max Post-AB Incl Trim of 0.05˚
aphelion
aphelion
aphelion
Quality of Multispectral Studies
bad
poor
good
very good
Solar Time
5:30 PM
5:20 PM
5:10 PM
5:00 PM
4:50 PM
4:40 PM
4:30 PM
4:20 PM
4:10 PM
4:00 PM
3:50 PM
3:40 PM
3:30 PM
3:20 PM
3:10 PM
3:00 PM
2:50 PM
2:40 PM
2:30 PM
Date [tics monthly]
12/1/99
11/30/00
11/30/01
11/30/02
12/1/03
11/30/04
11/30/05
LSP
MAPPING
Relay
LMST Nom-20 [92.93˚]
LTST Nom-20 [92.93˚]
LMST Nom [92.93˚]
LTST Nom [92.93˚]
LMST Nom+20 [92.93˚]
LTST Nom+20 [92.93˚]


Eclipse Durations - Close LP - Max Post-AB Incl Trim of 0.05˚
aphelion
aphelion
aphelion
symbols every 20 days
Eclipse Duration [minutes]
40
35
30
25
20
15
10
5
Date [tics monthly]
12/1/99
11/30/00
11/30/01
11/30/02
12/1/03
11/30/04
11/30/05
LSP
MAPPING
Relay
Eclipse[m] Nom-20 [92.93˚]
Eclipse[m] Nom [92.93˚]
Eclipse[m] Nom+20 [92.93˚]

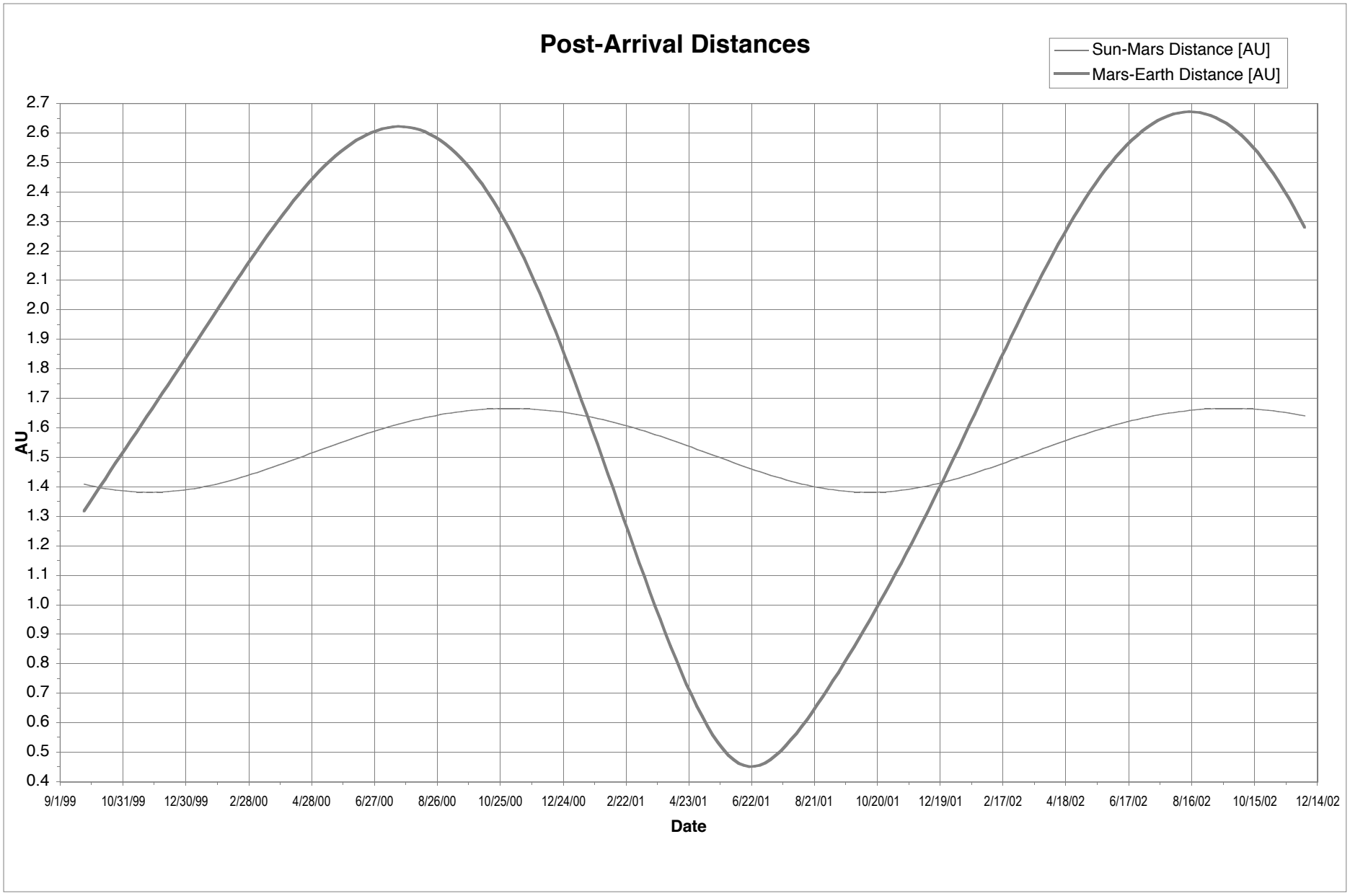

Solar Time - Close LP - Max Post-AB Incl Trim of 0.1˚
aphelion
aphelion
aphelion
Quality of Multispectral Studies
bad
poor
good
very good
symbols every 20 days
Solar Time
5:30 PM
5:20 PM
5:10 PM
5:00 PM
4:50 PM
4:40 PM
4:30 PM
4:20 PM
4:10 PM
4:00 PM
3:50 PM
3:40 PM
3:30 PM
3:20 PM
3:10 PM
3:00 PM
2:50 PM
2:40 PM
2:30 PM
Date [tics monthly]
12/1/99
11/30/00
11/30/01
11/30/02
12/1/03
11/30/04
11/30/05
LSP
MAPPING
Relay
LMST Nom-20 [92.98˚]
LTST Nom-20 [92.98˚]
LMST Nom [92.93˚]
LTST Nom [92.93˚]
LMST Nom+20 [92.88˚]
LTST Nom+20 [92.88˚]


Eclipse Durations - Close LP - Max Post-AB Incl Trim of 0.1˚
aphelion
aphelion
aphelion
symbols every 20 days
Eclipse Duration [minutes]
40
35
30
25
20
15
10
5
Date [tics monthly]
12/1/99
11/30/00
11/30/01
11/30/02
12/1/03
11/30/04
11/30/05
LSP
MAPPING
Relay
Eclipse[m] Nom-20 [92.98˚]
Eclipse[m] Nom [92.93˚]
Eclipse[m] Nom+20 [92.88˚]



Ranges		Δ from Mean	
Minimum Alt.	397	-24	km
Mean Alt.	421	0	km
Maximum Alt.	459	38	km

FROZEN ORBIT PLANETODETIC ALTITUDE VARIATIONS


Post-Arrival Distances
Sun-Mars Distance [AU]
Mars-Earth Distance [AU]
AU
2.7
2.6
2.5
2.4
2.3
2.2
2.1
2.0
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
9/1/99
10/31/99
12/30/99
2/28/00
4/28/00
6/27/00
8/26/00
10/25/00
12/24/00
2/22/01
4/23/01
6/22/01
8/21/01
10/20/01
12/19/01
2/17/02
4/18/02
6/17/02
8/16/02
10/15/02
12/14/02
Date

Date	Days from Earliest MOI	Days from Start of Mapping	Sun-Mars Distance [AU]	Mars-Earth Distance [AU]	ESM [deg.]	SEM [deg.]	SME [deg.]	Events
9/24/99	1		1.4085	1.3173	63.6326	73.3347	43.0327	Orbiter MOI
9/29/99	6		1.4045	1.3447	65.4709	71.8521	42.6770	
10/4/99	11		1.4008	1.3718	67.3062	70.4061	42.2877	
10/9/99	16		1.3974	1.3988	69.1398	68.9929	41.8673	
10/14/99	21		1.3943	1.4256	70.9729	67.6092	41.4179	
10/19/99	26		1.3915	1.4523	72.8070	66.2519	40.9411	
10/24/99	31		1.3891	1.4789	74.6431	64.9181	40.4389	
10/29/99	36		1.3869	1.5055	76.4825	63.6049	39.9126	
11/3/99	41		1.3852	1.5320	78.3264	62.3100	39.3636	
11/8/99	46		1.3837	1.5584	80.1758	61.0309	38.7933	
11/13/99	51		1.3826	1.5849	82.0318	59.7654	38.2027	
11/18/99	56		1.3819	1.6114	83.8954	58.5115	37.5930	
11/23/99	61		1.3815	1.6379	85.7674	57.2674	36.9652	
11/28/99	66		1.3815	1.6644	87.6486	56.0312	36.3202	Perihelion
12/3/99	71		1.3819	1.6910	89.5398	54.8014	35.6588	Lander Arrival
12/8/99	76		1.3826	1.7177	91.4416	53.5765	34.9819	
12/13/99	81		1.3837	1.7445	93.3545	52.3552	34.2903	
12/18/99	86		1.3851	1.7713	95.2790	51.1363	33.5847	
12/23/99	91		1.3869	1.7983	97.2155	49.9187	32.8658	
12/28/99	96		1.3890	1.8253	99.1642	48.7015	32.1343	
1/2/00	101		1.3915	1.8523	101.1254	47.4837	31.3909	
1/7/00	106		1.3942	1.8794	103.0992	46.2647	30.6361	
1/12/00	111		1.3973	1.9066	105.0855	45.0438	29.8707	
1/17/00	116		1.4008	1.9338	107.0845	43.8204	29.0951	
1/22/00	121		1.4045	1.9609	109.0960	42.5941	28.3099	
1/27/00	126		1.4084	1.9881	111.1198	41.3644	27.5157	
2/1/00	131		1.4127	2.0152	113.1559	40.1311	26.7130	
2/6/00	136		1.4172	2.0422	115.2039	38.8938	25.9023	
2/11/00	141		1.4220	2.0692	117.2637	37.6524	25.0840	
2/16/00	146		1.4269	2.0959	119.3349	36.4066	24.2585	
2/21/00	151		1.4321	2.1225	121.4174	35.1562	23.4264	
2/26/00	156		1.4375	2.1489	123.5107	33.9013	22.5880	
3/2/00	161	1	1.4431	2.1750	125.6148	32.6415	21.7437	End Lander Mission; Start Mapping
3/7/00	166	6	1.4488	2.2008	127.7293	31.3770	20.8938	
3/12/00	171	11	1.4547	2.2263	129.8539	30.1074	20.0387	
3/17/00	176	16	1.4607	2.2514	131.9885	28.8328	19.1787	
3/22/00	181	21	1.4669	2.2760	134.1328	27.5531	18.3141	
3/27/00	186	26	1.4731	2.3002	136.2868	26.2680	17.4451	
4/1/00	191	31	1.4795	2.3239	138.4503	24.9776	16.5721	
4/6/00	196	36	1.4859	2.3469	140.6233	23.6816	15.6951	
4/11/00	201	41	1.4923	2.3694	142.8056	22.3798	14.8145	
4/16/00	206	46	1.4988	2.3912	144.9974	21.0721	13.9305	
4/21/00	211	51	1.5054	2.4123	147.1986	19.7583	13.0431	
4/26/00	216	56	1.5119	2.4327	149.4093	18.4381	12.1526	
5/1/00	221	61	1.5184	2.4522	151.6296	17.1112	11.2592	
5/6/00	226	66	1.5249	2.4709	153.8596	15.7775	10.3629	
5/11/00	231	71	1.5314	2.4887	156.0994	14.4366	9.4640	
5/16/00	236	76	1.5379	2.5056	158.3493	13.0882	8.5625	
5/21/00	241	81	1.5443	2.5215	160.6091	11.7322	7.6587	
5/26/00	246	86	1.5506	2.5364	162.8788	10.3683	6.7529	
5/31/00	251	91	1.5568	2.5502	165.1582	8.9965	5.8453	
6/5/00	256	96	1.5630	2.5629	167.4464	7.6172	4.9365	
6/10/00	261	101	1.5690	2.5744	169.7415	6.2311	4.0274	
6/15/00	266	106	1.5750	2.5848	172.0389	4.8410	3.1201	
6/20/00	271	111	1.5808	2.5939	174.3257	3.4544	2.2199	
6/25/00	276	116	1.5864	2.6018	176.5531	2.1010	1.3460	
6/30/00	281	121	1.5920	2.6084	178.3783	0.9897	0.6320	
7/5/00	286	126	1.5974	2.6137	177.8429	1.3181	0.8389	
7/10/00	291	131	1.6026	2.6175	175.7372	2.6084	1.6544	
7/15/00	296	136	1.6077	2.6200	173.4108	4.0377	2.5516	
7/20/00	301	141	1.6126	2.6211	171.0203	5.5105	3.4692	Max Earth Dist
7/25/00	306	146	1.6173	2.6207	168.5950	7.0094	4.3956	
7/30/00	311	151	1.6218	2.6188	166.1434	8.5294	5.3271	

Date	Days from Earliest MOI	Days from Start of Mapping	Sun-Mars Distance [AU]	Mars-Earth Distance [AU]	ESM [deg.]	SEM [deg.]	SME [deg.]	Events
8/4/00	316	156	1.6261	2.6154	163.6692	10.0687	6.2621	
8/9/00	321	161	1.6303	2.6104	161.1737	11.6267	7.1996	
8/14/00	326	166	1.6342	2.6039	158.6576	13.2033	8.1392	
8/19/00	331	171	1.6379	2.5959	156.1211	14.7986	9.0803	
8/24/00	336	176	1.6414	2.5862	153.5645	16.4130	10.0225	
8/29/00	341	181	1.6447	2.5749	150.9877	18.0468	10.9655	
9/3/00	346	186	1.6478	2.5620	148.3908	19.7002	11.9090	
9/8/00	351	191	1.6506	2.5474	145.7738	21.3737	12.8525	
9/13/00	356	196	1.6532	2.5312	143.1369	23.0675	13.7956	
9/18/00	361	201	1.6556	2.5134	140.4802	24.7819	14.7379	
9/23/00	366	206	1.6577	2.4939	137.8040	26.5172	15.6788	
9/28/00	371	211	1.6596	2.4727	135.1085	28.2736	16.6179	
10/3/00	376	216	1.6613	2.4499	132.3942	30.0513	17.5545	
10/8/00	381	221	1.6627	2.4255	129.6616	31.8505	18.4880	
10/13/00	386	226	1.6638	2.3995	126.9112	33.6711	19.4177	
10/18/00	391	231	1.6647	2.3718	124.1437	35.5134	20.3429	
10/23/00	396	236	1.6654	2.3426	121.3600	37.3773	21.2627	
10/28/00	401	241	1.6658	2.3118	118.5610	39.2628	22.1762	
11/2/00	406	246	1.6660	2.2795	115.7476	41.1699	23.0826	Aphelion
11/7/00	411	251	1.6659	2.2457	112.9210	43.0984	23.9806	
11/12/00	416	256	1.6656	2.2104	110.0824	45.0483	24.8693	
11/17/00	421	261	1.6650	2.1737	107.2331	47.0194	25.7475	
11/22/00	426	266	1.6642	2.1356	104.3747	49.0116	26.6137	
11/27/00	431	271	1.6631	2.0963	101.5086	51.0247	27.4667	
12/2/00	436	276	1.6618	2.0556	98.6364	53.0587	28.3049	
12/7/00	441	281	1.6602	2.0137	95.7598	55.1135	29.1268	
12/12/00	446	286	1.6584	1.9707	92.8806	57.1889	29.9305	
12/17/00	451	291	1.6564	1.9266	90.0006	59.2852	30.7142	
12/22/00	456	296	1.6541	1.8815	87.1218	61.4023	31.4759	
12/27/00	461	301	1.6516	1.8355	84.2460	63.5405	32.2135	
1/1/01	466	306	1.6488	1.7886	81.3751	65.7003	32.9246	
1/6/01	471	311	1.6458	1.7410	78.5113	67.8820	33.6067	
1/11/01	476	316	1.6426	1.6926	75.6565	70.0866	34.2570	
1/16/01	481	321	1.6392	1.6437	72.8125	72.3149	34.8726	
1/21/01	486	326	1.6356	1.5942	69.9815	74.5683	35.4502	
1/26/01	491	331	1.6317	1.5443	67.1653	76.8484	35.9863	
1/31/01	496	336	1.6277	1.4941	64.3658	79.1571	36.4771	
2/5/01	501	341	1.6234	1.4437	61.5849	81.4969	36.9182	
2/10/01	506	346	1.6189	1.3931	58.8242	83.8707	37.3051	
2/15/01	511	351	1.6143	1.3425	56.0855	86.2820	37.6324	
2/20/01	516	356	1.6095	1.2919	53.3705	88.7350	37.8945	
2/25/01	521	361	1.6045	1.2415	50.6805	91.2346	38.0849	
3/2/01	526	366	1.5993	1.1914	48.0171	93.7865	38.1964	
3/7/01	531	371	1.5940	1.1417	45.3816	96.3974	38.2211	
3/12/01	536	376	1.5885	1.0924	42.7751	99.0751	38.1498	
3/17/01	541	381	1.5828	1.0438	40.1987	101.8287	37.9726	
3/22/01	546	386	1.5771	0.9959	37.6535	104.6687	37.6778	
3/27/01	551	391	1.5712	0.9488	35.1403	107.6069	37.2529	
4/1/01	556	396	1.5652	0.9027	32.6598	110.6570	36.6832	
4/6/01	561	401	1.5591	0.8577	30.2126	113.8346	35.9528	
4/11/01	566	406	1.5529	0.8140	27.7994	117.1570	35.0436	
4/16/01	571	411	1.5466	0.7716	25.4205	120.6437	33.9358	
4/21/01	576	416	1.5402	0.7309	23.0761	124.3157	32.6081	
4/26/01	581	421	1.5338	0.6920	20.7666	128.1958	31.0376	
5/1/01	586	426	1.5273	0.6550	18.4921	132.3072	29.2008	
5/6/01	591	431	1.5208	0.6203	16.2526	136.6728	27.0746	
5/11/01	596	436	1.5143	0.5881	14.0484	141.3130	24.6386	
5/16/01	601	441	1.5077	0.5586	11.8796	146.2428	21.8775	
5/21/01	606	446	1.5012	0.5321	9.7470	151.4678	18.7852	
5/26/01	611	451	1.4947	0.5089	7.6521	156.9777	15.3702	
5/31/01	616	456	1.4882	0.4893	5.5998	162.7358	11.6644	
6/5/01	621	461	1.4818	0.4736	3.6065	168.6480	7.7455	
6/10/01	626	466	1.4754	0.4618	1.7651	174.3519	3.8830	

Date	Days from Earliest MOI	Days from Start of Mapping	Sun-Mars Distance [AU]	Mars-Earth Distance [AU]	ESM [deg.]	SEM [deg.]	SME [deg.]	Events
6/15/01	631	471	1.4692	0.4541	1.1472	176.2861	2.5667	
6/20/01	636	476	1.4630	0.4505	2.6948	171.2176	6.0876	Min Earth Dist
6/25/01	641	481	1.4569	0.4509	4.5420	165.1750	10.2830	
6/30/01	646	486	1.4510	0.4551	6.4124	159.1408	14.4468	
7/5/01	651	491	1.4452	0.4628	8.2737	153.2982	18.4281	
7/10/01	656	496	1.4395	0.4737	10.1186	147.7305	22.1508	
7/15/01	661	501	1.4341	0.4874	11.9454	142.4828	25.5719	
7/20/01	666	506	1.4288	0.5035	13.7541	137.5749	28.6711	
7/25/01	671	511	1.4237	0.5218	15.5457	133.0090	31.4454	
7/30/01	676	516	1.4189	0.5419	17.3215	128.7747	33.9038	
8/4/01	681	521	1.4143	0.5635	19.0830	124.8539	36.0631	
8/9/01	686	526	1.4099	0.5863	20.8319	121.2235	37.9446	
8/14/01	691	531	1.4058	0.6103	22.5702	117.8586	39.5712	
8/19/01	696	536	1.4020	0.6352	24.2995	114.7341	40.9663	
8/24/01	701	541	1.3985	0.6609	26.0221	111.8257	42.1522	
8/29/01	706	546	1.3953	0.6873	27.7397	109.1104	43.1499	
9/3/01	711	551	1.3924	0.7143	29.4545	106.5671	43.9784	
9/8/01	716	556	1.3898	0.7419	31.1686	104.1763	44.6551	
9/13/01	721	561	1.3876	0.7700	32.8839	101.9207	45.1953	
9/18/01	726	566	1.3857	0.7985	34.6026	99.7845	45.6129	
9/23/01	731	571	1.3841	0.8275	36.3266	97.7533	45.9200	
9/28/01	736	576	1.3829	0.8569	38.0580	95.8146	46.1274	
10/3/01	741	581	1.3820	0.8867	39.7986	93.9568	46.2446	
10/8/01	746	586	1.3815	0.9170	41.5502	92.1698	46.2800	
10/13/01	751	591	1.3814	0.9477	43.3148	90.4442	46.2410	Perihelion
10/18/01	756	596	1.3816	0.9788	45.0939	88.7719	46.1343	
10/23/01	761	601	1.3822	1.0103	46.8890	87.1454	45.9656	
10/28/01	766	606	1.3832	1.0423	48.7017	85.5580	45.7403	
11/2/01	771	611	1.3845	1.0747	50.5332	84.0039	45.4629	
11/7/01	776	616	1.3862	1.1075	52.3847	82.4776	45.1376	
11/12/01	781	621	1.3882	1.1408	54.2572	80.9745	44.7682	
11/17/01	786	626	1.3905	1.1745	56.1516	79.4903	44.3581	
11/22/01	791	631	1.3932	1.2087	58.0685	78.0212	43.9103	
11/27/01	796	636	1.3962	1.2432	60.0085	76.5640	43.4275	
12/2/01	801	641	1.3995	1.2782	61.9720	75.1158	42.9122	
12/7/01	806	646	1.4031	1.3136	63.9591	73.6741	42.3668	
12/12/01	811	651	1.4069	1.3493	65.9699	72.2368	41.7933	
12/17/01	816	656	1.4111	1.3854	68.0043	70.8020	41.1937	
12/22/01	821	661	1.4155	1.4219	70.0621	69.3682	40.5697	
12/27/01	826	666	1.4202	1.4586	72.1429	67.9342	39.9230	
1/1/02	831	671	1.4251	1.4956	74.2461	66.4989	39.2550	
1/6/02	836	676	1.4302	1.5329	76.3712	65.0616	38.5672	
1/11/02	841	681	1.4355	1.5703	78.5175	63.6216	37.8608	
1/16/02	846	686	1.4410	1.6079	80.6842	62.1786	37.1371	Orbiter end of Mapping
1/21/02	851	691	1.4467	1.6456	82.8704	60.7323	36.3973	
1/26/02	856	696	1.4526	1.6834	85.0752	59.2825	35.6423	
1/31/02	861	701	1.4585	1.7212	87.2977	57.8292	34.8732	
2/5/02	866	706	1.4646	1.7589	89.5368	56.3724	34.0908	
2/10/02	871	711	1.4709	1.7966	91.7916	54.9123	33.2961	
2/15/02	876	716	1.4771	1.8342	94.0611	53.4491	32.4898	
2/20/02	881	721	1.4835	1.8715	96.3443	51.9830	31.6727	
2/25/02	886	726	1.4900	1.9086	98.6403	50.5141	30.8456	
3/2/02	891	731	1.4964	1.9455	100.9482	49.0428	30.0090	
3/7/02	896	736	1.5030	1.9819	103.2670	47.5694	29.1636	
3/12/02	901	741	1.5095	2.0180	105.5960	46.0940	28.3100	
3/17/02	906	746	1.5160	2.0536	107.9345	44.6169	27.4486	
3/22/02	911	751	1.5225	2.0887	110.2817	43.1382	26.5801	
3/27/02	916	756	1.5290	2.1232	112.6370	41.6582	25.7047	
4/1/02	921	761	1.5355	2.1571	114.9999	40.1770	24.8230	
4/6/02	926	766	1.5419	2.1903	117.3700	38.6947	23.9354	
4/11/02	931	771	1.5482	2.2228	119.7467	37.2112	23.0421	
4/16/02	936	776	1.5545	2.2545	122.1298	35.7266	22.1436	
4/21/02	941	781	1.5607	2.2853	124.5190	34.2410	21.2400	

Date	Days from Earliest MOI	Days from Start of Mapping	Sun-Mars Distance [AU]	Mars-Earth Distance [AU]	ESM [deg.]	SEM [deg.]	SME [deg.]	Events
4/26/02	946	786	1.5668	2.3154	126.9143	32.7541	20.3317	
5/1/02	951	791	1.5727	2.3444	129.3153	31.2658	19.4189	
5/6/02	956	796	1.5786	2.3726	131.7222	29.7760	18.5018	
5/11/02	961	801	1.5843	2.3997	134.1350	28.2844	17.5806	
5/16/02	966	806	1.5899	2.4257	136.5536	26.7909	16.6555	
5/21/02	971	811	1.5954	2.4506	138.9783	25.2950	15.7266	
5/26/02	976	816	1.6007	2.4744	141.4093	23.7966	14.7941	
5/31/02	981	821	1.6058	2.4971	143.8466	22.2952	13.8582	
6/5/02	986	826	1.6107	2.5185	146.2906	20.7905	12.9189	
6/10/02	991	831	1.6155	2.5386	148.7416	19.2821	11.9763	
6/15/02	996	836	1.6201	2.5574	151.1997	17.7696	11.0307	
6/20/02	1001	841	1.6245	2.5750	153.6651	16.2528	10.0821	
6/25/02	1006	846	1.6287	2.5911	156.1381	14.7312	9.1307	
6/30/02	1011	851	1.6328	2.6059	158.6187	13.2046	8.1768	
7/5/02	1016	856	1.6366	2.6192	161.1066	11.6729	7.2205	
7/10/02	1021	861	1.6401	2.6311	163.6013	10.1362	6.2625	
7/15/02	1026	866	1.6435	2.6415	166.1015	8.5951	5.3033	
7/20/02	1031	871	1.6467	2.6504	168.6043	7.0512	4.3445	
7/25/02	1036	876	1.6496	2.6578	171.1028	5.5086	3.3887	
7/30/02	1041	881	1.6523	2.6636	173.5787	3.9782	2.4431	
8/4/02	1046	886	1.6548	2.6678	175.9677	2.4998	1.5324	
8/9/02	1051	891	1.6570	2.6704	177.8957	1.3055	0.7988	
8/14/02	1056	896	1.6590	2.6714	177.5634	1.5129	0.9237	Max Earth Distance
8/19/02	1061	901	1.6607	2.6708	175.4183	2.8471	1.7346	
8/24/02	1066	906	1.6622	2.6685	172.9427	4.3892	2.6681	
8/29/02	1071	911	1.6635	2.6646	170.3774	5.9900	3.6326	
9/3/02	1076	916	1.6645	2.6590	167.7698	7.6204	4.6098	
9/8/02	1081	921	1.6653	2.6518	165.1345	9.2715	5.5940	
9/13/02	1086	926	1.6658	2.6428	162.4778	10.9396	6.5826	
9/18/02	1091	931	1.6661	2.6322	159.8026	12.6231	7.5744	
9/23/02	1096	936	1.6661	2.6199	157.1106	14.3211	8.5683	Aphelion
9/28/02	1101	941	1.6659	2.6059	154.4032	16.0330	9.5638	
10/3/02	1106	946	1.6654	2.5902	151.6811	17.7585	10.5603	
10/8/02	1111	951	1.6647	2.5729	148.9454	19.4973	11.5574	
10/13/02	1116	956	1.6637	2.5540	146.1967	21.2489	12.5544	
10/18/02	1121	961	1.6625	2.5334	143.4360	23.0130	13.5510	
10/23/02	1126	966	1.6611	2.5112	140.6641	24.7893	14.5465	
10/28/02	1131	971	1.6594	2.4874	137.8821	26.5773	15.5406	
11/2/02	1136	976	1.6574	2.4620	135.0910	28.3764	16.5326	
11/7/02	1141	981	1.6552	2.4351	132.2920	30.1861	17.5219	
11/12/02	1146	986	1.6528	2.4068	129.4863	32.0058	18.5079	
11/17/02	1151	991	1.6502	2.3770	126.6752	33.8348	19.4900	
11/22/02	1156	996	1.6473	2.3457	123.8603	35.6722	20.4674	
11/27/02	1161	1001	1.6442	2.3131	121.0431	37.5174	21.4395	
12/2/02	1166	1006	1.6408	2.2792	118.2251	39.3694	22.4055	

A.7 Orbiter Configuration Drawings

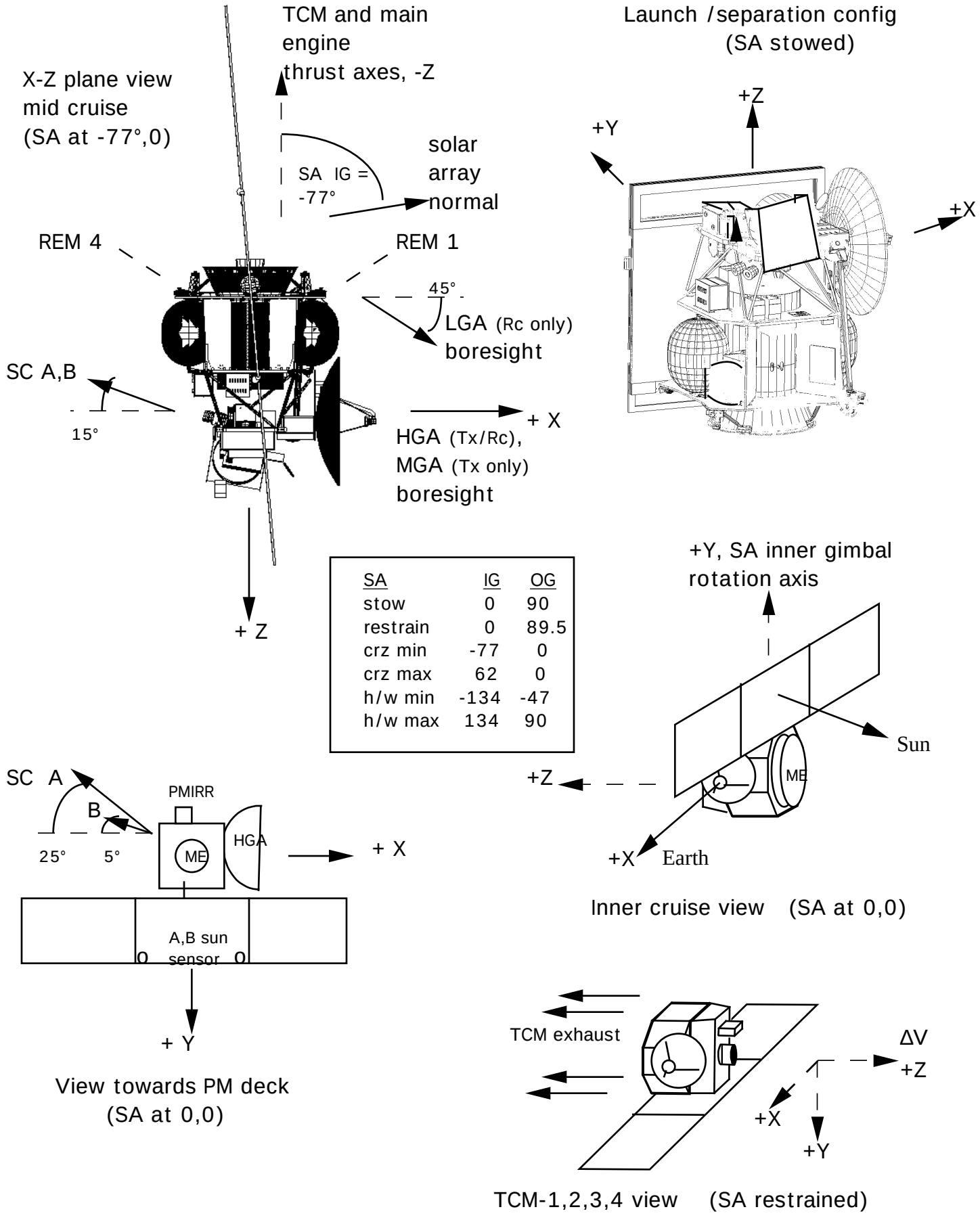
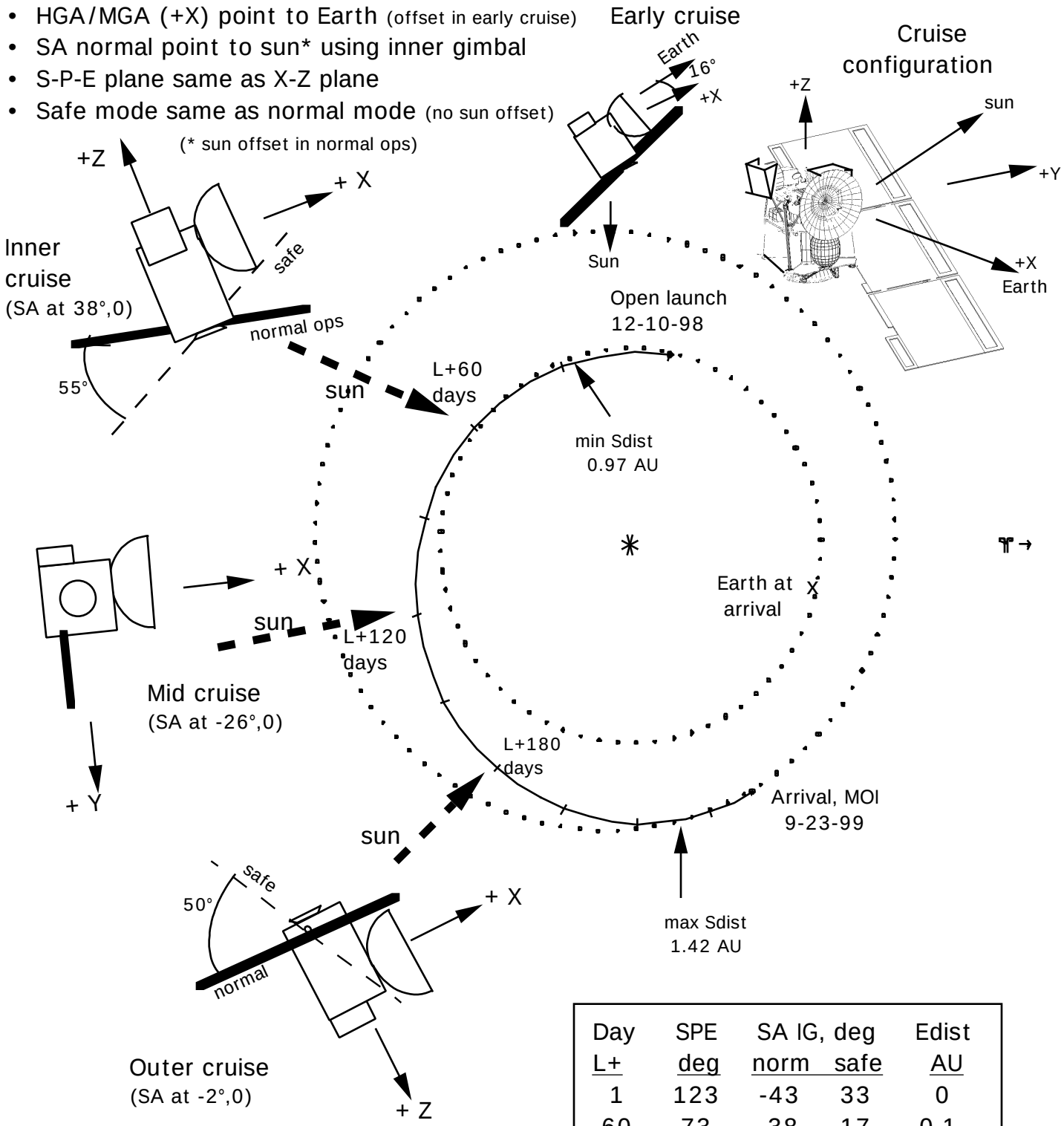


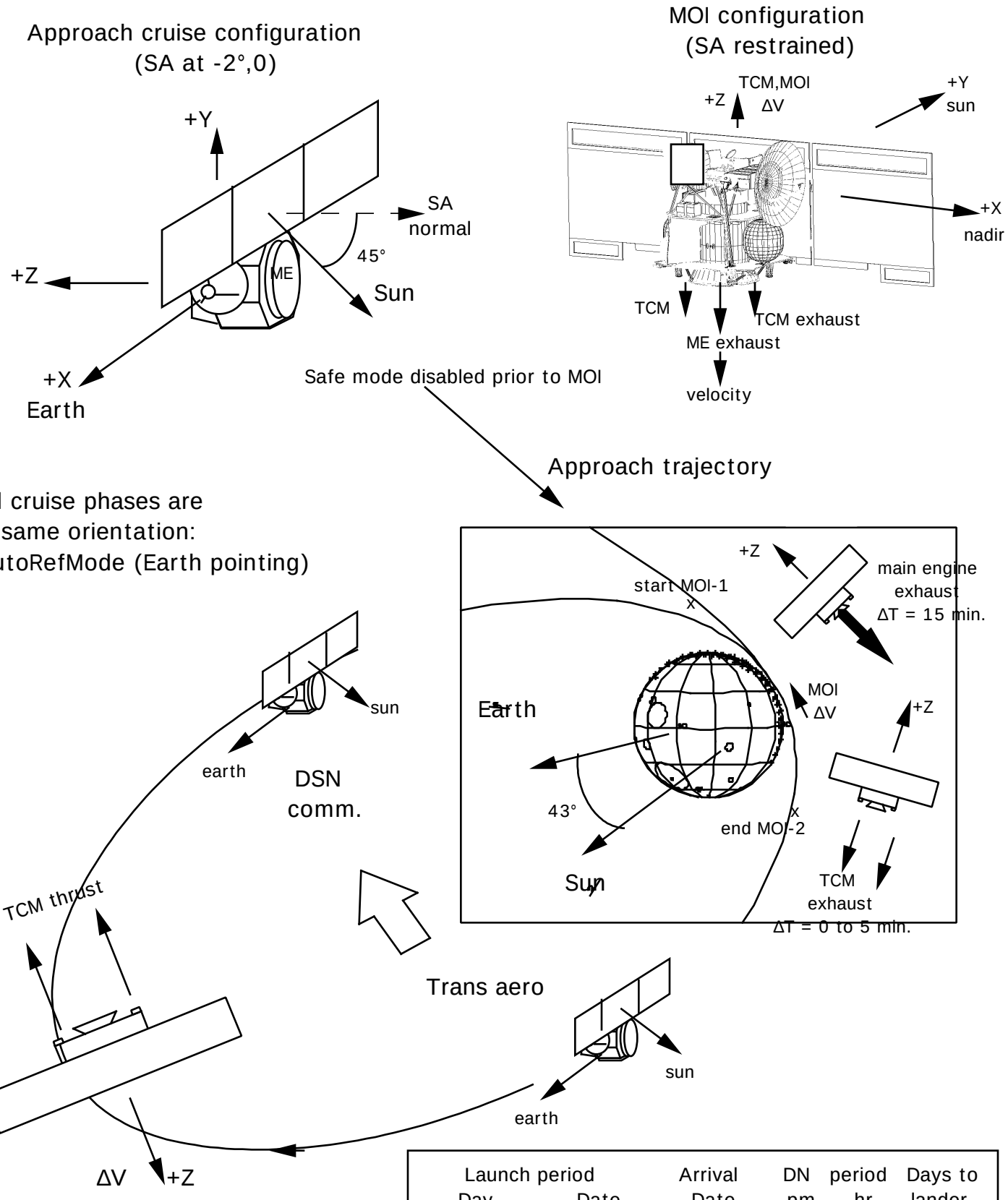
Figure 1.3.6.14.1-1 Orbiter Cruise Configurations



Day L+	SPE deg	SA IG, deg norm	SA IG, deg safe	Edist AU
1	123	-43	33	0
60	73	38	-17	0.1
120	14	-26	-76	0.2
180	42	2	-48	0.5
285	43	-2	-47	1.3

Nominal TCMs at L+15, L+45, MOI-60, MOI-10 days

Figure 1.3.6.14.1-2 Orbiter Cruise Geometry



Launch period		Arrival	DN	period	Days to
Day	Date	Date	pm	hr.	lander
Open	12/10/98	9/23/99	6:15	25.0	71.6
close prim	12/17/98	9/29/99	6:06	23.2	65.8
close cntng	12/23/98	10/4/99	5:52	21.0	60.1

Figure 1.3.6.14.1-3 Mars Orbit Insertion Orientation

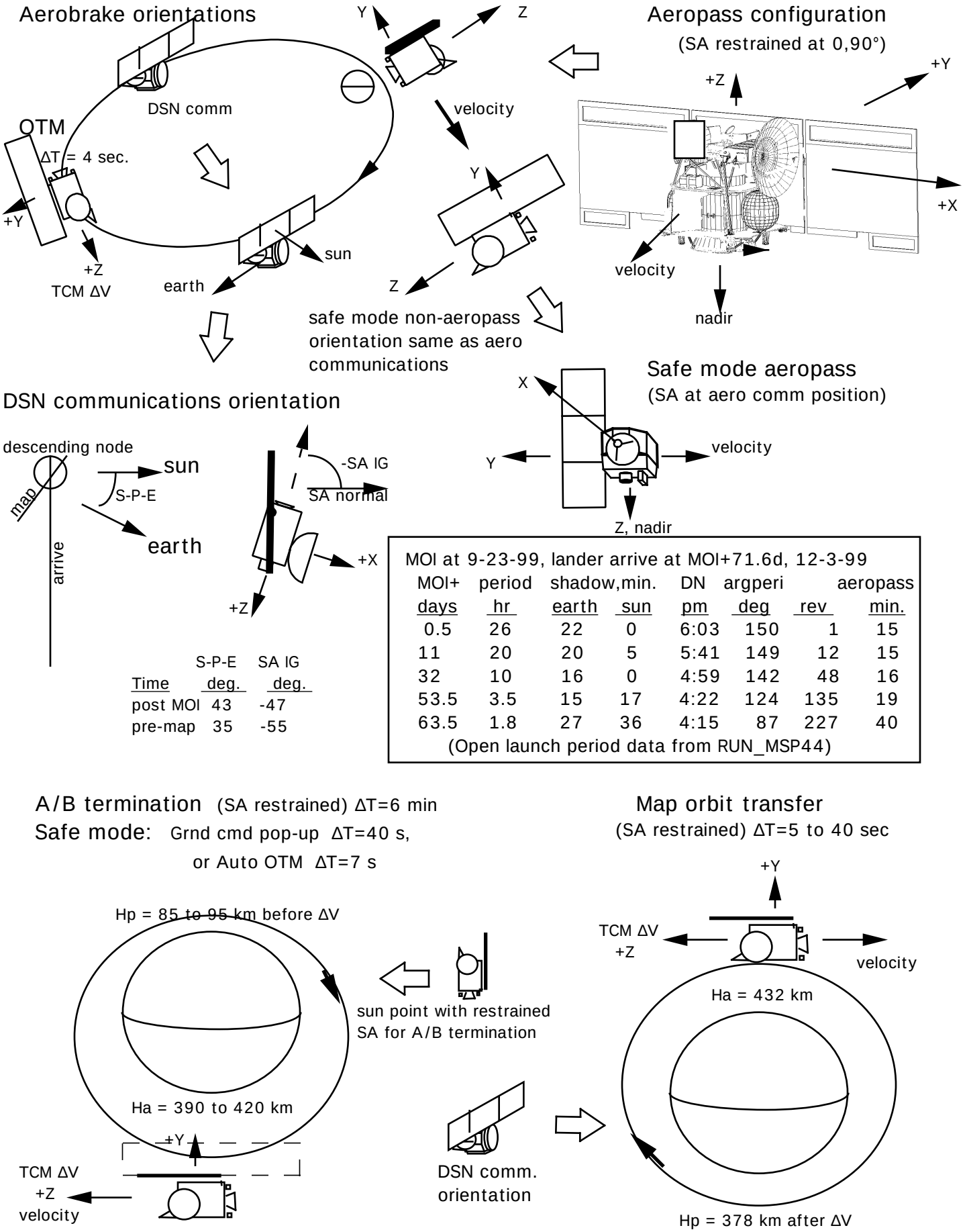


Figure 1.3.6.14.1-4 Aerobraking Configurations and Orientations

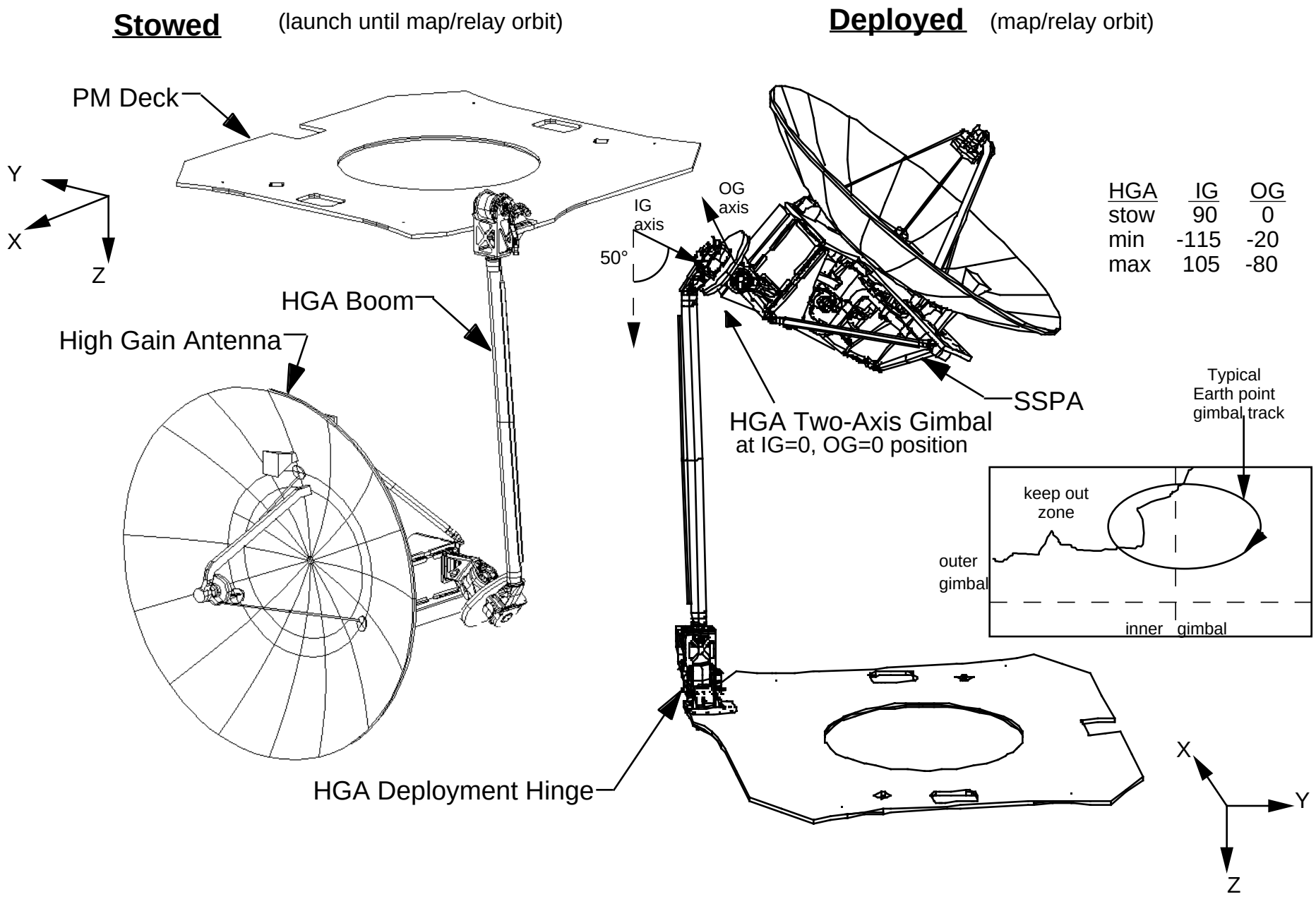
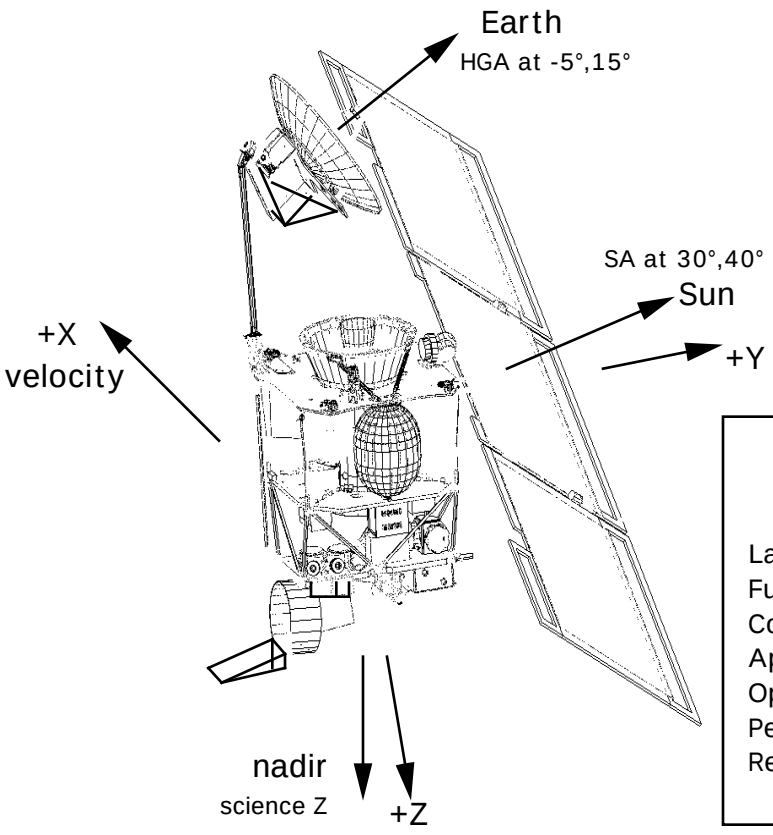


Figure 1.3.6.14.1-5 High Gain Antenna Orientation

Mapping/relay configuration

(at ~day 60, ~over south pole)



HGA constraints

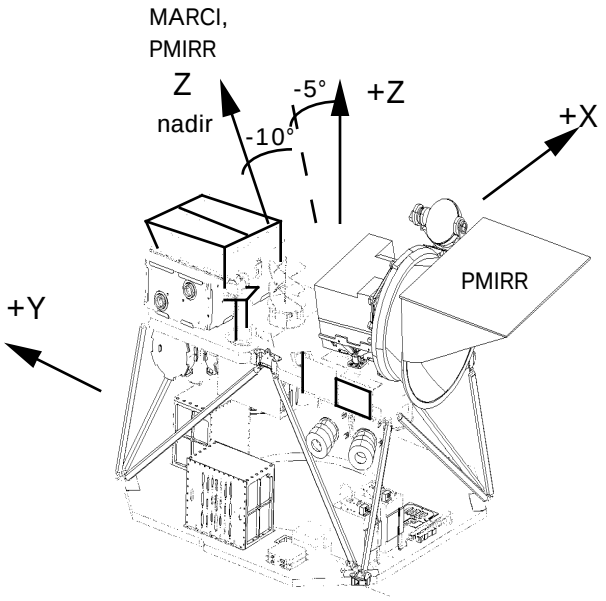
- Gimbal travel & rate
- Earth occultation
- Avoid SA during Tx/Rc
- Mechanical keep out zone

SA constraints

- Gimbal travel & rate
- Sun eclipse
- Avoid HGA beam during Tx/Rc
- Off-sun power
- Rewind
- Minimize MARCI intrusion

		at sun side (PM) equator crossing			
		HGA gimbals		SA gimbals	
Event	Day	inner	outer	inner	outer
Lander arrival	0	-35	52	-50	48
Full science	71	-43	36	-49	42
Conjunction	212	-7	8	-7	48
Aphelion	336	5	-9	20	53
Opposition	549	-7	29	-20	65
Perihelion	680	-22	58	-55	50
Relay begin	758	-44	50	-50	43

Science deck



Mapping safe mode

(HGA at -90°,-20° and SA at -110° to -65°,0°)

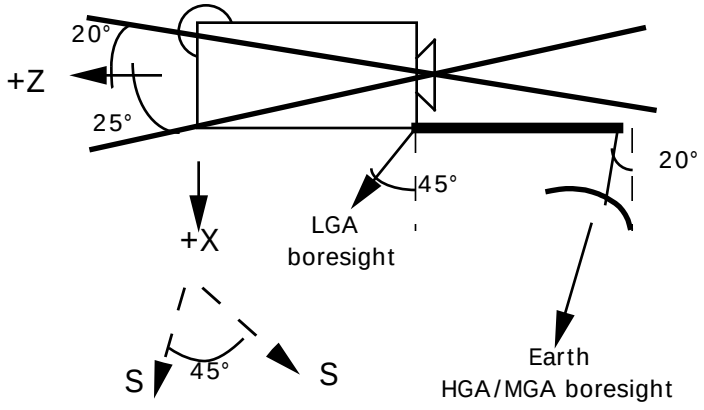
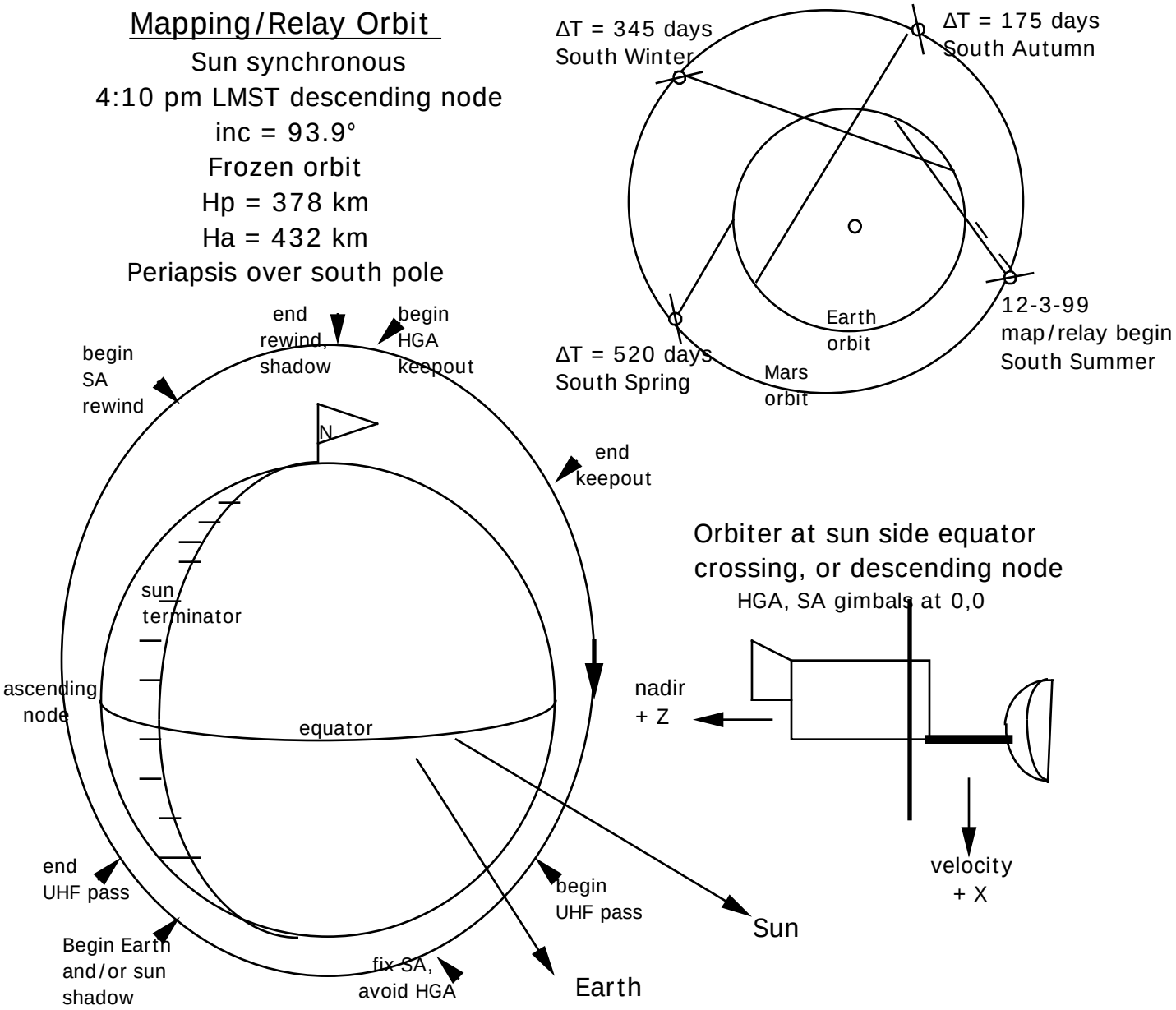


Figure 1.3.6.14.1-6 Mapping/Relay Configurations

Mapping/Relay Orbit

Sun synchronous
4:10 pm LMST descending node
inc = 93.9°
Frozen orbit
Hp = 378 km
Ha = 432 km
Periapsis over south pole



			shadow,min.		distance,AU		SPE	DN	max
Date	Event	Day	Earth	Sun	Earth	Sun	deg.	pm	Mb/day
12-3-99	Lander arrival	0	0	29	1.7	1.4	35	4:10	220
2-12-99	Full science	71	18	33	2.1	1.4	25	3:30	180
7-2-00	Conjunction	212	27	27	2.6	1.6	0	3:40	120
11-3-00	Aphelion	336	38	22	2.3	1.7	-23	4:20	100
6-11-01	Opposition	549	0	0	0.5	1.5	0	4:50	2300
10-13-01	Perihelion	680	0	27	0.9	1.4	46	4:10	500
12-30-01	Relay begin	758	9	33	1.5	1.4	40	3:30	230

Figure 1.3.6.14.1-7 Mapping / Relay Geometry

A.8 Orbiter Navigation Memo

This memo was last updated September 18, 1996, and should be used only as a general discussion of the navigation approach, and assumptions used in the navigation analysis. Since that time, the effects of 95% PCS have been added, and additional navigation analyses have been done for cruise, aerobraking, and mapping. Updated results [e.g. TCM ΔV estimates and tracking schedules] are indicated in the Mission Plan, and in the Databook Appendix A.11 [Orbiter Mapping Navigation].

Jet Propulsion Laboratory

INTEROFFICE MEMORANDUM
IOM 312.3-96-016, Rev. A
September 18, 1996

To: Distribution
From: Pieter Kallemeyn
Subject: Navigation analysis report for the Mars Surveyor '98 Orbiter

SUMMARY

This memo details the work to date in characterizing the navigation capability for the Mars Surveyor '98 Orbiter mission. This report supersedes those results that were first presented in Reference [1]. The interplanetary cruise phase is emphasized in this study. A preliminary orbit determination analysis of the aerobraking phase was performed and is summarized in this report.

Statistical information on the required ΔV for interplanetary TCM usage was calculated using the resulting OD error covariances, execution errors for the TCMs and an injection error covariance from McDonnell Douglas (received Sept. 5, 1996). The total interplanetary ΔV required for 95% confidence is 62 m/sec. The 1σ B-plane guidance error ellipse for the last midcourse maneuver is 12.8 km by 6.9 km with an uncertainty in the linearized time of flight of 1.84 seconds.

INTERPLANETARY PHASE NAVIGATION ANALYSIS

Reference Trajectory

The reference trajectory used for this orbit determination and guidance analysis is a Type 2 Earth-Mars transfer corresponding to the first day of the MSP '98 orbiter primary launch period. The trajectory is shown in Figure 1 and summarized in Table 1.

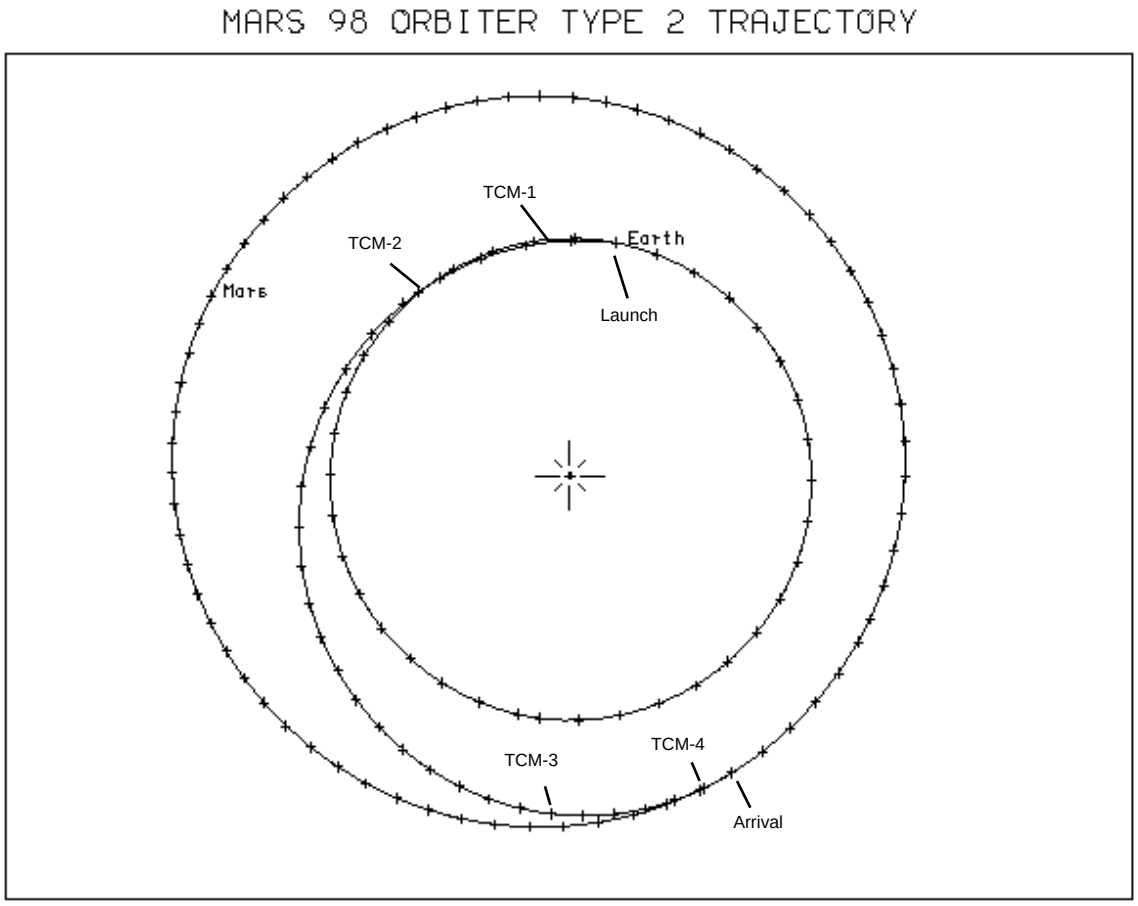


Figure 1: Mars '98 orbiter trajectory corresponding to a 12/10/1998 launch

Table 1: Orbiter reference trajectory characteristics

Injection Date	Arrival Date	Length	Arrival V_∞ (km/sec)
12/10/1998, 20:11	9/24/1999, 10:00	287 days 13.75 hours	3.34

Trajectory Correction Maneuvers

The four opportunities currently planned for interplanetary trajectory correction maneuvers (TCM's) are described in Table 2.

Table 2: Scheduled trajectory correction maneuvers

TCM #	Relative Date	Calendar Date	Comments
TCM-1	Launch+15 days	12/25/98	Corrects LV injection errors
TCM-2	Launch+45 days	1/24/99	Corrects NAV errors at TCM-1
TCM-3	Arrival-60 days	7/25/99	Targets to orbit insertion point
TCM-4	Arrival-10 days	9/14/99	Corrects errors from TCM-3

Orbit determination assumptions

Table 3 shows the tracking coverage assumed for the orbit determination analysis.

Table 3: Tracking Data schedule for orbiter OD analysis

Period	Tracking Schedule
Launch to Launch + 30 days	One 4-hour pass of Doppler and range per day
Launch +30 to Arrival -45 days	one 4-hour pass per complex per week (3 passes/week) of Doppler and range
Arrival - 45 days to Arrival	Three 4-hour passes of Doppler and range per day
TCM coverage:	
TCM -/+ 3 days	One 4-hour pass per day of Doppler and range
TCM -/+ 12 hours	Three 4-hour passes of Doppler and range

Table 4 gives a summary of the error sources included in the OD study, their nominal value, and level of assumed uncertainty. Many of the error sources (such as media, Earth motion, and non-gravitational accelerations) are assumed to be random in nature, and are therefore modeled as first-order Gauss-Markov processes. This model involves statistically correlated behavior, and is useful for describing these phenomena. Table 4 gives the steady-state uncertainty and the correlation time for the stochastic parameters. Parameters listed in Table 4 without these values, such as solar pressure, station locations, initial position and velocity, were assumed to be non-stochastic (bias) parameters. A complete description of these error source models can be found in References [2] through [6].

Table 4: Orbit Determination error assumptions for MSP '98 Orbiter interplanetary cruise

Error Source	Nominal value	Apriori uncertainty (1σ)	Corr. Time (days)	Steady-State Unc.	Comments
2-way Doppler noise	-	3 mHz	-	-	
SRA range noise	-	1 meter	-	-	
Initial Position	variable	100 km	-	-	
Initial Velocity	variable	1.0 km/s	-	-	
Solar Radiation Model:					
orbiter bus: specular	0.15	0.15	-	-	2.4 m^2, Sun pointed
diffuse	0.09	0.09	-	-	
orb. solar panel: specular	0.1	0.1	-	-	2.4 m^2 Sun pointed
diffuse	0.37	0.37	-	-	
orbiter antenna: specular	0.29	0.03	-	-	2.4 m^2, Earth pointed
diffuse	0.04	0.007	-	-	
S/C component area	100%	1%	-	-	error in sunlit area
ΔV from attitude turns (every 5 days)	0	2 mm/s in all directions	-	-	Models turns and momentum de-sat
anomalous self-induced accelerations	0	1.0E-12 km/s^2 in all directions	1.5 d	1.0E-12 km/s^2	
TCM magnitude[1]	variable	0.33% (TCM1) 066% (TCM2-4)	-	-	from Exibit 1
TCM pointing	variable	0.33% (TCM1) 066% (TCM2-4)	-	-	
Station-induced range bias	0	1 meter	0.0 d	1 meter	independent across all three stations
S/C-induced Doppler bias	0	0.02 mm/s	3 d	0.02 mm/s	
Troposphere calibrations	0	5 cm	0.1 d	5 cm	
Night Ionosphere calibrations	0	1 cm	1.0 d	1 cm	
Day Ionosphere calibrations	0	3 cm	0.2 d	3 cm	
Station locations	variable	10 cm	-	-	
Polar Motion calibrations	0	10 cm	2.0 d	10 cm	
UTC calibration	0	30 cm	1.0 d	30 cm	
Earth and Mars ephemeris	-	for Mars: Radial = 0.5 km Transverse = 5.0 km Normal = 5.0 km	-	-	Current knowledge. (This can be reduced with data from MGS)

[1] In addition to this proportional magnitude error, there is a fixed error of .033 m/s for TCM-1 and 0.0033 m/s for all other TCM's [from Exhibit 1, requirement 3.C.2].

Orbit Determination Analysis Results

The Orbit Determination Program (ODP) coupled with the MIRAGE OD filter was used for this analysis [7]. MIRAGE employs a batch-sequential filtering method to a set of simulated Doppler and range data (scheduled according to Table 3). For each maneuver, tracking data up to 5 days before each TCM was reduced and fit to the reference trajectory. The orbit determination error covariance was mapped to the Mars-centered, Mars-Mean-Equator of Date *B*-plane at a time 1 hour before closest approach to Mars (A description of this coordinate frame is provided in Appendix A). The important results are the size, shape and orientation of the error ellipse in the two-dimensional B-plane and the linearized time of flight uncertainty. The orbit determination knowledge uncertainties for each of the four TCM's are described in Table 5 and illustrated in Figure 2.

Table 5: Orbiter orbit determination knowledge uncertainty (1σ) at the time of TCM design (TCM-5 days).

[The reference frame is the Mars-Centered, Mars Mean Equator of Date B-plane while the reference time is 1 hour prior to closest approach to Mars]

	Ellipse Semi-Major Axis (km)	Ellipse Semi-Minor Axis (km)	Ellipse orientation relative to T-axis	Linearized time of flight (seconds)
TCM-1	430	96	32°	211.1
TCM-2	312	91	30°	135.9
TCM-3	19.6	13.6	106°	3.43
TCM-4	12.6	6.6	107°	1.75

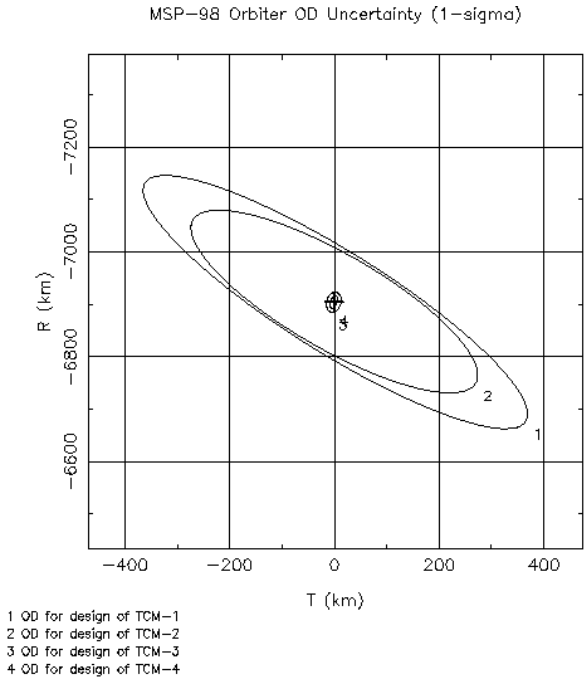


Figure 2a: Orbit determination results for the Orbiter mapped in the B-plane

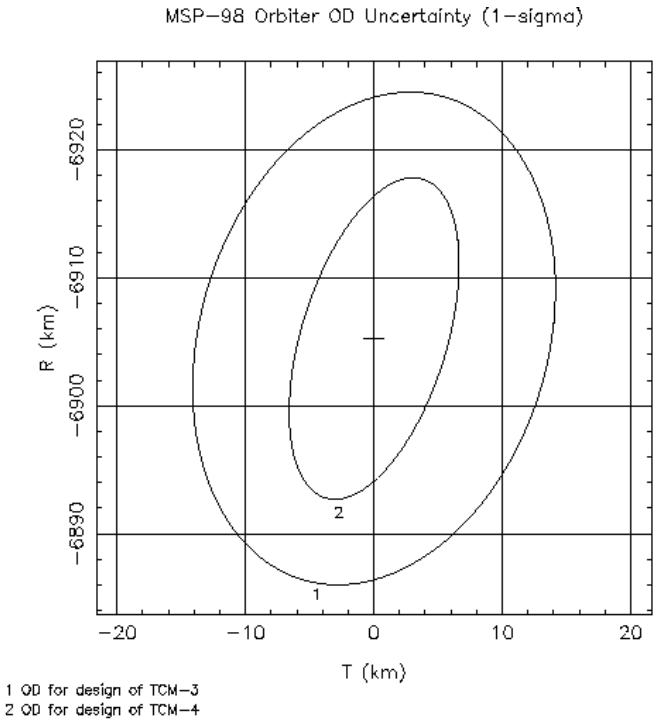


Figure 2b: Orbit determination results for the Orbiter mapped in the B-plane (for TCM3 and TCM4)

Guidance Analysis Results

The OD results from Table 5 were combined with the maneuver execution assumptions described in Table 6 below to determine statistical data on the ΔV magnitude required for all four TCMs. The JPL programs INJCOV, LAMBIC, and PQ were used for this analysis [8].

Table 6: Trajectory correction maneuver assumptions for orbiter

Deterministic part of TCM-1	Fixed Magnitude Error (1-σ)	Proportional Magnitude Error (1-σ)	Proportional Pointing Error (1-σ)
17.3 m/s	0.033 m/s for TCM-1 0.0033 m/s for TCM 2-4	0.33% for TCM-1 0.66% for TCM 2-4	0.33% for TCM-1 0.66% for TCM 2-4

The launch vehicle injection errors were modeled with a covariance supplied by McDonnell-Douglas for the Delta-II 7425 launch vehicle received Sept. 5, 1996. (see Appendix B). Using K-matrices for the nominal trajectory, this injection covariance was mapped to the Mars B-plane at closest approach. The resulting uncertainty ellipse is shown in Figure 3 along with the B-plane contour for a 1.0E-4 probability of impact. NASA planetary protection regulations requires the injection aimpoint to be outside this contour to minimize the chance the upper stage will impact on Mars. Therefore the launch vehicle aimpoint was targeted to B•R=60,000 km, B•T=-60,000 km in a manner that minimizes the deterministic part of TCM-1.

To further reduce the interplanetary ΔV required, the minimum deterministic TCM-1 that satisfies planetary protection requirements was used in the LAMBIC computation [9]. This

minimum ΔV has the effect of moving the arrival time earlier (from Sept. 24, 1999 10:00 to Sept. 23, 1999 06:50), increases arrival V_∞ to 3.573 m/s and increases velocity at periapsis (Vp) by 0.173 m/s. Note that the effect of a 95% probability of command shutdown (PCS) of the launch vehicle has not yet been considered in this analysis.

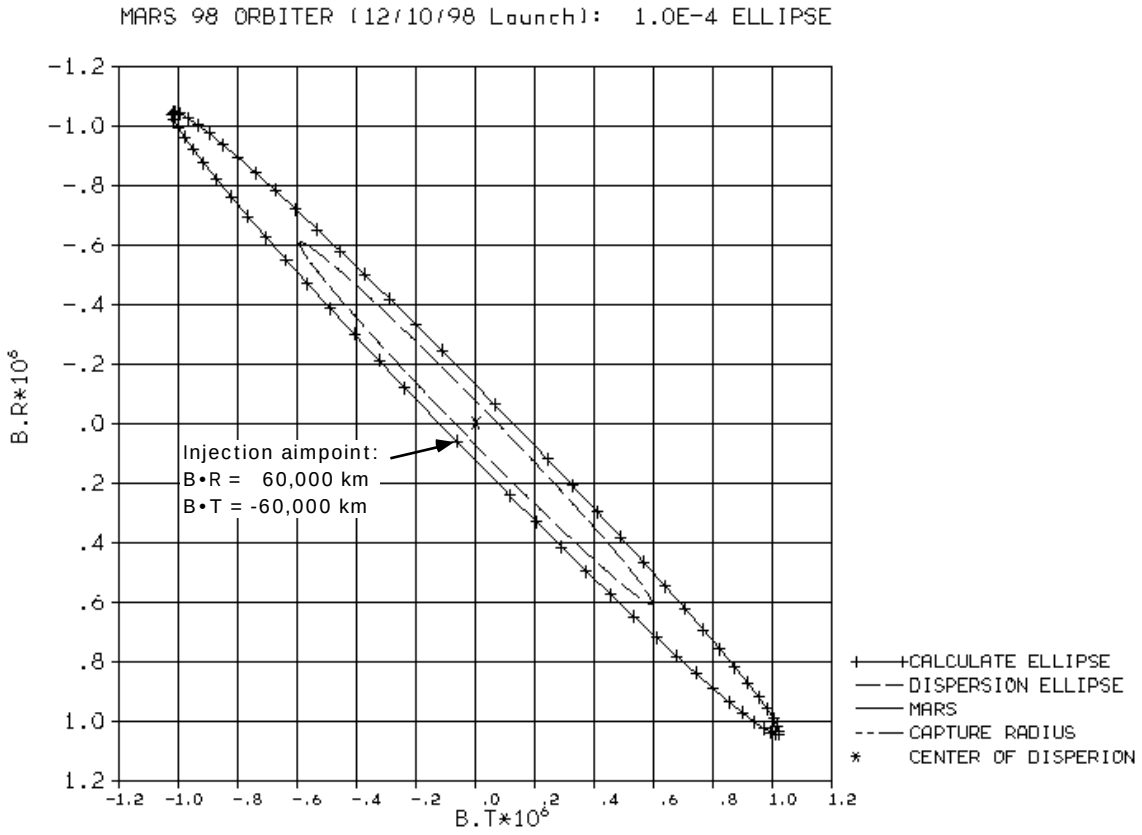


Figure 3: Injection error covariance mapped to the Mars B-plane, and injection aimpoint for P(impact)<1.0E-4

Table 7 gives the ΔV results from LAMBIC. Figure 4 is a histogram illustrating the statistical spread of required ΔV for the orbiter.

Table 7: Results of maneuver analysis (m/s) for orbiter

Maneuver	Mean	1σ	95%
TCM-1	31.68	15.49	61.0
TCM-2	0.27	0.18	0.63
TCM-3	0.18	0.15	0.50
TCM-4	0.04	0.02	0.08
Mission Total	**32.18**	**15.62**	**61.93**

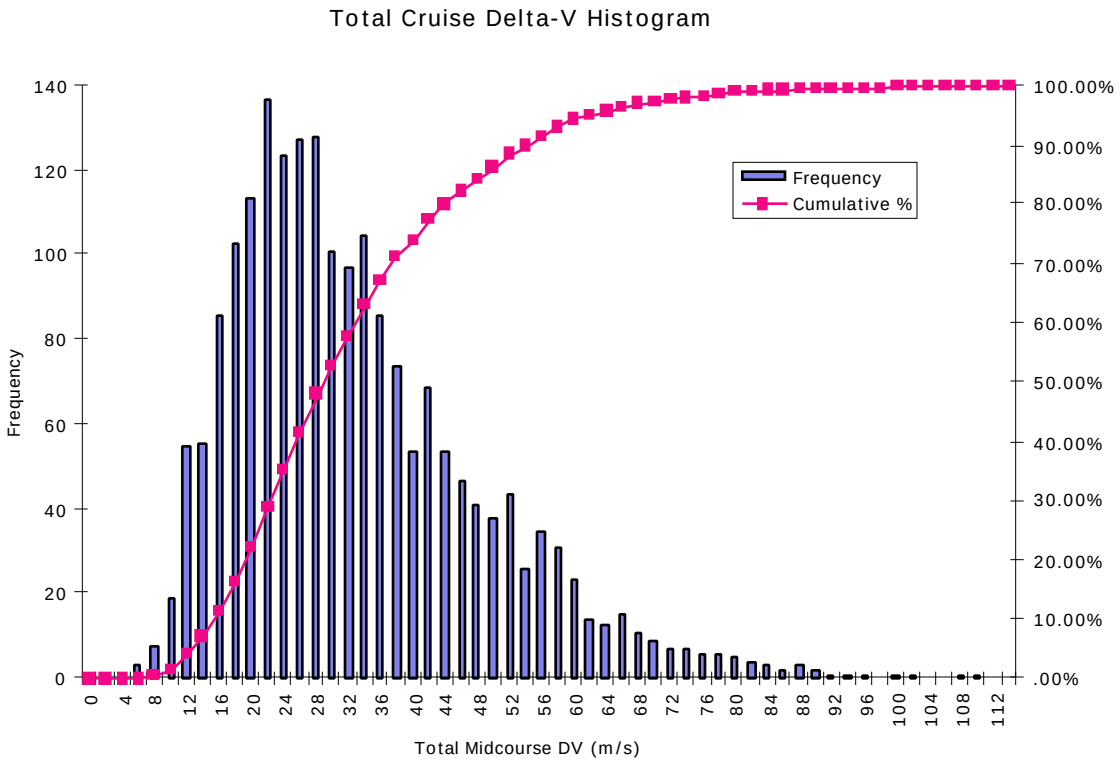
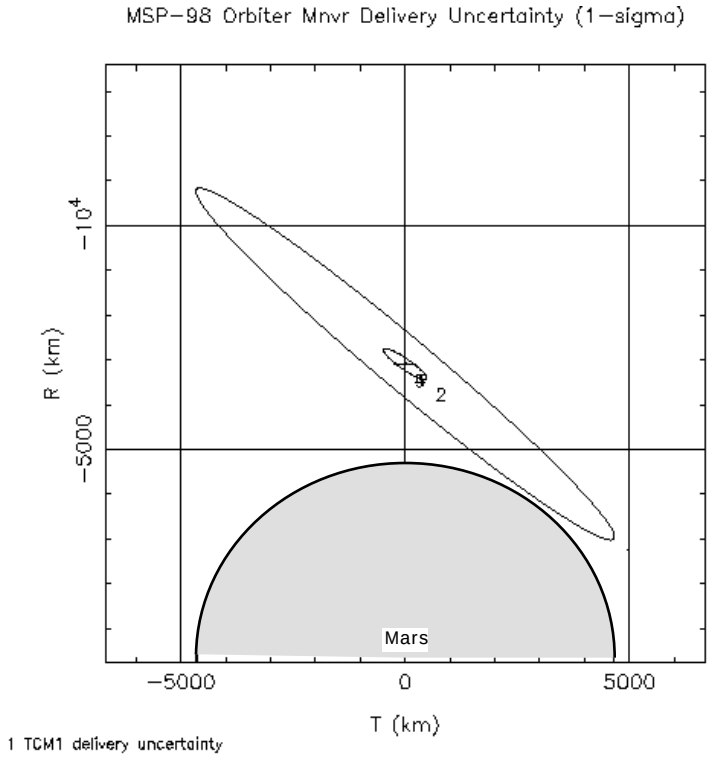


Figure 4: Histogram of maneuver ΔV (m/s) for interplanetary TCM usage

LAMBIC also provides the guidance error covariance, mapped to the Mars-Centered B-plane at closest approach (Table 8 and Figure 5). The guidance error is different than the OD error in that it includes maneuver execution errors. Guidance error from TCM-1 and TCM-2 are considerably larger than the corresponding OD error because these maneuver are large and the resulting maneuver ΔV error is also large. Also, there is considerably more time between execution of these maneuvers and the arrival at Mars, so these errors propagate longer into a larger B-plane error. TCM-3 and TCM-4 are much smaller maneuvers and they occur closer to Mars, therefore their resulting guidance errors are not significantly larger than their corresponding OD errors.

Table 8: Maneuver Delivery Uncertainty Ellipses (1-σ) for orbiter mapped in the Mars-centered, Mars Mean Equator of Date B-plane

	Semi-Major Axis (km)	Semi-Minor Axis (km)	Ellipse Orientation to T-axis	Linearized Time of Flight
TCM-1	6070	830	40°	4085
TCM-2	580	120	35°	332
TCM-3	22.2	19.2	87°	6.1
TCM-4	12.8	6.9	107°	1.84



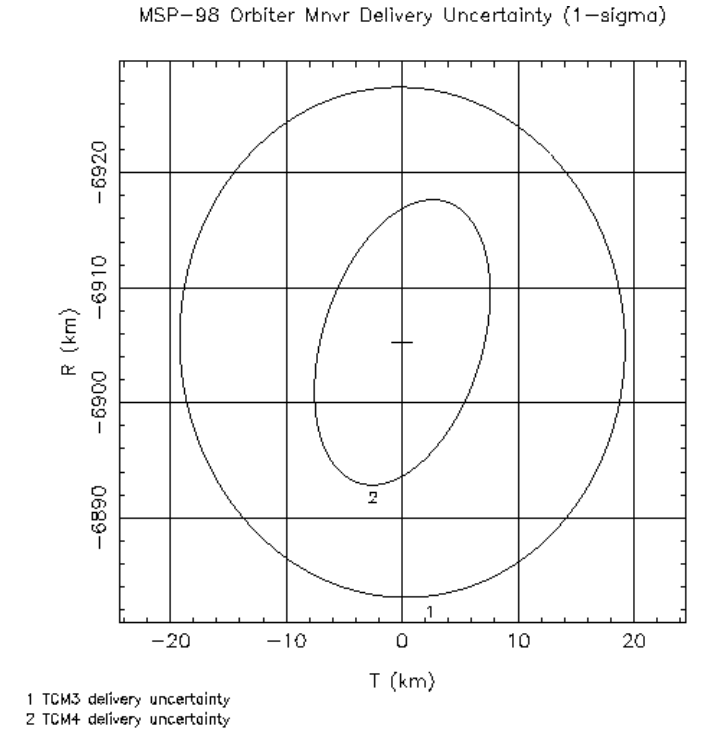


Figure 5: Guidance error results (1-σ) for the orbiter, mapped in the Mars-centered, Mars Mean Equator of Date B-plane

AEROBRAKING PHASE NAVIGATION ANALYSIS

A very preliminary study of the orbit determination capability during the aerobraking phase was performed to answer a few key questions concerning tracking data needs. The ODP was used on a set of orbits ranging in period from 100 hr. to 2 hr. This analysis was done similar to the Mars Global Surveyor aerobraking analysis [10,11], except that the tracking data is not continuous during this phase. Instead, tracking data was simulated to correspond to an expected "4 hours on/5 hours off" schedule, which is driven by power and thermal constraints on the orbiter transmitter.

In the analysis, one full orbit (minus 5 hour gaps) plus 4 hours after the last periapsis (designated P1) is fit assuming a 30% (1σ) uncertainty in the atmosphere. The atmosphere uncertainty is the dominant source of the overall orbit prediction error. It was further assumed that the variability in the atmosphere was so great that any knowledge gained from the last periapsis does not improve the uncertainty for the future aeropasses. The resulting orbit determination error covariance was mapped forward to successive periapsis times to obtain the uncertainty in time of periapsis passage (Tp) and the radius at periapsis (Rp). For those orbits where the period was less than 9 hours, the tracking was scheduled so that half the orbit was tracked starting 30 minutes after periapsis. Figure 6 illustrates the aerobraking orbit analysis.

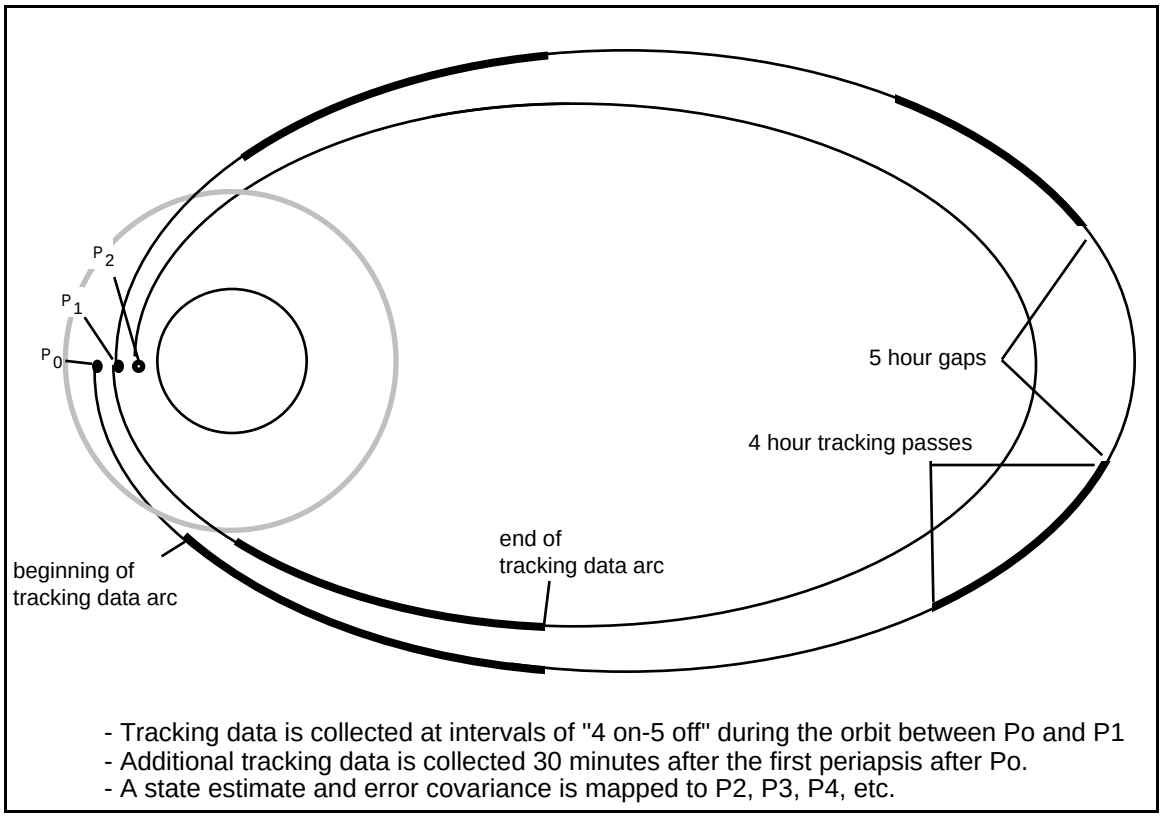


Figure 6: Aerobraking orbit determination

Table 9 gives the estimated uncertainty in predicted periapsis time and radius for aerobraking orbits of 100 hr., 48 hr., 6 hr. and 2 hr periods. Although no formal requirement for Tp error has been adapted for the MSP '98 mission, the MGS requirement in Tp is 225 seconds (3σ) and in Rp is 1.5 km (3σ) [10].

Table 9: Preliminary results of aerobraking phase orbit determination analysis

100-hour period orbit

periapsis #	1σ error in Tp (s)	1σ error in Rp (km)
P2	9.2	0.01
P3	1489	0.01

48-hour period orbit

periapsis #	1σ error in Tp (s)	1σ error in Rp (km)
P2	4.7	0.02
P3	790	0.03
P4	1525	0.04

6-hour period orbit

periapsis #	1σ error in Tp (s)	1σ error in Rp (km)
P2	.45	0.1
P3	17.2	0.1
P4	52.6	0.1

2-hour period orbit

periapsis #	1σ error in Tp (s)	1σ error in Rp (km)
P2	0.30	0.1
P3	4.9	0.1
P4	14.2	0.1
P5	28.1	0.1
P6	46.5	0.1
P7	69.5	0.1
P8	97.6	0.1
P9	130.2	0.1
P10	166.7	0.11
P11	207.4	0.11
P12	253.0	0.12

Topics for future study

1) On the opening day of the primary launch period (12/10/98), there is 5% chance the launch vehicle will have a velocity deficit that will have to be corrected at TCM-1. Although the data on the probability and value of this deficit has been received from McDonnell-Douglas, I haven't had the time to properly incorporate it into the LAMBIC analysis. Cliff Helfrich is currently assuming the maneuver design duties from me and will perform this study in the next two weeks.

2) The MOI and subsequent aerobraking strategy may benefit from moving the final midcourse maneuver from Arrival-10 days to Arrival-5 or Arrival-2 days. A TCM-4 at Arrival-2 days has been adapted as the baseline for the MSP '98 lander mission. An OD analysis could be done with this orbiter trajectory to see how much improvement in maneuver delivery uncertainty is obtained with 5 or more days of tracking data. The magnitude of TCM-4 would be 2-5 times higher than if it were performed at Arrival-10 days, but should not be prohibitively large.

3) The aerobraking OD analysis presented in this report was performed in January, 1996. Since that time, the aerobraking plan has changed dramatically to a more aggressive campaign that completes aerobraking in 2 months. Furthermore, in comparing the aerobraking results in this report with those from the MGS NAV plan, I have discovered some differences. The most likely explanation is a difference in how I used the exponential atmosphere model versus how Stuart Demcak used it for the MGS study. For revisiting the MSP '98 aerobraking OD study, I would recommend using the latest MarsGRAM atmosphere modeling capability in DPTRAJ.

DISTRIBUTION

JPL:

Gene Bollman
Pat Esposito
Phil Knocke
Cliff Helfrich
Jim McDanell
David Spencer
Sam Thurman
Bobby Williams

LMA:

Phil Hong
David Murrow
Bill Willcockson
Steve Jolly

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11. Conversations with Pat Esposito and Stuart Demcak, Dec. 1995 through Jan. 1996.

Appendix A

Definition of the Asymptotic Aiming Plane Coordinate System (B-plane)

The asymptotic aiming plane, or *B-plane*, coordinate system, is shown in Fig. 7. The orientation of this system in space is defined by the arrival asymptote direction, designated **S**, which is parallel to the velocity vector $\mathbf{V}_\infty$. The unit vectors **T** and **R** form an orthogonal triad with **S**; the direction of **T** is chosen to lie in the Martian equatorial plane, at a given date. The point of aim corresponding to the desired landing site is defined by the miss vector, **B**, in Fig. 7, which is oriented in the **T-R** plane, called the *B-plane*, by the angle φ, and has magnitude |B|. The miss vector specifies where the point of closest approach would be if the target body had no mass and did not deflect the flight path. Navigational uncertainty is characterized by a two-dimensional dispersion ellipse in the B-plane with semi-major axis *SMAA*, semi-minor axis *SMIA*, and orientation angle θ, and by the uncertainty in the time of arrival at the point of atmospheric entry, the time of arrival.

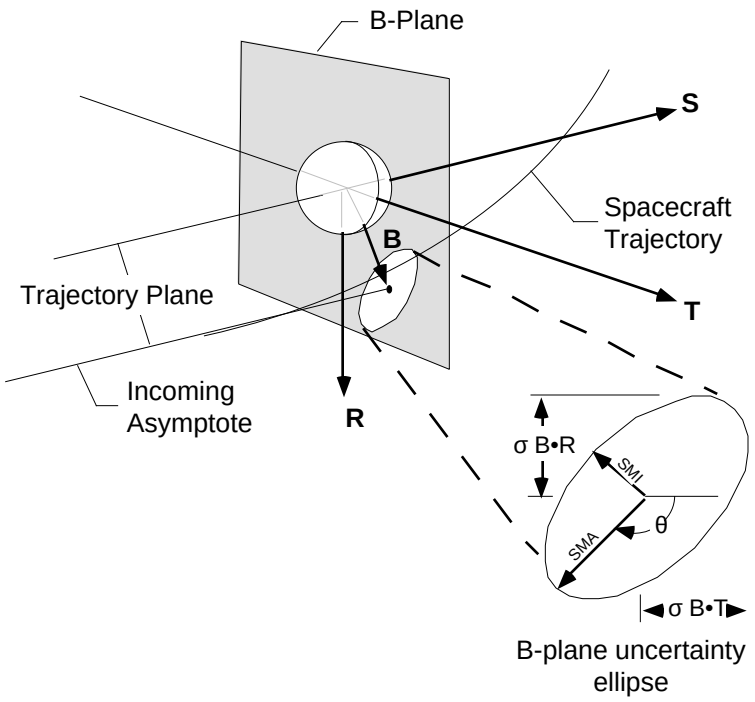


Figure 7: Target-centered aiming plane (B-plane) coordinate system.

Appendix B

Injection error covariance of the Delta II 7425 Launch Vehicle for the Mars Surveyor '98 orbiter mission (12/10/98 launch)

Delta 7425 MARS Orbiter Mission - 12/10/98 Launch Date
Preliminary Orbit Injection Covariance Matrix without PCS Effects
9/5/96 - Updated Velocity Pointing Error and Coning Velocity Loss
Tau at ignition = 182 sec Tau at burnout=56 sec Rgain start uniform from 55 sec to 80 sec

MSP ORBITER - 12/10/98 -- 95 % PCS -- 95 FLT AZ
COVARIANCE MATRIX OF TECO INJECTION CONDITIONS BASED ON -3 SIGMA SENSITIVITIES

		VELOCITY FT/SEC	GAMMA DEGREES	AZIMUTH DEGREES	LONG. + W DEGREES	LATITUDE DEGREES	RADIUS FEET
VELOCITY	FT/SEC	0.20181546E+03	0.44187331E+00	0.69277287E-01	-0.14061408E+00	-0.36883505E-01	-0.23056336E+05
GAMMA	DEGREES	0.44187331E+00	0.21136523E-01	-0.14560763E-02	-0.33297234E-02	-0.91135862E-03	-0.19186262E+02
AZIMUTH	DEGREES	0.69277287E-01	-0.14560763E-02	0.21874953E-01	0.42792515E-02	0.11717830E-02	0.44735897E+02
LONG. + W	DEGREES	-0.14061408E+00	-0.33297234E-02	0.42792515E-02	0.98455124E-02	0.26907739E-02	0.10884905E+03
LATITUDE	DEGREES	-0.36883505E-01	-0.91135862E-03	0.11717830E-02	0.26907739E-02	0.73871678E-03	0.27980987E+02
RADIUS	FEET	-0.23056336E+05	-0.19186262E+02	0.44735897E+02	0.10884905E+03	0.27980987E+02	0.26086771E+08
THETA LP	DEGREES	0.15058810E+01	0.69339403E-01	-0.43135543E-02	-0.98544942E-02	-0.26946305E-02	-0.10279562E+03
PSI LP	DEGREES	0.36547449E+00	-0.14680300E-02	0.67923257E-01	0.42792614E-02	0.11696496E-02	0.44749689E+02

		THETA LP DEGREES	PSI LP DEGREES
VELOCITY	FT/SEC	0.15058810E+01	0.36547449E+00
GAMMA	DEGREES	0.69339403E-01	-0.14680300E-02
AZIMUTH	DEGREES	-0.43135543E-02	0.67923257E-01
LONG. + W	DEGREES	-0.98544942E-02	0.42792614E-02
LATITUDE	DEGREES	-0.26946305E-02	0.11696496E-02
RADIUS	FEET	-0.10279562E+03	0.44749689E+02
THETA LP	DEGREES	0.22775448E+00	-0.43657570E-02
PSI LP	DEGREES	-0.43657570E-02	0.21996929E+00

Delta 7425 MARS Orbiter Mission - 12/10/98 Launch Date
Preliminary Orbit Injection Covariance Matrix (NASA System) without PCS Effects
9/5/96 - Updated Velocity Pointing Error and Coning Velocity Loss
Tau at ignition = 182 sec Tau at burnout=56 sec Rgain start uniform from 55 sec to 80 sec

MSP ORBITER - 12/10/98 -- 95 % PCS -- 95 FLT AZ
COVARIANCE MATRIX OF TECO INJECTION CONDITIONS BASED ON -3 SIGMA SENSITIVITIES

		X (NASA) FEET	Y (NASA) FEET	Z (NASA) FEET	VX (NASA) FT/SEC	VY (NASA) FT/SEC	VZ (NASA) FT/SEC
X (NASA)	FEET	0.13933555E+10	-0.10119626E+07	-0.35294272E+08	0.39287805E+05	-0.16697828E+02	-0.16190124E+07
Y (NASA)	FEET	-0.10119626E+07	0.41384520E+06	0.40332584E+05	-0.42255790E+02	-0.49013929E+03	0.11838380E+04
Z (NASA)	FEET	-0.35294272E+08	0.40332584E+05	0.26152156E+08	-0.22559951E+05	0.13773348E+02	0.51565839E+05
VX (NASA)	FT/SEC	0.39287805E+05	-0.42255790E+02	-0.22559951E+05	0.20943257E+03	-0.11595209E+03	0.32046145E+03
VY (NASA)	FT/SEC	-0.16697828E+02	-0.49013929E+03	0.13773348E+02	-0.11595209E+03	0.87078393E+04	0.38670597E+01
VZ (NASA)	FT/SEC	-0.16190124E+07	0.11838380E+04	0.51565839E+05	0.32046145E+03	0.38670597E+01	0.10578415E+05
THETA LP	DEGREES	0.37075735E+04	-0.26912080E+01	-0.93985345E+02	0.20088161E+01	0.19175826E-01	0.39207332E+02
PSI LP	DEGREES	-0.16099316E+04	0.99934921E+00	0.40924619E+02	0.53613886E+00	-0.43574952E+02	0.18542801E+01

		THETA LP DEGREES	PSI LP DEGREES
X (NASA)	FEET	0.37075735E+04	-0.16099316E+04
Y (NASA)	FEET	-0.26912080E+01	0.99934921E+00
Z (NASA)	FEET	-0.93985345E+02	0.40924619E+02
VX (NASA)	FT/SEC	0.20088161E+01	0.53613886E+00
VY (NASA)	FT/SEC	0.19175826E-01	-0.43574952E+02
VZ (NASA)	FT/SEC	0.39207332E+02	0.18542801E+01
THETA LP	DEGREES	0.22775448E+00	-0.43657570E-02
PSI LP	DEGREES	-0.43657570E-02	0.21996929E+00

X, Y, Z (NASA) Coordinate System:
Positive x-axis is parallel to the projection of the instantaneous vehicle velocity vector onto a plane perpendicular to the radius vector.
Z-axis is positive away from the earth along the radius vector.
Y-axis completes the right-handed orthogonal system.
The origin is at the nominal vehicle present position point and the system is inertial.

Delta 7425 MARS Orbiter Mission - 12/10/98 Launch Date
Preliminary 95 % PCS Effects on Injection Velocity

MSP ORBITER - 12/10/98 -- 95 % PCS -- 95 FLT AZ

VELOCITY DEFICIT VS. PROBABILITY

VELOCITY DEFICIT (FPS)	PROBABILITY LEVEL	VELOCITY DEFICIT (FPS)	PROBABILITY LEVEL
0.00	0.95130	73.38	0.98730
3.47	0.95370	83.75	0.98970
6.74	0.95610	94.29	0.99210
9.85	0.95850	109.79	0.99450
14.10	0.96090	130.79	0.99690
18.89	0.96330	133.77	0.99720
23.35	0.96570	148.63	0.99800
27.52	0.96810	155.70	0.99860
31.31	0.97050	164.95	0.99900
34.86	0.97290	171.86	0.99930
40.03	0.97530	180.55	0.99950
48.00	0.97770	207.52	0.99970
52.36	0.98010	244.24	0.99980
57.45	0.98250	254.84	0.99990
66.90	0.98490	304.82	1.00000

THE CORRESPONDING SENSITIVITIES TO THE ABOVE VELOCITY DEFICITS ARE:*

IN POLAR COORDINATES-

PARAMETER	SENSITIVITY
INERTIAL RADIUS	-0.000352 (NMI/FPS)
INERTIAL VELOCITY	0.996670 (FPS/FPS)
INERTIAL FLIGHT PATH ANGLE	0.000140 (DEG/FPS)
AZIMUTH	-0.000079 (DEG/FPS)
LONGITUDE (+W)	-0.000186 (DEG/FPS)
GEOCENTRIC LATITUDE	-0.000047 (DEG/FPS)

* BASED ON A VELOCITY DEFICIT OF 155.70 FPS (0.99860 PROBABILITY LEVEL)

Delta 7425 MARS Orbiter Mission
Preliminary 99.865 % Probable Maximum and Minimum
Injection Condition Dispersions
Based on 9/5/96 Updated Velocity Pointing Error and Coning Velocity Loss
Tau at ignition = 182 sec Tau at burnout = 56 sec Rgain start uniform from 55 sec to 80 sec

McDonnell Douglas Aerospace-Space Transportation Division

Launch Date:	12/10/98
PCS (%):	95
Parameter	
Injection altitude (nmi)	+2.5 / -2.7
Injection Velocity (fps)	+39.3 / -163.3
Elevation angle (deg)	+0.45 / -0.43
Azimuth angle (deg)	+0.44 / -0.46
Longitude (+w,deg)	+0.29 / -0.30
Geocentric latitude (deg)	+0.08 / -0.08

Note: Errors do not include launch time effects

Launch Date:	12/10/98
PCS (%):	95
Parameter	
Inclination (deg)	+0.22 / -0.22
Longitude of the ascending node (deg)	+0.75 / -0.79
Argument of perigee (deg)	+1.01 / -1.04
True anomaly (deg)	+0.82 / -0.80
Perigee altitude (nmi)	+2.5 / -2.7
V infinity magnitude (fps)	+130.1 / -577.2
Right ascension of V infinity (deg)	+1.48 / -0.86
Declination of V infinity (fps)	+0.74 / -0.44

A.9 Orbiter Monte Carlo Simulation Description

6/3/97

TO: Distribution

FROM: Philip Knocke

SUBJECT: **ORBITER END-TO-END PROPELLANT CONSUMPTION: MONTE CARLO ANALYSIS PROGRAM**

Overview:

This memo provides a brief overview of a model for determining end-to-end propellant consumption for the MSP98 Orbiter.

Assumptions:

Figure 1 summarizes the parameter values and models used.

Interplanetary Trajectories:

Two thousand dispersed interplanetary trajectories have been calculated using the LAMBIC program, for the end of the Orbiter primary launch period. The effects of launch vehicle injection errors, orbit determination errors, and maneuver execution errors are modeled, as are the effects of solar radiation pressure and non-gravitational perturbations due to attitude thruster firing. The launch vehicle injection aimpoint was chosen to ensure < 1E-4 probability of upper stage impact with Mars, as required by Planetary Protection regulations. Each of the cases has a different value of each of the four TCM's, and hence a different approach mass, as well as a different approach aimpoint.

MOI:

For a given oxidizer propellant load, the resultant capture orbit for each trajectory is calculated, accounting for MOI pointing errors and the concurrent effects of RCS thruster usage during the biprop MOI burn. The latter effect is modeled by slightly "derating" the biprop Isp and increasing effective thrust to account for the RCS system supplying a small amount of additional translational ΔV during the MOI biprop burn. It is assumed the oxidizer is burned to depletion during the biprop burn. Both the biprop MOI maneuver and the hydrazine makeup maneuver are modeled as finite burn gravity turns. In reality, both burns will be constant pitch rate maneuvers. The difference in performance can be simulated by using an MOI aimpoint for the gravity turn approximately 4 km higher than that used for the constant pitch rate. The aimpoint used in the gravity turn calculations was designed to keep the final periapse altitude > ~ 150 km, to avoid overheating during MOI.

Inclination Trim:

The effects of the incoming dispersed trajectories and MOI pointing errors result in small errors in the desired inclination of the capture orbit. It is assumed in this analysis that these errors will be removed during the early phase of aerobraking, when the orbit period is 20 hrs. The corrective maneuver is assumed to occur at the optimum point on the orbit, resulting in a small node change as well as an inclination change. A second inclination trim is also calculated when the orbit period is 10 hrs, also at the optimum point on the orbit. This maneuver removes the majority of the inclination dispersions caused by Aerobraking; these dispersions are modeled as a uniform random distribution between 0 and 0.2 deg.

Additional ΔV:

Walk-in ΔV is calculated at apoapse of the final capture orbit, assuming that the periapse must be lowered to 100 km. The ΔV required to transfer from the final aerobraking orbit [apoapse altitude = 405±15 km] to the mapping orbit is modeled as a uniform distribution between 84.5 and 91.9 m/s [Open Primary], or 84 - 90.4 m/s [Close Primary], assuming insertion into the frozen 405 km circular orbit and a North approach. Remaining ΔV's and mass drops are currently calculated as fixed quantities.

Verification:

This program was used to estimate propellant load and maximum dry mass capability for the mission. The calculations were verified by comparison with Phil Hong's propellant spreadsheet, version XC0151. With identical assumptions, the Monte Carlo program agreed with the spreadsheet calculations to within 0.1 kg.

Mission Requirements and Constraints:

It is required that the Orbiter, if launched within its primary launch period, achieve a minimum 95% probability of completing aerobraking by the time of lander arrival. Assuming Orbiter launch at the end of its primary period [launch 12/17/98, arrival 9/29/99] and launch of the Lander during its primary period [arrival 12/3/99], the maximum allowable capture orbit period is approximately 29 hrs. This is the most stressful case within the Orbiter's primary launch period because it allows the least time for aerobraking, and also has the highest arrival V-infinity value. For this analysis, a maximum wet mass capability of 643 kg was assumed, consistent with the performance of the Delta II 7425 launched at the start of the Orbiter's primary period, where the launch energy is highest [C3 = 11.19 km^2/s^2].

Acknowledgments:

Major portions of this analysis were provided by the following:

Pieter Kallemeyn:	**Interplanetary trajectories, TCM ΔV's**
Cliff Helfrich:	**TCM ΔV's, 95% PCS calculations**
Andrey Sergeyevsky:	**Approach mass program, detailed MOI analysis**
Ted Sweetser:	**Integration subroutine for MOI burns**
Phil Hong:	**Model parameter values & statistics**
Bill Willcockson:	**Aerobraking analyses**

ORBITER Monte Carlo Simulation Assumptions Rev 1.6 Date 6/3/97

TCM Summary	TCM #	Placement	95% Low ΔV	Mean ΔV	95% High ΔV	
	1	Launch + 15 days	12.36	33.98	68.11	Modeling includes maneuver execution and OD errors
	2	Launch + 45 days	0.07	0.29	0.69	MACDAC Injection covariance dated 9/5/96,
	3	MOI - 60 days	0.03	0.19	0.51	including effects of 95% PCS.
	4	MOI - 10 days	0.01	0.04	0.08	
	Totals		**12.66**	**34.51**	**68.81**	

	Description		Mean	Units	3 σ Variation	Model	Comments
LV Data	**Max Injected Wet Mass**		643	kg			For open of Primary Launch Period, C3 = 11.16 km2/s2
ΔV Modeling	TCM Maneuver Execution errors:	Proportional magnitude error	0	%	1% for TCM1 2% for other TCMs	Gaussian	Exhibit 1 requirement 3.C.1
		Proportional pointing error	0	radians / axis	0.01 for TCM1 0.02 for other TCMs	Gaussian	Based on Exhibit 1 requirement 3.C.1
		Fixed magnitude error	0	m/s	0.01 m/s for burns ≤ 2 m/s 0.1 m/s for burns > 2 m/s	Gaussian	Exhibit 1 requirement 3.C.2
		Fixed pointing error	0	m/s / axis		fixed	
	MOI-1[biprop] and MOI-2 [hydrazine]						Both modeled as finite burn gravity turns, calibrated to simulate constant pitch rate burns.
	MOI-1	Isp factor	0.99695			fixed	Multiply by Nominal Biprop Isp to get "effective" Biprop Isp including effect of concurrent RCS
		Thrust factor	1.0082			fixed	Multiply by Nominal Biprop Thrust to get "effective" Biprop Thrust including effect of concurrent RCS
	MOI-2 [Hydrazine makeup]	Start MOI-2 at end of MOI-1 burn +	60	s		fixed	
	Target Orbit Period, end Primary	End Primary = 12/17/98	29	h			[TBR] Required to finish aerobraking 24h before lander arr: 12/3/99
	Inclination Trims [2]						Two trims are calculated: one at 20 hrs for correcting inclination dispersions at MOI, the other at 10 hrs to correct up to 0.2 deg. of AB dispersions. The latter is modeled as a uniform distribution from 0 to 0.2 degrees. Both ΔV's are assumed to occur at the optimum point on the orbit, which results in both an inclination change and a change in node.
	Walk-in	Translational					ΔV required to reduce altitude after MOI-2 to 100 km
	Transfer to Map Orbit	Translational	85.4 - 91.9 84 - 90.4	m/s m/s	Open LP Close LP	uniform uniform	Based on uncertainties in final AB state [N. approach]
	Corridor Control	Translational	12.00	m/s		fixed	
		Rotational	15.22	m/s		fixed	
	Aero exit/reentry	Translational	17.00	m/s		fixed	
	End Game	Translational	1.50	m/s		fixed	
	RCS map/relay ops	Rotational	22.63	m/s		fixed	
	Orbit maintenance	Translational	0.00	m/s		fixed	
	RCS contingency	Rotational	15.97	m/s		fixed	RCS uncertainty, failed reaction wheel, other contingency, project mgr reserve
Mass Drops	**Cruise RCS**		2.03	kg		fixed	divided equally between TCM's
	MOI-1RCS mass		0.9	kg		fixed	RCS mass consumed during MOI
S/C Data	**Nominal Biprop Isp**		318	s	1	Uniform	
	Hydrazine Isp	Translational	225	s	10	Gaussian	
		Rotational	170	s	10	Gaussian	
	MOI Pointing Error	Crosstrack	0	deg.	0.25	Gaussian	
		Normal	0	deg.	0.017	Gaussian	
	Fuel Mixture Ratio		0.85		0.04	Gaussian	
	Nominal Biprop Thrust		640.355	N		fixed	
	Hydrazine Thrust		80.1	N		fixed	
	Trapped oxidizer		0.2	kg		fixed	
	% Trapped Hydrazine		2	%		fixed	
	Pressurant		0.91	kg		fixed	

FIGURE 1 - ORBITER MONTE CARLO ASSUMPTIONS - Rev 1.6

A.10 Orbiter Data Rates, Earth Contact Durations, Daily Data Volumes

A.10.1 Orbiter and Lander Communication Strategy during the Mission Memo MSP-SE-97-0162

A.10.2 Data Rates, Data Volumes during Mapping

Interoffice Memo

LOCKHEED MARTIN

Memo No.: MSP-SE-97-0162

Date: 3/31/97

To: P. Knocke

cc: MSP

From: K. Nii

Subject: Orbiter and Lander Communication Strategy during Cruise
==========

This memo documents the Mission Operations plan for communication strategies with the orbiter and lander during the Cruise portion of the mission.

Orbiter Cruise Comm Strategy Overview:

Each mission phase drives one or more subsystem performance parameter. After separation, key engineering data are broadcast to available X-band sites to support post-flight anomaly investigation. As the S/C approaches the first DSN station, the 34 m antenna will be used to acquire and track the Orbiter. Coherent two way ranging is key during daily telecommunication passes throughout all the phases. The Orbiter transmits 2.1 kbps on the MGA and receives 125 bps on the LGA during the S/C Init and Cruise Phases. Each DSN contact nominally lasts four hours. The Orbiter transfers from the MGA/LGA to the HGA at Launch + 80 days. During the rest of Cruise the Orbiter transmits at 2100 bps and receives at 125 bps. At MOI - 45 days, the orbiter will transition to a communicating strategy of 4 hours on and 5 hours off.

When not in planned communication with the ground the orbiter will be in receive mode on the LGA at 7.8125 bps.

Lander Cruise Comm Strategy Overview:

Each mission phase drives one or more subsystem performance parameter. After separation, key engineering data are broadcast to available X-band sites to support post-flight anomaly investigation. As the S/C approaches the first DSN station, the 34 m antenna will be used to acquire and track the Lander. Coherent two way ranging is key during daily telecommunication passes throughout the Cruise phase. The lander uses the cruise MGA to transmit and receive for the entire cruise phase. DSN contacts are planned to occur once/day for all of cruise until EDL-46 days. At this time the lander will transition to a four hours on five hours off communication strategy.

When not in planned communication with the ground the lander will be in receive mode on the LGA at 7.8125 bps.

Orbiter

Possible Transmit Rates: MGA/HGA 40, 2100, 5688, 9954, 33180, 71100, 110600 bps
8 kbps UHF

Possible Receive Rates: LGA 7.8125, 125 bps
HGA 7.8125, 125, 500, 1000* bps (* No ranging)
128 kbps UHF

Phase:	Nominal Transmit Rates:	Nominal Receive Rates:
Initial Acquisition	2.1K bits per second	125 bits per second
Cruise	2.1 kbps	125 bps

Lander

Possible Transmit Rates: Cruise MGA 40, 100, 2100 bits per second (bps)
Landed MGA 40, 395 (R=1/2), 700 (R=1/6), 1400 bps
8 kbps, 128 kbps UHF (nominal)

Possible Receive Rates: Cruise MGA 7.8125, 125, 500 bps
Landed MGA 7.8125, 125, 500 bps
8 kbps UHF (nominal) (128 kbps possible)

Phase:	Transmit	Receive
Initial Acquisition	2.1 kbits per second	125 bits per second
Cruise	100 bps	125 bps
Approach (EDL-46 days)	40 bps	7.8125 bps

Orbiter DSN Cruise Contact Plan (Open of Launch period):

# Days	Mission Day	Frequency	Antenna	Operations
80	1-80	1/day	LGA/MGA	Cruise (4 hours)
164	81-244	1/day	HGA	Cruise (4 hours)
45	245-289	3/day*	HGA	Approach (*4 hours on, 5 hours off) Includes TCM-4

Orbiter DSN Cruise Contact Plan (Close of Launch period):

# Days	Mission Day	Frequency	Antenna	Operations
80	1-80	1/day	LGA/MGA	Cruise (4 hours)
160	81-240	1/day	HGA	Cruise (4 hours)
45	241-285	3/day*	HGA	Approach (*4 hours on, 5 hours off) Includes TCM-4

Lander DSN Cruise Contact Plan (Open of Launch period):

# Days	Mission Day	Frequency	Antenna	Operations
301	1-302	1/day	MGA	Cruise (4 hours)
46	303-347	3/day*	MGA	Approach (*4 hours on, 5 hours off) Includes TCM-4

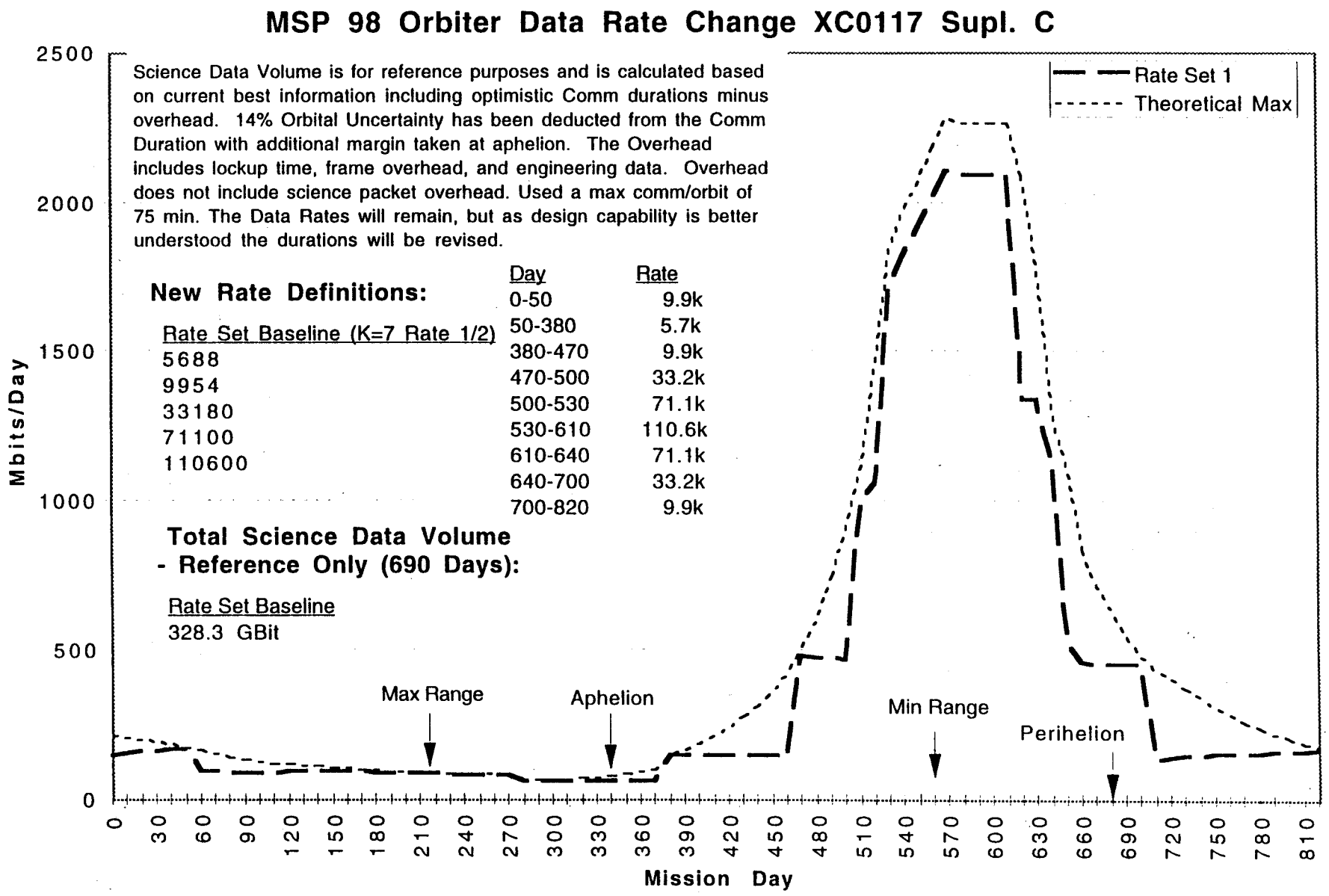
Lander DSN Cruise Contact Plan (Close of Launch period):

# Days	Mission Day	Frequency	Antenna	Operations
289	1-290	1/day	MGA	Cruise (4 hours)
46	291-335	3/day*	MGA	Approach (*4 hours on, 5 hours off) Includes TCM-4

original signed by

Kendall M. Nii

5 New Rates with SA Management ==> High Science Vol.



Maximum Telecom Data Rate vs. Orbiter Mission Day

** Includes Frame, RS encoding, Transfer overhead				
[does not include packet overhead]				
Engineering data (Mbits)			2.52825	
* Includes 2 min lock up time				
Mission Day	minutes/ orbit	Rate Set 1	Total Mbits /Day *	Science MBits /Day **
0	61	9954	176	150
10	64	9954	184	157
20	65	9954	189	161
30	66	9954	192	163
40	67	9954	194	166
50	68	9954	197	168
60	68	5688	113	95
70	66	5688	110	92
80	65	5688	107	90
90	65	5688	107	90
100	65	5688	107	90
110	65	5688	107	90
120	65	5688	108	91
130	65	5688	108	91
140	65	5688	108	91
150	65	5688	108	91
160	65	5688	108	91
170	65	5688	108	91
180	65	5688	107	90
190	64	5688	105	88
200	63	5688	104	87
210	62	5688	102	86
220	61	5688	101	85
230	60	5688	99	83
240	59	5688	98	82
250	59	5688	98	82
260	59	5688	96	81
270	58	5688	95	80
280	57	5688	93	78
290	42	5688	69	57
300	42	5688	69	57
310	42	5688	69	57
320	42	5688	68	57
330	42	5688	68	57
340	42	5688	68	57
350	42	5688	68	57
360	42	5688	68	56
370	42	5688	68	56
380	42	9954	119	100
390	42	9954	119	100

Maximum Telecom Data Rate vs. Orbiter Mission Day

** Includes Frame, RS encoding, Transfer overhead				
400	59	9954	171	146
410	59	9954	171	146
420	59	9954	171	146
430	60	9954	174	148
440	59	9954	171	146
450	59	9954	171	146
460	59	9954	169	143
470	59	33180	562	484
480	58	33180	554	477
490	58	33180	554	477
500	57	33180	545	469
510	57	71100	1169	1008
520	59	71100	1224	1056
530	61	110600	1961	1693
540	65	110600	2103	1817
550	69	110600	2217	1916
560	72	110600	2332	2014
570	75	110600	2437	2105
580	75	110600	2420	2090
590	75	110600	2420	2090
600	75	110600	2420	2090
610	75	110600	2420	2090
620	75	110600	2420	2090
630	75	71100	1555	1343
640	63	71100	1297	1119
650	64	33180	614	528
660	56	33180	537	462
670	55	33180	528	454
680	55	33180	528	454
690	55	33180	528	454
700	55	33180	528	454
710	56	9954	161	137
720	59	9954	169	143
730	60	9954	174	148
740	61	9954	176	150
750	62	9954	179	152
760	63	9954	182	155
770	64	9954	184	157
780	64	9954	184	157
790	65	9954	187	159
800	65	9954	189	161
810	66	9954	192	163
820	67	9954	194	166
		Total MBits	Science+Eng	Science
		820 Days	41625	35796
		690 Days	38925	33493

A.11 Mapping Phase Navigation Capabilities

The data in this appendix represent very preliminary estimates of downtrack prediction capabilities in the MSP98 Orbiter orbit. Shown are downtrack prediction capabilities for 95% and 99.9% confidence levels, as a function of prediction interval, due to atmospheric uncertainty. Data are presented for three dates: 1/1/2000 [during the Lander Support Phase], 12/1/00 [near the middle of the Mapping Phase] and 7/7/01 [near the end of Mapping].

1/1/00				
Pred. Interval	95.0%	95.0%	99.9%	99.9%
[days]	[km]	[sec]	[km]	[sec]
1	0.89	0.27	4.81	1.43
2	3.42	1.02	18.50	5.51
3	8.02	2.39	43.36	12.92
4	13.98	4.16	75.56	22.51
5	21.57	6.43	116.63	34.75
6	30.81	9.18	166.59	49.64
7	42.68	12.72	230.74	68.75
14	**167.78**	**49.99**	**907.04**	**270.28**
21	375.30	111.83	2028.97	604.58
12/1/00				
Pred. Interval	95.0%	95.0%	99.9%	99.9%
[days]	[km]	[sec]	[km]	[sec]
1	0.11	0.03	0.60	0.18
2	0.41	0.12	2.32	0.69
3	0.96	0.29	5.43	1.62
4	1.67	0.50	9.47	2.82
5	2.57	0.77	14.61	4.35
6	3.68	1.10	20.87	6.22
7	5.09	1.52	28.91	8.61
14	**20.02**	**5.96**	**113.65**	**33.86**
21	44.77	13.34	254.22	75.75
7/7/01				
Pred. Interval	95.0%	95.0%	99.9%	99.9%
[days]	[km]	[sec]	[km]	[sec]
1	0.16	0.05	0.82	0.25
2	0.63	0.19	3.17	0.95
3	1.47	0.44	7.43	2.22
4	2.56	0.76	12.96	3.86
5	3.95	1.18	20.00	5.96
6	5.64	1.68	28.57	8.51
7	7.82	2.33	39.56	11.79
14	**30.72**	**9.15**	**155.53**	**46.34**
21	68.72	20.48	347.90	103.67

A.12 34m BWG Usage and Tracking Schedule Modifications

DSN coverage for the majority of the mission is via the 34m subnet and the 70m subnet. Use of the 34m HEF antennae has been maximized, but 34m BWG support is necessary for limited intervals, to accommodate DSN usage conflicts and to maximize tracking of the Orbiter during the last 30 days of Lander approach [interval of near-simultaneous tracking]. In addition, some modification of the nominal tracking profile is occasionally required in order to accommodate conflicts with other missions using the same DSN assets. The following data summarize the use of BWG antennae and/or modifications to the tracking schedule required during the mission.

A.12.1 DSN Contention Resolution

A.12.2 Approach, near-Simultaneous Tracking Integrated Schedule: an integrated [Orbiter + Lander] schedule of tracks for the interval of near-simultaneous tracking starting 30 days from Entry. These tracks have not been edited to be consistent with Earth view periods, but are intended to show the approximate variation of lander track durations and timing as a function of date.

Summary of Recommendations - DSN Resource Contention Resolution [Mars98]

PCK DRAFT - 4/29/97, updated 7/18/97

Contention Period	Recommendation (Source)	Dates	M98 Orbiter Action	Impact on M98 Orbiter	M98 Lander Action	Impact on M98 Lander	Comments
# 6 [1/4/99 - 3/7/99]	M98 Lander and Orbiter use BWG on days when MGS has continuous coverage. (RAP)	1/5/99 - 1/12/99	Use GLD & CAN HEF overlap [6 2-hr passes/week?]. Supplement with BWG to total 7 4-hr passes/week. Some coverage from all 3 stations required.	No Impact.	BWG: continuous coverage to 1/10/99 BWG: 7 4-hr passes/week 1/10/99 - 1/12/99	No Impact.	• GLD/CAN overlap pass duration of 2-hrs is an estimate, with pre&post-cal taken out.
		1/13/99 - 1/19/99	HEF: 6 4-hr passes/week	Reduced monitoring	BWG: 7 4-hr passes/week	No Impact.	
		1/20/99 - 1/27/99	Use GLD & CAN HEF overlap [6 2-hr passes/week?]. Supplement with BWG to total 7 4-hr passes/week. Some coverage from all 3 stations required.	No Impact.	BWG: 7 4-hr passes/week	No Impact.	
		1/28/99 - 2/2/99	HEF: 6 4-hr passes/week	Reduced monitoring	BWG: 7 4-hr passes/week	No Impact.	
		2/3/99 - 2/10/99	Use GLD & CAN HEF overlap [6 2-hr passes/week?]. Supplement with BWG to total 7 4-hr passes/week. Some coverage from all 3 stations required.	No Impact.	BWG: 7 4-hr passes/week	No Impact.	
		2/11/99 - 2/17/99	HEF [MAD only]: 7 4-hr passes/week	Reduced Nav accuracy	BWG: 7 4-hr passes/week	No Impact.	• MGS diametric occultations
		2/18/99 - 2/22/99	BWG: 7 4-hr passes/week	No Impact.	Use GLD & CAN HEF overlap [6 2-hr passes/week?].	Reduced monitoring, nav accuracy	
		2/23/99 - 3/5/99	BWG: 7 4-hr passes/week from GLD & CAN	Reduced Nav accuracy	HEF: GLD 4 hr/day, CAN 1 hr/day	Reduced nav accuracy	
# 8 [5/3/99 - 5/9/99]	M98 Lander and Orbiter use BWG (RAP)	5/3/99 - 5/9/99	BWG: 7 4-hr passes/week	No Impact.	Use GLD/CAN HEF overlap [7 3-hr passes/week?]. Supplement with BWG to total 7 4-hr passes/week. Some coverage from all 3 stations required.	No Impact.	• Lander 's use of BWG requires deadbands tightened to ±9°, leading to minimal propellant hit [<< 0.1 kg].
# 9 [6/21/99 - 7/25/99]	M98 Lander & Orbiter use BWG every 3rd day (RAP)	6/21/99 - 7/25/99	1 4-hr HEF pass/day* except every 3rd day, go to 1 4-hr BWG pass.	No Impact.	No action required.	No impact.	
#10 [7/26/99 - 8/15/99]	M98 Lander & Orbiter use BWG (RAP)	8/2/99 - 8/9/99	BWG: 7 4-hr passes/week	No Impact.	Use GLD/CAN HEF overlap [7 3-hr passes/week?]. Supplement with BWG to total 7 4-hr passes/week. Some coverage from all 3 stations required.	No Impact.	• Lander 's use of BWG may require deadbands tightened to ±TBD°, leading to propellant hit.
# 11 [8/16/99 - 10/16/99]	M98 Lander use BWG (RAP)	8/16/99 - 10/16/99	No action required. Orbiter receives needed HEF tracking during approach.	No Impact.	Lander uses HEF throughout. 1 4-hr pass/day* except every 3rd day, the Lander pass is truncated to fit within DSN capability.	Reduction in monitoring. Other impacts TBD [e.g. impact on TCM-3 10/4/99].	• Lander alternative: use BWG during 8/16-9/10/99 only, requiring deadbands tightened to ±2° for 25 days, leading to propellant hit of 0.1 kg. + TBD impacts.
# 12 [10/18/99 - 12/5/99]	Give Stardust 6 contiguous hrs/week of HEF time. (Stardust)	10/18/99 - 12/5/99	No action required. Orbiter receives needed HEF tracking during aerobraking.	No Impact.	Lander gets requisiteHEF tracking [near-simultaneous w/ Orbiter] except for Stardust tracks. Per 4/24/997 agreement, no Stardust tracks occur 11/26/99 - 12/5/99.	No impact.	
week 38-39, 1999	Accept 2-3 hr/day gap in continuous 70m coverage for Orbiter. (GLL)	9/21/99 - 9/25/99	Accept, per GLL memo 4/1/97, 2-3 hr gap in continuous 70m coverage.	No Impact	No action required.	No impact.	
week 48 - 49, 1999	Maximize use of Canberra 70m antenna for Lander D/L during Sol 0,1. (GLL)	12/1/99 - 12/5/99	Accept, per GLL memo 4/1/97, reduction in DSS-14 [Goldstone] coverage in favor of DSS-43 [Canberra].	No Impact	No action required.	No impact..	

* Baseline Coverage

Legend: GLD = Goldstone, MAD = Madrid, CAN = Canberra

Integrated Tracking Schedule
Near-Simultaneous Tracking
Open Primary [Starting E-30d]

Assumptions:
- Minimum 2 hr / lander track
- Minimum 1h 24 m between tracks
- 4 on/ 5 off or equivalent
- Use 0.5h Orbiter tracks and 4 on/5 off Lander tracks 2d before end of AB
- End near-simul tracking NLT Entry-30h

Days to Entry	s/c. antenna	Start Track	Track 1 duration h	End Track
-30.7	Orb.HEF	11/3/99 4:25	3.83	11/3/99 8:15
-30.5	Lander	11/3/99 9:39	2.05	11/3/99 11:42
-30.3	Orb.HEF	11/3/99 13:06	3.77	11/3/99 16:52
-30.1	Lander	11/3/99 18:16	4.00	11/3/99 22:16
-30.0	Orb.BWG	11/3/99 21:40	3.72	11/4/99 1:24
-29.6	Orb.HEF	11/4/99 6:06	3.68	11/4/99 9:46
-29.4	Lander	11/4/99 11:10	4.00	11/4/99 15:10
-29.3	Orb.BWG	11/4/99 14:26	3.62	11/4/99 18:03
-28.9	Orb.HEF	11/4/99 22:38	3.57	11/5/99 2:12
-28.7	Lander	11/5/99 3:36	4.00	11/5/99 7:36
-28.6	Orb.BWG	11/5/99 6:45	3.53	11/5/99 10:17
-28.3	Orb.HEF	11/5/99 14:44	3.47	11/5/99 18:13
-28.1	Lander	11/5/99 19:37	4.00	11/5/99 23:37
-27.9	Orb.BWG	11/5/99 22:37	3.43	11/6/99 2:03
-27.6	Orb.HEF	11/6/99 6:25	3.39	11/6/99 9:48
-27.4	Lander	11/6/99 11:12	4.00	11/6/99 15:12
-27.3	Orb.BWG	11/6/99 14:05	3.34	11/6/99 17:26
-27.0	Orb.HEF	11/6/99 21:40	3.30	11/7/99 0:59
-26.8	Lander	11/7/99 2:23	4.00	11/7/99 6:23
-26.7	Orb.BWG	11/7/99 5:10	3.25	11/7/99 8:25
-26.3	Orb.HEF	11/7/99 12:33	3.21	11/7/99 15:46
-26.2	Lander	11/7/99 17:10	4.00	11/7/99 21:10
-26.0	Orb.BWG	11/7/99 19:51	3.18	11/7/99 23:02
-25.7	Orb.HEF	11/8/99 3:03	3.13	11/8/99 6:11
-25.6	Lander	11/8/99 7:35	4.00	11/8/99 11:35
-25.4	Orb.BWG	11/8/99 10:09	3.10	11/8/99 13:15
-25.2	Orb.HEF	11/8/99 17:11	3.05	11/8/99 20:14
-25.0	Lander	11/8/99 21:38	4.00	11/9/99 1:38
-24.9	Orb.BWG	11/9/99 0:07	3.02	11/9/99 3:09
-24.6	Orb.HEF	11/9/99 6:58	2.98	11/9/99 9:57
-24.4	Lander	11/9/99 11:21	4.00	11/9/99 15:21
-24.3	Orb.BWG	11/9/99 13:44	2.94	11/9/99 16:41
-24.0	Orb.HEF	11/9/99 20:26	2.91	11/9/99 23:20
-23.8	Lander	11/10/99 0:44	4.00	11/10/99 4:44
-23.7	Orb.BWG	11/10/99 3:02	2.87	11/10/99 5:54
-23.5	Orb.HEF	11/10/99 9:33	2.84	11/10/99 12:24
-23.3	Lander	11/10/99 13:48	4.00	11/10/99 17:48
-23.2	Orb.BWG	11/10/99 15:59	2.81	11/10/99 18:48
-22.9	Orb.HEF	11/10/99 22:22	2.78	11/11/99 1:09
-22.8	Lander	11/11/99 2:33	4.00	11/11/99 6:33
-22.7	Orb.BWG	11/11/99 4:40	2.75	11/11/99 7:24
-22.4	Orb.HEF	11/11/99 10:54	2.72	11/11/99 13:37
-22.2	Lander	11/11/99 15:01	4.00	11/11/99 19:01
-22.2	Orb.BWG	11/11/99 17:04	2.68	11/11/99 19:45
-21.9	Orb.HEF	11/11/99 23:09	2.65	11/12/99 1:48
-21.7	Lander	11/12/99 3:12	4.00	11/12/99 7:12
-21.7	Orb.BWG	11/12/99 5:10	2.62	11/12/99 7:47
-21.4	Orb.HEF	11/12/99 11:06	2.59	11/12/99 13:41
-21.2	Lander	11/12/99 15:05	4.00	11/12/99 19:05
-21.2	Orb.BWG	11/12/99 16:59	2.56	11/12/99 19:32
-20.9	Orb.HEF	11/12/99 22:47	2.53	11/13/99 1:19
-20.8	Lander	11/13/99 2:43	4.00	11/13/99 6:43
-20.7	Orb.BWG	11/13/99 4:31	2.50	11/13/99 7:01
-20.4	Orb.HEF	11/13/99 10:11	2.47	11/13/99 12:39
-20.3	Lander	11/13/99 14:03	4.00	11/13/99 18:03
-20.2	Orb.BWG	11/13/99 15:47	2.44	11/13/99 18:13
-20.0	Orb.HEF	11/13/99 21:19	2.41	11/13/99 23:44
-19.8	Lander	11/14/99 1:08	4.00	11/14/99 5:08
-19.8	Orb.BWG	11/14/99 2:48	2.39	11/14/99 5:11
-19.5	Orb.HEF	11/14/99 8:13	2.36	11/14/99 10:35

Integrated Tracking Schedule
Near-Simultaneous Tracking
Open Primary [Starting E-30d]

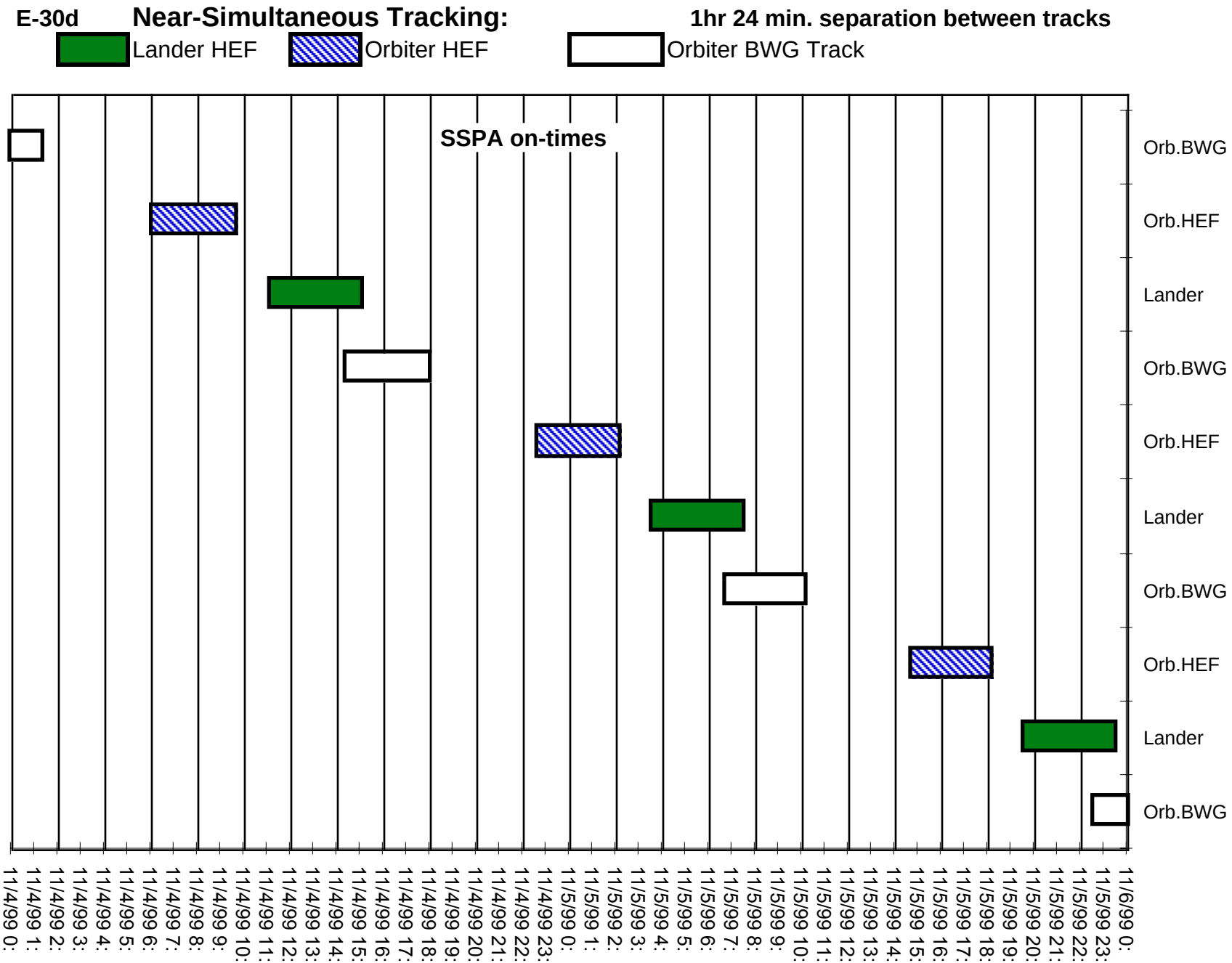
Days to Entry	s/c. antenna	Start Track	Track 1 duration h	End Track
-19.4	Lander	11/14/99 11:59	4.00	11/14/99 15:59
-19.3	Orb.BWG	11/14/99 13:34	2.34	11/14/99 15:54
-19.1	Orb.HEF	11/14/99 18:52	2.31	11/14/99 21:11
-18.9	Lander	11/14/99 22:35	4.00	11/15/99 2:35
-18.9	Orb.BWG	11/15/99 0:06	2.28	11/15/99 2:23
-18.6	Orb.HEF	11/15/99 5:17	2.25	11/15/99 7:33
-18.5	Lander	11/15/99 8:57	4.00	11/15/99 12:57
-18.4	Orb.BWG	11/15/99 10:24	2.22	11/15/99 12:38
-18.2	Orb.HEF	11/15/99 15:28	2.20	11/15/99 17:40
-18.1	Lander	11/15/99 19:04	4.00	11/15/99 23:04
-18.0	Orb.BWG	11/15/99 20:28	2.17	11/15/99 22:38
-17.8	Orb.HEF	11/16/99 1:24	2.15	11/16/99 3:33
-17.7	Lander	11/16/99 4:57	4.00	11/16/99 8:57
-17.6	Orb.BWG	11/16/99 6:17	2.13	11/16/99 8:24
-17.4	Orb.HEF	11/16/99 11:06	2.10	11/16/99 13:12
-17.3	Lander	11/16/99 14:36	4.00	11/16/99 18:36
-17.2	Orb.BWG	11/16/99 15:53	2.08	11/16/99 17:58
-17.0	Orb.HEF	11/16/99 20:36	2.06	11/16/99 22:40
-16.9	Lander	11/17/99 0:04	4.00	11/17/99 4:04
-16.8	Orb.BWG	11/17/99 1:17	2.04	11/17/99 3:20
-16.6	Orb.HEF	11/17/99 5:55	2.02	11/17/99 7:56
-16.5	Lander	11/17/99 9:20	4.00	11/17/99 13:20
-16.4	Orb.BWG	11/17/99 10:31	2.00	11/17/99 12:31
-16.2	Orb.HEF	11/17/99 15:02	1.98	11/17/99 17:01
-16.1	Lander	11/17/99 18:25	3.95	11/17/99 22:22
-16.1	Orb.BWG	11/17/99 19:32	1.95	11/17/99 21:29
-15.9	Orb.HEF	11/17/99 23:58	1.93	11/18/99 1:54
-15.7	Lander	11/18/99 3:18	3.87	11/18/99 7:10
-15.7	Orb.BWG	11/18/99 4:21	1.91	11/18/99 6:16
-15.5	Orb.HEF	11/18/99 8:42	1.89	11/18/99 10:36
-15.4	Lander	11/18/99 12:00	3.78	11/18/99 15:46
-15.3	Orb.BWG	11/18/99 13:00	1.87	11/18/99 14:52
-15.2	Orb.HEF	11/18/99 17:15	1.85	11/18/99 19:06
-15.0	Lander	11/18/99 20:30	3.69	11/19/99 0:12
-15.0	Orb.BWG	11/18/99 21:27	1.83	11/18/99 23:17
-14.8	Orb.HEF	11/19/99 1:36	1.81	11/19/99 3:25
-14.7	Lander	11/19/99 4:49	3.57	11/19/99 8:23
-14.6	Orb.BWG	11/19/99 5:42	1.79	11/19/99 7:30
-14.5	Orb.HEF	11/19/99 9:47	1.77	11/19/99 11:33
-14.3	Lander	11/19/99 12:57	3.44	11/19/99 16:24
-14.3	Orb.BWG	11/19/99 13:49	1.75	11/19/99 15:34
-14.1	Orb.HEF	11/19/99 17:48	1.73	11/19/99 19:32
-14.0	Lander	11/19/99 20:56	3.29	11/20/99 0:14
-14.0	Orb.BWG	11/19/99 21:44	1.71	11/19/99 23:27
-13.8	Orb.HEF	11/20/99 1:38	1.70	11/20/99 3:19
-13.7	Lander	11/20/99 4:43	3.19	11/20/99 7:55
-13.6	Orb.BWG	11/20/99 5:30	1.68	11/20/99 7:10
-13.5	Orb.HEF	11/20/99 9:19	1.66	11/20/99 10:58
-13.4	Lander	11/20/99 12:22	3.05	11/20/99 15:25
-13.3	Orb.BWG	11/20/99 13:05	1.65	11/20/99 14:43
-13.2	Orb.HEF	11/20/99 16:49	1.63	11/20/99 18:27
-13.0	Lander	11/20/99 19:51	2.94	11/20/99 22:47
-13.0	Orb.BWG	11/20/99 20:31	1.61	11/20/99 22:08
-12.9	Orb.HEF	11/21/99 0:11	1.59	11/21/99 1:47
-12.7	Lander	11/21/99 3:11	2.81	11/21/99 6:00
-12.7	Orb.BWG	11/21/99 3:49	1.58	11/21/99 5:24
-12.6	Orb.HEF	11/21/99 7:24	1.56	11/21/99 8:57
-12.4	Lander	11/21/99 10:21	2.69	11/21/99 13:03
-12.4	Orb.BWG	11/21/99 10:57	1.55	11/21/99 12:30
-12.3	Orb.HEF	11/21/99 14:27	1.53	11/21/99 15:59

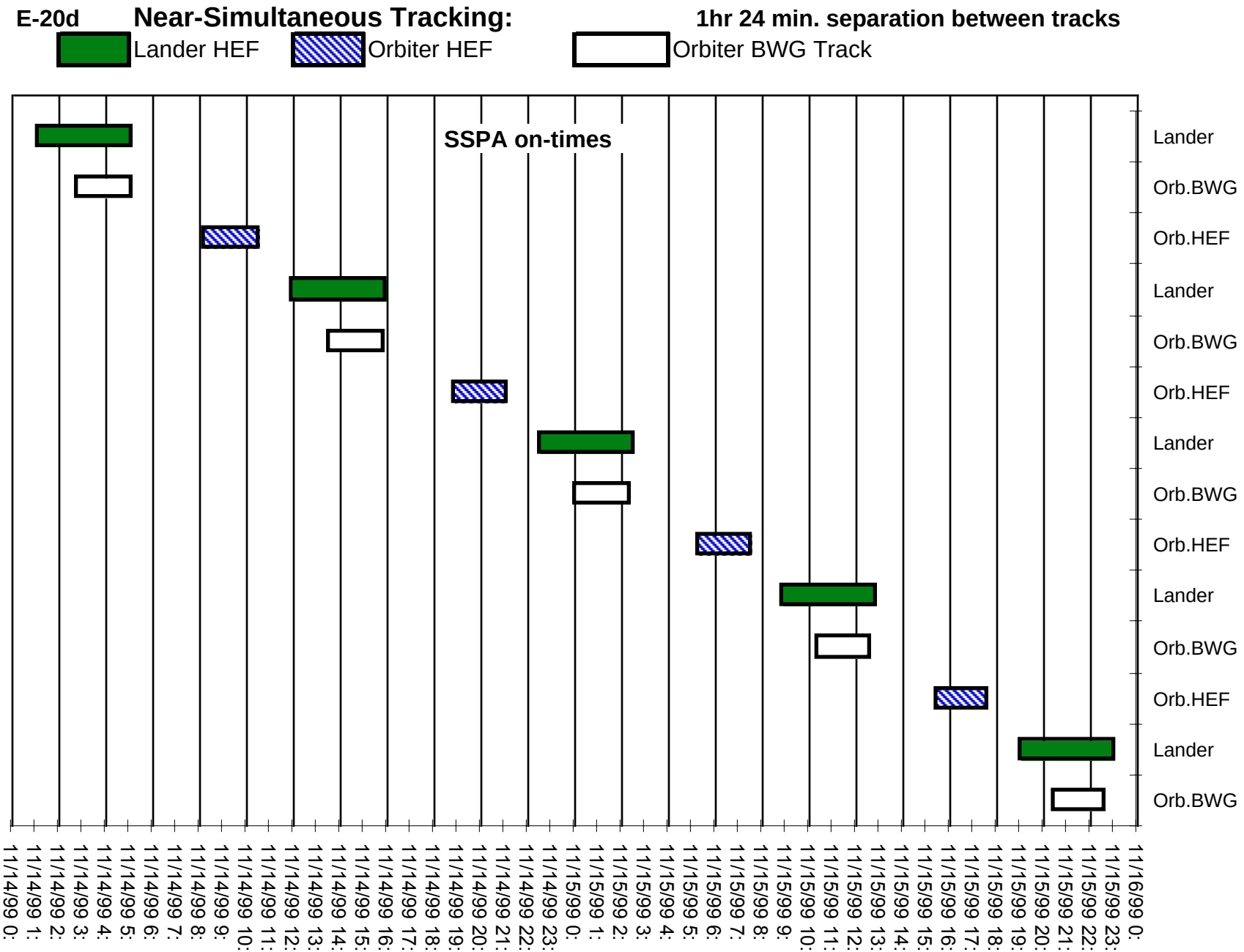
Integrated Tracking Schedule
Near-Simultaneous Tracking
Open Primary [Starting E-30d]

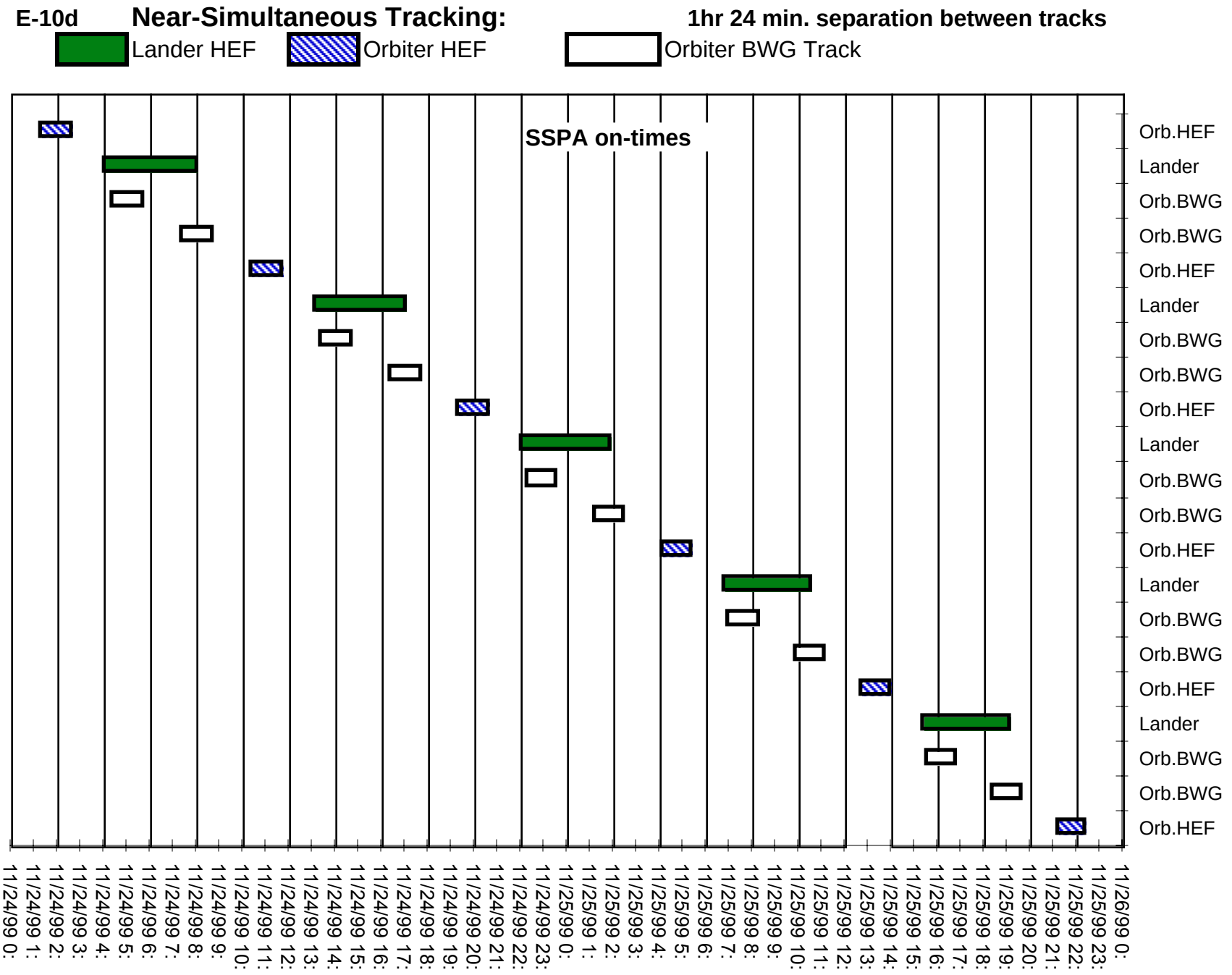
Days to Entry	s/c. antenna	Start Track	Track 1 duration h	End Track
-12.1	Lander	11/21/99 17:23	2.61	11/21/99 19:59
-12.1	Orb.BWG	11/21/99 17:56	1.52	11/21/99 19:27
-12.0	Orb.HEF	11/21/99 21:23	1.50	11/21/99 22:53
-11.9	Lander	11/22/99 0:17	2.47	11/22/99 2:45
-11.8	Orb.BWG	11/22/99 0:48	1.49	11/22/99 2:17
-11.7	Orb.HEF	11/22/99 4:09	1.48	11/22/99 5:38
-11.6	Lander	11/22/99 7:02	2.40	11/22/99 9:26
-11.6	Orb.BWG	11/22/99 7:31	1.47	11/22/99 8:59
-11.4	Orb.HEF	11/22/99 10:50	1.46	11/22/99 12:17
-11.3	Lander	11/22/99 13:41	2.36	11/22/99 16:03
-11.3	Orb.BWG	11/22/99 14:10	1.45	11/22/99 15:37
-11.1	Orb.HEF	11/22/99 17:27	1.45	11/22/99 18:54
-11.0	Lander	11/22/99 20:18	2.31	11/22/99 22:36
-11.0	Orb.BWG	11/22/99 20:44	1.44	11/22/99 22:11
-10.9	Orb.HEF	11/23/99 0:00	1.43	11/23/99 1:26
-10.8	Lander	11/23/99 2:50	2.23	11/23/99 5:04
-10.7	Orb.BWG	11/23/99 3:15	1.42	11/23/99 4:40
-10.6	Orb.HEF	11/23/99 6:28	1.41	11/23/99 7:52
-10.5	Lander	11/23/99 9:16	2.17	11/23/99 11:27
-10.5	Orb.BWG	11/23/99 9:39	1.40	11/23/99 11:03
-10.3	Orb.HEF	11/23/99 12:51	1.39	11/23/99 14:14
-10.2	Lander	11/23/99 15:38	2.08	11/23/99 17:43
-10.2	Orb.BWG	11/23/99 16:00	1.38	11/23/99 17:22
-10.1	Orb.HEF	11/23/99 19:07	1.37	11/23/99 20:29
-10.0	Lander	11/23/99 21:53	2.03	11/23/99 23:54
-9.9	Orb.BWG	11/23/99 22:14	1.36	11/23/99 23:35
-9.8	Orb.HEF	11/24/99 1:18	1.35	11/24/99 2:39
-9.7	Lander	11/24/99 4:03	4.00	11/24/99 8:03
-9.7	Orb.BWG	11/24/99 4:23	1.34	11/24/99 5:43
-9.6	Orb.BWG	11/24/99 7:24	1.33	11/24/99 8:44
-9.4	Orb.HEF	11/24/99 10:26	1.32	11/24/99 11:45
-9.3	Lander	11/24/99 13:09	3.96	11/24/99 17:06
-9.3	Orb.BWG	11/24/99 13:26	1.31	11/24/99 14:44
-9.2	Orb.BWG	11/24/99 16:24	1.30	11/24/99 17:42
-9.1	Orb.HEF	11/24/99 19:21	1.30	11/24/99 20:39
-9.0	Lander	11/24/99 22:03	3.88	11/25/99 1:56
-8.9	Orb.BWG	11/24/99 22:17	1.29	11/24/99 23:34
-8.8	Orb.BWG	11/25/99 1:13	1.28	11/25/99 2:30
-8.7	Orb.HEF	11/25/99 4:07	1.27	11/25/99 5:23
-8.6	Lander	11/25/99 6:47	3.82	11/25/99 10:37
-8.6	Orb.BWG	11/25/99 7:01	1.27	11/25/99 8:17
-8.5	Orb.BWG	11/25/99 9:53	1.26	11/25/99 11:08
-8.3	Orb.HEF	11/25/99 12:44	1.25	11/25/99 13:59
-8.2	Lander	11/25/99 15:23	3.76	11/25/99 19:09
-8.2	Orb.BWG	11/25/99 15:35	1.24	11/25/99 16:50
-8.1	Orb.BWG	11/25/99 18:24	1.24	11/25/99 19:38
-8.0	Orb.HEF	11/25/99 21:12	1.23	11/25/99 22:26
-7.9	Lander	11/25/99 23:50	3.69	11/26/99 3:32
-7.9	Orb.BWG	11/26/99 0:01	1.22	11/26/99 1:14
-7.8	Orb.BWG	11/26/99 2:47	1.21	11/26/99 3:59
-7.6	Orb.HEF	11/26/99 5:32	1.20	11/26/99 6:44
-7.5	Lander	11/26/99 8:08	3.59	11/26/99 11:44
-7.5	Orb.BWG	11/26/99 8:15	1.19	11/26/99 9:27
-7.4	Orb.BWG	11/26/99 10:58	1.18	11/26/99 12:09
-7.3	Orb.HEF	11/26/99 13:39	1.17	11/26/99 14:50
-7.2	Lander	11/26/99 16:14	3.52	11/26/99 19:45
-7.2	Orb.BWG	11/26/99 16:19	1.17	11/26/99 17:29
-7.1	Orb.BWG	11/26/99 18:57	1.16	11/26/99 20:07
-7.0	Orb.HEF	11/26/99 21:36	1.15	11/26/99 22:45
-6.9	Lander	11/27/99 0:09	3.45	11/27/99 3:36

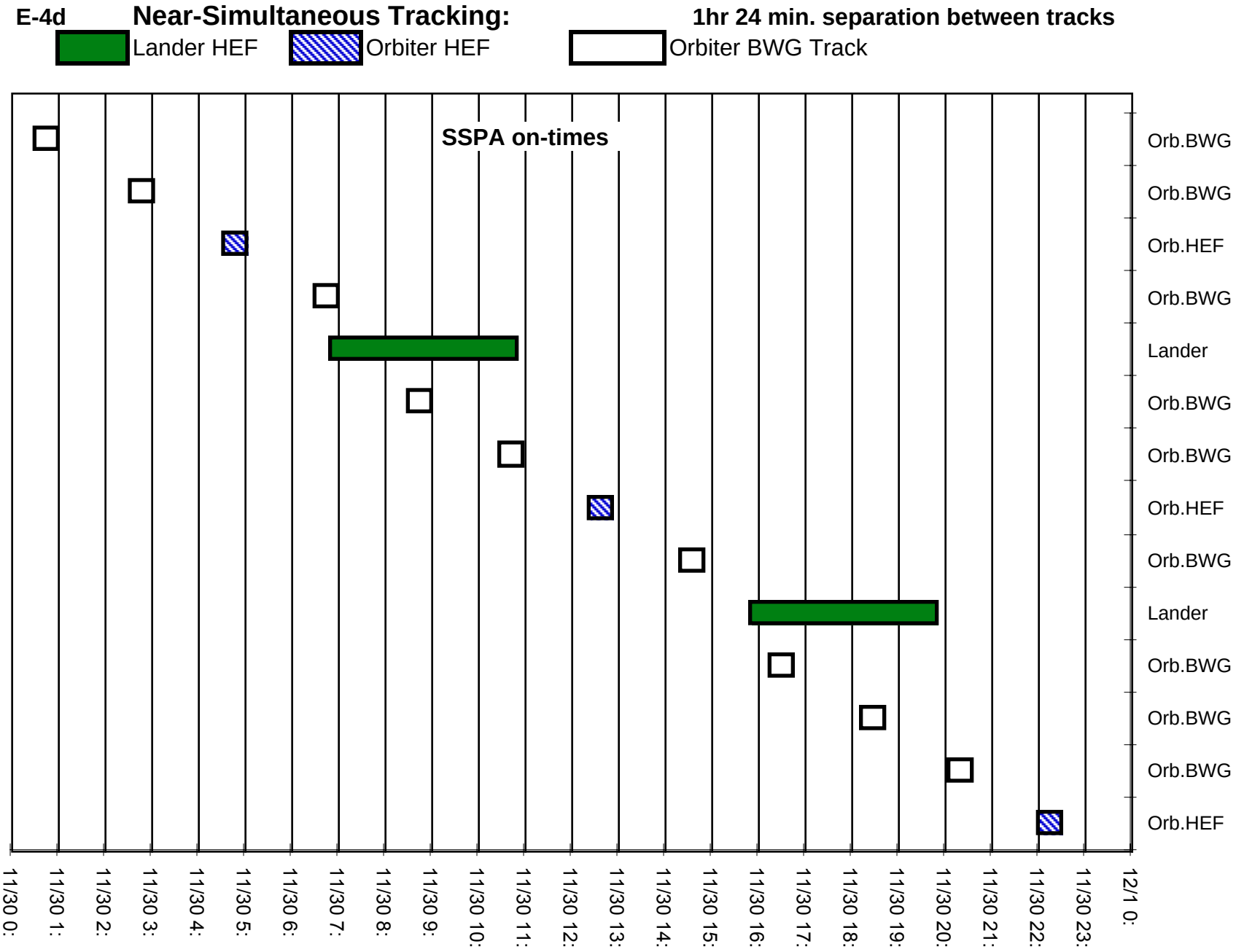
Integrated Tracking Schedule Near-Simultaneous Tracking Open Primary [Starting E-30d]	Days to Entry	s/c. antenna	Start Track	Track 1 duration h	End Track
	-6.9	Orb.BWG	11/27/99 0:11	1.14	11/27/99 1:20
	-6.8	Orb.BWG	11/27/99 2:47	1.13	11/27/99 3:55
	-6.6	Orb.HEF	11/27/99 5:23	1.13	11/27/99 6:30
	-6.5	Lander	11/27/99 7:54	3.38	11/27/99 11:17
	-6.5	Orb.BWG	11/27/99 7:55	1.12	11/27/99 9:02
	-6.4	Orb.BWG	11/27/99 10:28	1.11	11/27/99 11:35
	-6.3	Orb.HEF	11/27/99 13:01	1.11	11/27/99 14:07
	-6.2	Orb.BWG	11/27/99 15:31	1.10	11/27/99 16:37
	-6.2	Lander	11/27/99 15:31	3.32	11/27/99 18:50
	-6.1	Orb.BWG	11/27/99 18:01	1.09	11/27/99 19:06
	-6.0	Orb.HEF	11/27/99 20:30	1.09	11/27/99 21:36
	-5.9	Orb.BWG	11/27/99 22:59	1.08	11/28/99 0:03
	-5.9	Lander	11/27/99 23:00	3.25	11/28/99 2:15
	-5.8	Orb.BWG	11/28/99 1:26	1.07	11/28/99 2:30
	-5.7	Orb.HEF	11/28/99 3:51	1.06	11/28/99 4:55
	-5.6	Orb.BWG	11/28/99 6:15	1.05	11/28/99 7:18
	-5.6	Lander	11/28/99 6:19	3.17	11/28/99 9:29
	-5.5	Orb.BWG	11/28/99 8:38	1.04	11/28/99 9:40
	-5.4	Orb.HEF	11/28/99 11:01	1.03	11/28/99 12:03
	-5.3	Orb.BWG	11/28/99 13:22	1.02	11/28/99 14:23
	-5.3	Lander	11/28/99 13:27	3.10	11/28/99 16:32
	-5.2	Orb.BWG	11/28/99 15:42	1.02	11/28/99 16:43
	-5.1	Orb.HEF	11/28/99 18:00	1.01	11/28/99 19:00
	-5.0	Orb.BWG	11/28/99 20:17	1.00	11/28/99 21:17
	-5.0	Lander	11/28/99 20:24	3.01	11/28/99 23:25
	-4.9	Orb.BWG	11/28/99 22:34	0.99	11/28/99 23:33
	-4.8	Orb.HEF	11/29/99 0:49	0.99	11/29/99 1:49
	-4.7	Orb.BWG	11/29/99 3:03	0.98	11/29/99 4:02
	-4.7	Lander	11/29/99 3:12	2.89	11/29/99 6:06
	-4.6	Orb.BWG	11/29/99 5:17	0.97	11/29/99 6:16
	-4.6	Orb.HEF	11/29/99 7:30	0.96	11/29/99 8:28
	-4.5	Orb.BWG	11/29/99 9:41	0.50	11/29/99 10:11
Start 30 minute Orbiter Tracks	-4.4	Orb.BWG	11/29/99 11:52	0.50	11/29/99 12:22
	-4.3	Lander	11/29/99 12:52	4.00	11/29/99 16:52
	-4.3	Orb.BWG	11/29/99 14:02	0.50	11/29/99 14:32
	-4.2	Orb.BWG	11/29/99 16:10	0.50	11/29/99 16:40
	-4.1	Orb.HEF	11/29/99 18:17	0.50	11/29/99 18:47
	-4.0	Orb.BWG	11/29/99 20:24	0.50	11/29/99 20:54
	-4.0	Lander	11/29/99 21:52	4.00	11/30/99 1:52
	-3.9	Orb.BWG	11/29/99 22:28	0.50	11/29/99 22:58
	-3.8	Orb.BWG	11/30/99 0:31	0.50	11/30/99 1:01
	-3.8	Orb.BWG	11/30/99 2:34	0.50	11/30/99 3:04
	-3.7	Orb.HEF	11/30/99 4:34	0.50	11/30/99 5:04
	-3.6	Orb.BWG	11/30/99 6:32	0.50	11/30/99 7:02
	-3.6	Lander	11/30/99 6:52	4.00	11/30/99 10:52
	-3.5	Orb.BWG	11/30/99 8:31	0.50	11/30/99 9:01
	-3.4	Orb.BWG	11/30/99 10:29	0.50	11/30/99 10:59
	-3.4	Orb.HEF	11/30/99 12:25	0.50	11/30/99 12:55
	-3.3	Orb.BWG	11/30/99 14:21	0.50	11/30/99 14:51
	-3.2	Lander	11/30/99 15:52	4.00	11/30/99 19:52
	-3.2	Orb.BWG	11/30/99 16:17	0.50	11/30/99 16:47
	-3.1	Orb.BWG	11/30/99 18:14	0.50	11/30/99 18:44
	-3.0	Orb.BWG	11/30/99 20:08	0.50	11/30/99 20:38
	-3.0	Orb.HEF	11/30/99 22:03	0.50	11/30/99 22:33
	-2.9	Orb.BWG	11/30/99 23:58	0.50	12/1/99 0:28
	-2.8	Lander	12/1/99 0:52	4.00	12/1/99 4:52
	-2.8	Orb.BWG	12/1/99 1:53	0.50	12/1/99 2:23
	-2.7	Orb.BWG	12/1/99 3:47	0.50	12/1/99 4:17
	-2.6	Orb.BWG	12/1/99 5:41	0.50	12/1/99 6:11
	-2.5	Orb.BWG	12/1/99 8:09	1.35	12/1/99 9:30

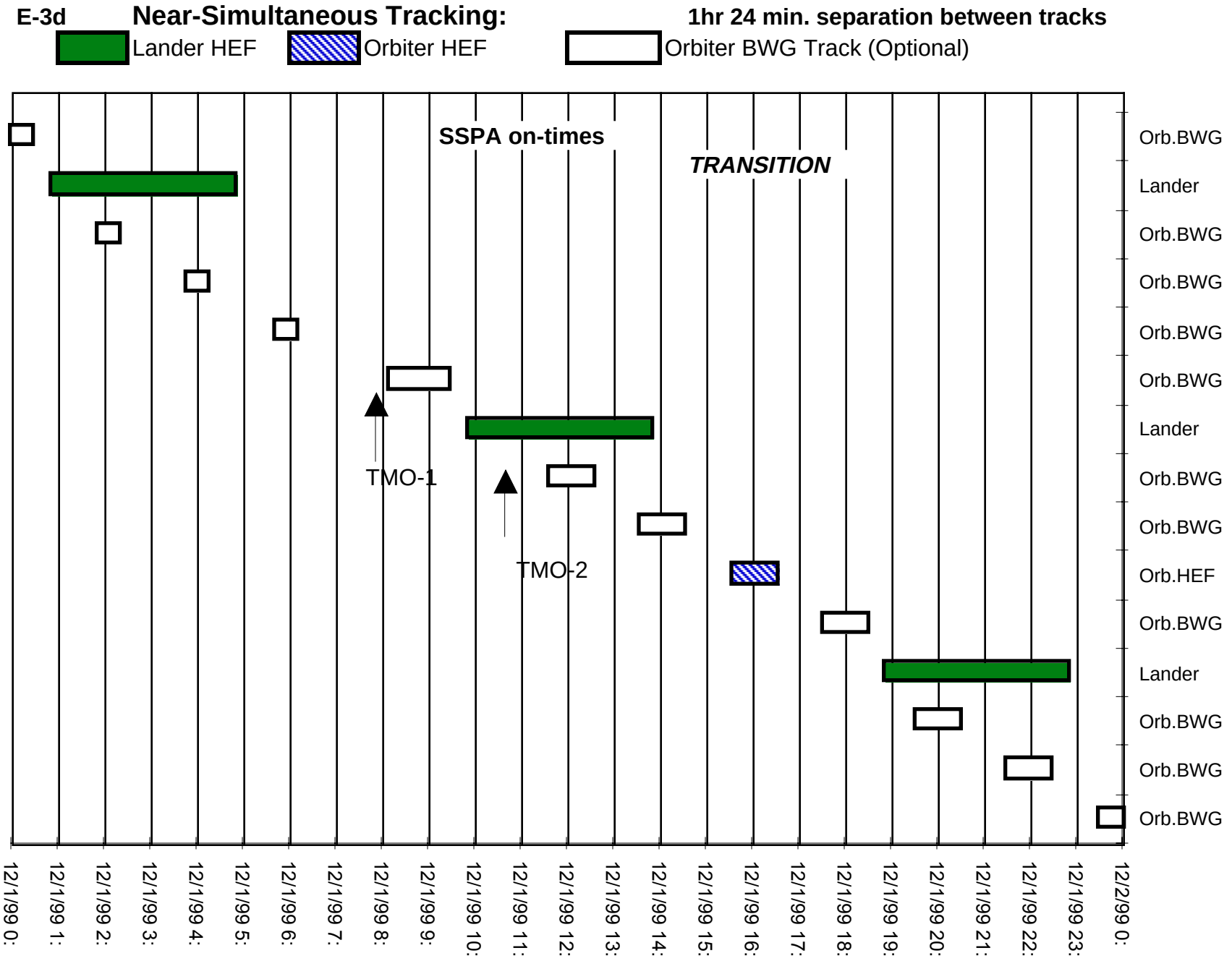
Integrated Tracking Schedule Near-Simultaneous Tracking Open Primary [Starting E-30d]	Days to Entry	s/c. antenna	Start Track	Track 1 duration h	End Track
Start Transfer to Map	-2.5	Lander	12/1/99 9:52	4.00	12/1/99 13:52
	-2.4	Orb.BWG	12/1/99 11:37	1.00	12/1/99 12:37
	-2.3	Orb.BWG	12/1/99 13:36	1.00	12/1/99 14:36
	-2.2	Orb.HEF	12/1/99 15:34	1.00	12/1/99 16:34
	-2.1	Orb.BWG	12/1/99 17:33	1.00	12/1/99 18:33
	-2.1	Lander	12/1/99 18:52	4.00	12/1/99 22:52
	-2.1	Orb.BWG	12/1/99 19:31	1.00	12/1/99 20:31
	-2.0	Orb.BWG	12/1/99 21:30	1.00	12/1/99 22:30
	-1.9	Orb.BWG	12/1/99 23:29	1.00	12/2/99 0:29
	-1.8	Orb.HEF	12/2/99 1:27	1.00	12/2/99 2:27
	-1.7	Orb.BWG	12/2/99 3:26	1.00	12/2/99 4:26
	-1.7	Lander	12/2/99 3:52	4.00	12/2/99 7:52
	-1.6	Orb.BWG	12/2/99 5:24	1.00	12/2/99 6:24
	-1.6	Orb.BWG	12/2/99 7:23	1.00	12/2/99 8:23
Last Near Simultaneous track	-1.5	Orb.HEF	12/2/99 9:22	1.00	12/2/99 10:22
	-1.4	Orb.BWG	12/2/99 11:20	1.00	12/2/99 12:20
	-1.3	Lander	12/2/99 12:52	4.00	12/2/99 16:52
	-1.3	Orb.BWG	12/2/99 13:19	1.00	12/2/99 14:19
	-1.2	Orb.BWG	12/2/99 15:18	1.00	12/2/99 16:18
	-1.1	Orb.BWG	12/2/99 17:16	1.00	12/2/99 18:16
	-1.1	Orb.BWG	12/2/99 19:15	1.00	12/2/99 20:15
	-1.0	Orb.BWG	12/2/99 21:13	1.00	12/2/99 22:13
	-1.0	Lander	12/2/99 21:52	4.00	12/3/99 1:52
	-0.9	Orb.BWG	12/2/99 23:12	1.00	12/3/99 0:12
	-0.8	Orb.BWG	12/3/99 1:11	1.00	12/3/99 2:11
	-0.7	Orb.BWG	12/3/99 3:09	1.00	12/3/99 4:09
	-0.7	Orb.BWG	12/3/99 5:08	1.00	12/3/99 6:08
	-0.6	Lander	12/3/99 6:52	4.00	12/3/99 10:52
Final Track pre TCM-5	-0.6	Orb.BWG	12/3/99 7:07	1.00	12/3/99 8:07
	-0.5	Orb.BWG	12/3/99 9:05	1.00	12/3/99 10:05
	-0.4	Orb.BWG	12/3/99 11:04	1.00	12/3/99 12:04
	-0.3	Lander	12/3/99 12:57	0.50	12/3/99 13:27
DSN-2	-0.3	Orb.BWG	12/3/99 13:02	1.00	12/3/99 14:02
	-0.3	TCM-5	12/3/99 13:32	0.58	12/3/99 14:07
TCM-5	-0.2	Orb.BWG	12/3/99 15:01	1.00	12/3/99 16:01
	-0.2	Lander	12/3/99 15:52	1.00	12/3/99 16:52
DSN-3	-0.2	Orb.BWG	12/3/99 17:00	1.00	12/3/99 18:00
	-0.1	Orb.BWG	12/3/99 18:58	1.00	12/3/99 19:58
	0.0	Lander	12/3/99 20:27	0.25	12/3/99 20:42
DSN-4	0.0	Landing	12/3/99 20:56	0.01	12/3/99 20:56
	0.0	Orb.BWG	12/3/99 20:57	1.00	12/3/99 21:57

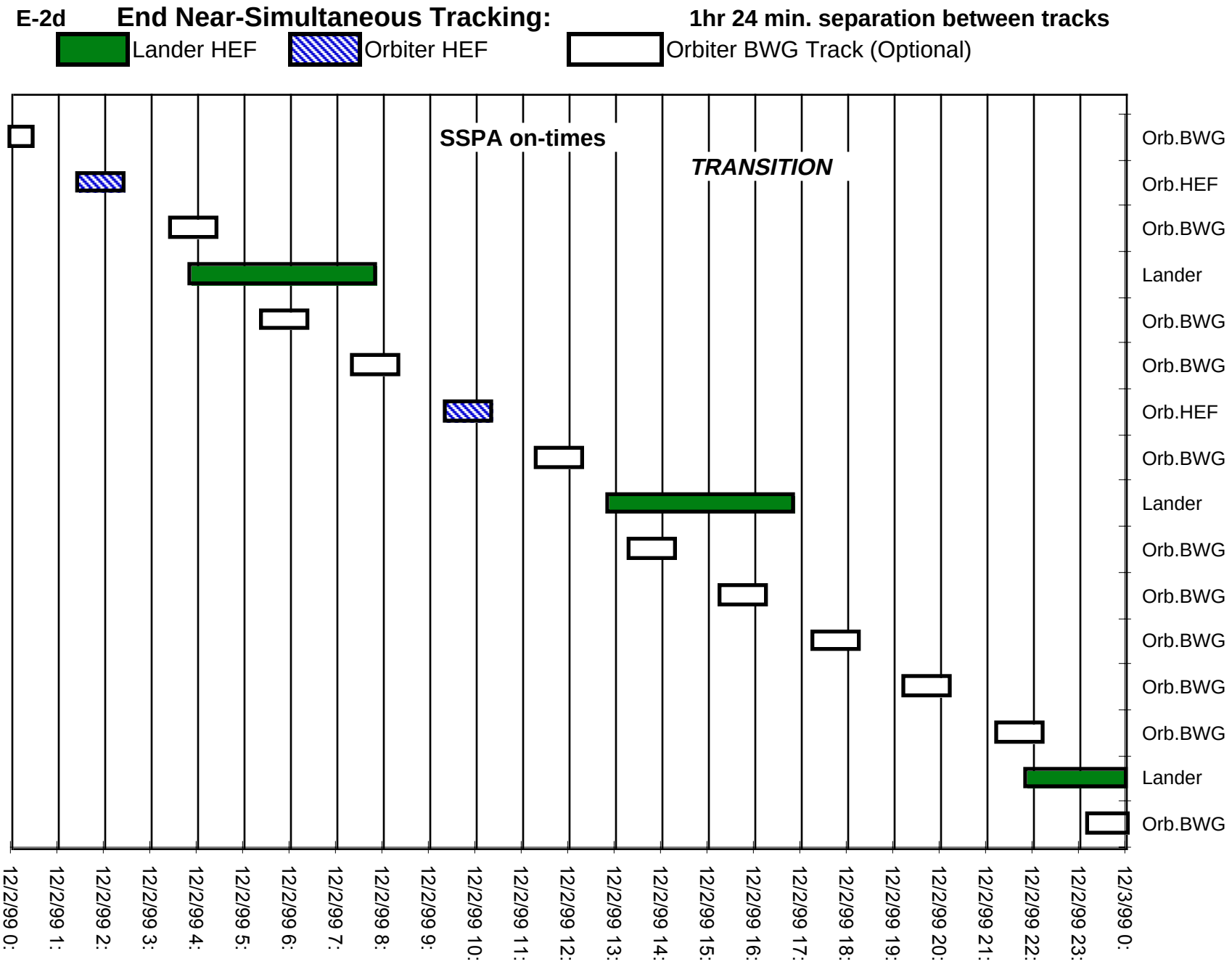

E-30d
Near-Simultaneous Tracking:
1hr 24 min. separation between tracks
Lander HEF
Orbiter HEF
Orbiter BWG Track
SSPA on-times
Orb.BWG
Orb.HEF
Lander
Orb.BWG
Orb.HEF
Lander
Orb.BWG
Orb.HEF
Lander
Orb.BWG
11/4/99 0:
11/4/99 1:
11/4/99 2:
11/4/99 3:
11/4/99 4:
11/4/99 5:
11/4/99 6:
11/4/99 7:
11/4/99 8:
11/4/99 9:
11/4/99 10:
11/4/99 11:
11/4/99 12:
11/4/99 13:
11/4/99 14:
11/4/99 15:
11/4/99 16:
11/4/99 17:
11/4/99 18:
11/4/99 19:
11/4/99 20:
11/4/99 21:
11/4/99 22:
11/4/99 23:
11/5/99 0:
11/5/99 1:
11/5/99 2:
11/5/99 3:
11/5/99 4:
11/5/99 5:
11/5/99 6:
11/5/99 7:
11/5/99 8:
11/5/99 9:
11/5/99 10:
11/5/99 11:
11/5/99 12:
11/5/99 13:
11/5/99 14:
11/5/99 15:
11/5/99 16:
11/5/99 17:
11/5/99 18:
11/5/99 19:
11/5/99 20:
11/5/99 21:
11/5/99 22:
11/5/99 23:
11/6/99 0:

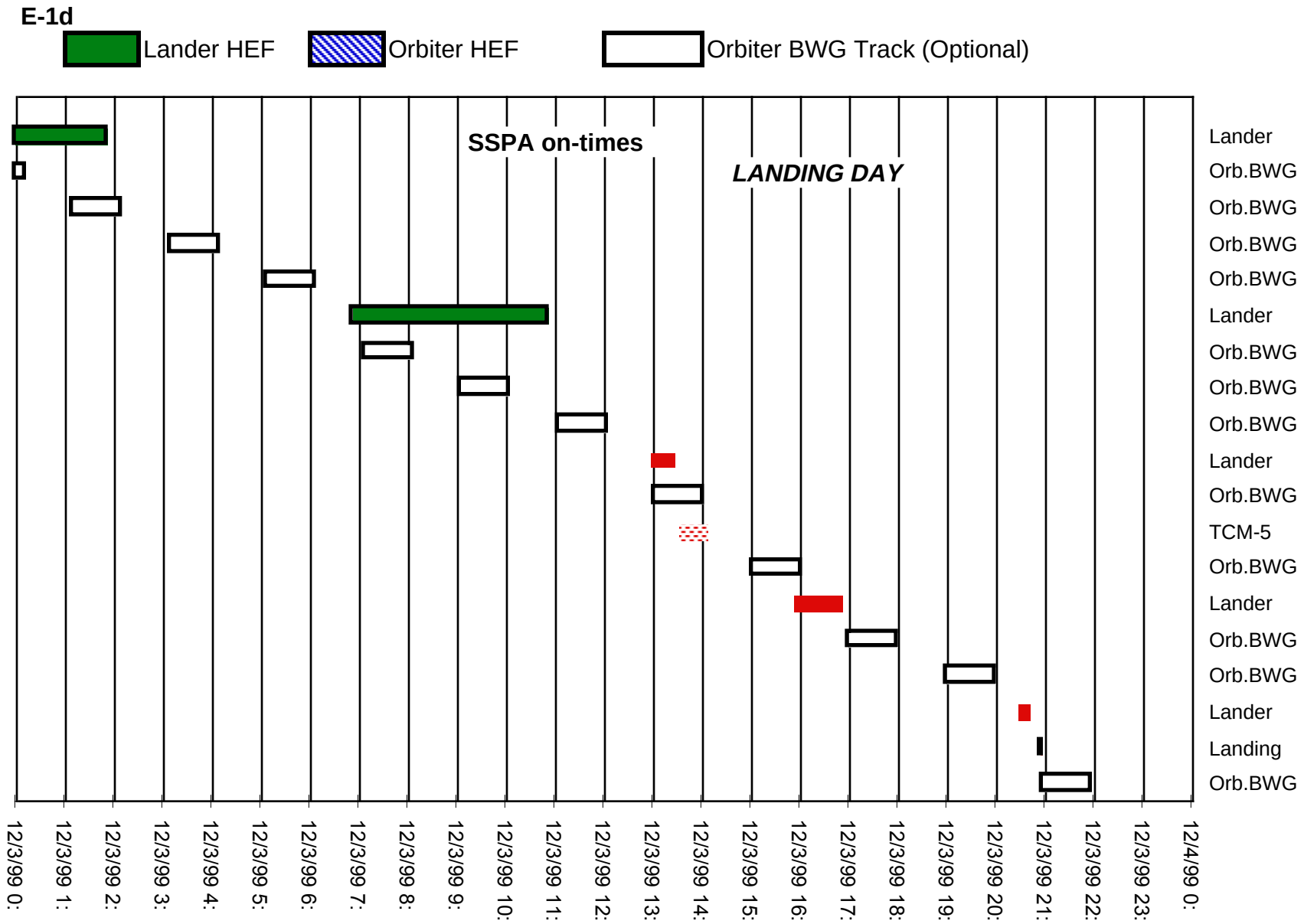

E-20d
Near-Simultaneous Tracking:
1hr 24 min. separation between tracks
Lander HEF
Orbiter HEF
Orbiter BWG Track
SSPA on-times
Lander
Orb.BWG
Orb.HEF
Lander
Orb.BWG
Orb.HEF
Lander
Orb.BWG
Orb.HEF
Lander
Orb.BWG
Orb.HEF
Lander
Orb.BWG
11/14/99 0:
11/14/99 1:
11/14/99 2:
11/14/99 3:
11/14/99 4:
11/14/99 5:
11/14/99 6:
11/14/99 7:
11/14/99 8:
11/14/99 9:
11/14/99 10:
11/14/99 11:
11/14/99 12:
11/14/99 13:
11/14/99 14:
11/14/99 15:
11/14/99 16:
11/14/99 17:
11/14/99 18:
11/14/99 19:
11/14/99 20:
11/14/99 21:
11/14/99 22:
11/14/99 23:
11/15/99 0:
11/15/99 1:
11/15/99 2:
11/15/99 3:
11/15/99 4:
11/15/99 5:
11/15/99 6:
11/15/99 7:
11/15/99 8:
11/15/99 9:
11/15/99 10:
11/15/99 11:
11/15/99 12:
11/15/99 13:
11/15/99 14:
11/15/99 15:
11/15/99 16:
11/15/99 17:
11/15/99 18:
11/15/99 19:
11/15/99 20:
11/15/99 21:
11/15/99 22:
11/15/99 23:
11/16/99 0:


E-10d
Near-Simultaneous Tracking:
1hr 24 min. separation between tracks
Lander HEF
Orbiter HEF
Orbiter BWG Track
SSPA on-times
Orb.HEF
Lander
Orb.BWG
Orb.BWG
Orb.HEF
Lander
Orb.BWG
Orb.BWG
Orb.HEF
Lander
Orb.BWG
Orb.BWG
Orb.HEF
Lander
Orb.BWG
Orb.BWG
Orb.HEF
Lander
Orb.BWG
Orb.BWG
Orb.HEF
11/24/99 0:
11/24/99 1:
11/24/99 2:
11/24/99 3:
11/24/99 4:
11/24/99 5:
11/24/99 6:
11/24/99 7:
11/24/99 8:
11/24/99 9:
11/24/99 10:
11/24/99 11:
11/24/99 12:
11/24/99 13:
11/24/99 14:
11/24/99 15:
11/24/99 16:
11/24/99 17:
11/24/99 18:
11/24/99 19:
11/24/99 20:
11/24/99 21:
11/24/99 22:
11/24/99 23:
11/25/99 0:
11/25/99 1:
11/25/99 2:
11/25/99 3:
11/25/99 4:
11/25/99 5:
11/25/99 6:
11/25/99 7:
11/25/99 8:
11/25/99 9:
11/25/99 10:
11/25/99 11:
11/25/99 12:
11/25/99 13:
11/25/99 14:
11/25/99 15:
11/25/99 16:
11/25/99 17:
11/25/99 18:
11/25/99 19:
11/25/99 20:
11/25/99 21:
11/25/99 22:
11/25/99 23:
11/26/99 0:


E-4d
Near-Simultaneous Tracking:
1hr 24 min. separation between tracks
Lander HEF
Orbiter HEF
Orbiter BWG Track
SSPA on-times
Orb.BWG
Orb.BWG
Orb.HEF
Orb.BWG
Lander
Orb.BWG
Orb.BWG
Orb.HEF
Orb.BWG
Lander
Orb.BWG
Orb.BWG
Orb.BWG
Orb.HEF
11/30 0:
11/30 1:
11/30 2:
11/30 3:
11/30 4:
11/30 5:
11/30 6:
11/30 7:
11/30 8:
11/30 9:
11/30 10:
11/30 11:
11/30 12:
11/30 13:
11/30 14:
11/30 15:
11/30 16:
11/30 17:
11/30 18:
11/30 19:
11/30 20:
11/30 21:
11/30 22:
11/30 23:
12/1 0:


E-3d
Near-Simultaneous Tracking:
1hr 24 min. separation between tracks
Lander HEF
Orbiter HEF
Orbiter BWG Track (Optional)
SSPA on-times
TRANSITION
TMO-1
TMO-2
Orb.BWG
Lander
Orb.BWG
Orb.BWG
Orb.BWG
Orb.BWG
Lander
Orb.BWG
Orb.BWG
Orb.HEF
Orb.BWG
Lander
Orb.BWG
Orb.BWG
Orb.BWG
12/1/99 0:
12/1/99 1:
12/1/99 2:
12/1/99 3:
12/1/99 4:
12/1/99 5:
12/1/99 6:
12/1/99 7:
12/1/99 8:
12/1/99 9:
12/1/99 10:
12/1/99 11:
12/1/99 12:
12/1/99 13:
12/1/99 14:
12/1/99 15:
12/1/99 16:
12/1/99 17:
12/1/99 18:
12/1/99 19:
12/1/99 20:
12/1/99 21:
12/1/99 22:
12/1/99 23:
12/2/99 0:


E-2d
End Near-Simultaneous Tracking:
1hr 24 min. separation between tracks
Lander HEF
Orbiter HEF
Orbiter BWG Track (Optional)
SSPA on-times
TRANSITION
Orb.BWG
Orb.HEF
Orb.BWG
Lander
Orb.BWG
Orb.BWG
Orb.HEF
Orb.BWG
Lander
Orb.BWG
Orb.BWG
Orb.BWG
Orb.BWG
Orb.BWG
Lander
Orb.BWG
12/2/99 0:
12/2/99 1:
12/2/99 2:
12/2/99 3:
12/2/99 4:
12/2/99 5:
12/2/99 6:
12/2/99 7:
12/2/99 8:
12/2/99 9:
12/2/99 10:
12/2/99 11:
12/2/99 12:
12/2/99 13:
12/2/99 14:
12/2/99 15:
12/2/99 16:
12/2/99 17:
12/2/99 18:
12/2/99 19:
12/2/99 20:
12/2/99 21:
12/2/99 22:
12/2/99 23:
12/3/99 0:


E-1d
Lander HEF
Orbiter HEF
Orbiter BWG Track (Optional)
SSPA on-times
LANDING DAY
Lander
Orb.BWG
Orb.BWG
Orb.BWG
Orb.BWG
Lander
Orb.BWG
Orb.BWG
Orb.BWG
Lander
Orb.BWG
TCM-5
Orb.BWG
Lander
Orb.BWG
Orb.BWG
Lander
Landing
Orb.BWG
12/3/99 0:
12/3/99 1:
12/3/99 2:
12/3/99 3:
12/3/99 4:
12/3/99 5:
12/3/99 6:
12/3/99 7:
12/3/99 8:
12/3/99 9:
12/3/99 10:
12/3/99 11:
12/3/99 12:
12/3/99 13:
12/3/99 14:
12/3/99 15:
12/3/99 16:
12/3/99 17:
12/3/99 18:
12/3/99 19:
12/3/99 20:
12/3/99 21:
12/3/99 22:
12/3/99 23:
12/4/99 0:

A.13 Orbiter Approach Targeting Data **This Section under Change Control**

[To be Supplied] This section contains approach data to be used for MOI analyses.