MARS GLOBAL SURVEYOR

LAUNCH VEHICLE

TRAJECTORY CERTIFICATION REVIEW

(SUMMARY)

LAUNCH VEHICLE INTEGRATION
TRAJECTORY DESIGN CYCLES

***TRAJECTORY DATA FLOW ***

MDA SPECIAL FEASIBILITY ANALYSES (2/95)

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MGS PRELIMINARY TARGET SPECIFICATION (6/95)

↓

MDA PRELIMINARY MISSION ANALYSIS (PMA) REPORT (2/96)

↓

MGS FINAL TARGET SPECIFICATION (2/96)

↓

MDA DETAILED TEST OBJECTIVES (DTO) REPORT (5/96) → MGS LAUNCH VEHICLE TRAJECTORY CERTIFICATION (6/96)

(FLIGHT TRAJECTORIES)

↓

MDA GUIDED NOMINAL TRAJECTORIES → MGS (8/96)

↓

MDA BEST EXPECTED TRAJECTORIES (10/96)

CONCLUSIONS (1 OF 2)

- NO SIGNIFICANT CHANGES FROM THE MDA PMA REPORT TO THE MDA DTO REPORT (I.E. LAUNCH AZIMUTHS, PARKING ORBIT INCLINATIONS, ETC.)
- DELTA II FLIGHT PROFILES (POST-SECO 1) SIMULATED BY JPL FOR THE FINAL TARGET SPECIFICATION PRODUCTION WERE A GOOD REPRESENTATION OF THE MDA PRODUCED DTO TRAJECTORIES
- VERIFIED THAT THE MDA INJECTION CONDITIONS ARE CONSISTENT WITH THE TARGET SETS SPECIFIED IN THE FINAL TARGET SPECIFICATION
- VERIFIED THAT THE DESIRED B-PLANE AIMPOINTS AT MARS ARE ACHIEVED WITHIN ACCEPTABLE BOUNDS

CONCLUSIONS (2 OF 2)

- VERIFIED THAT THE “NON-BURN” ATTITUDES AND OTHER SPECIAL MISSION REQUIREMENTS SPECIFIED IN THE FINAL TARGET SPECIFIATION HAVE BEEN SUCCESSFULLY INCORPORATED INTO THE DELTA FLIGHT PROFILE

- NASA-LERC INDEPENDENT REVIEW ACTIVITIES ARE IN GOOD AGREEMENT WITH JPL TARGET SPECIFICATION PRODUCTS

LAUNCH VEHICLE MISSION DESIGN - OPEN ITEMS

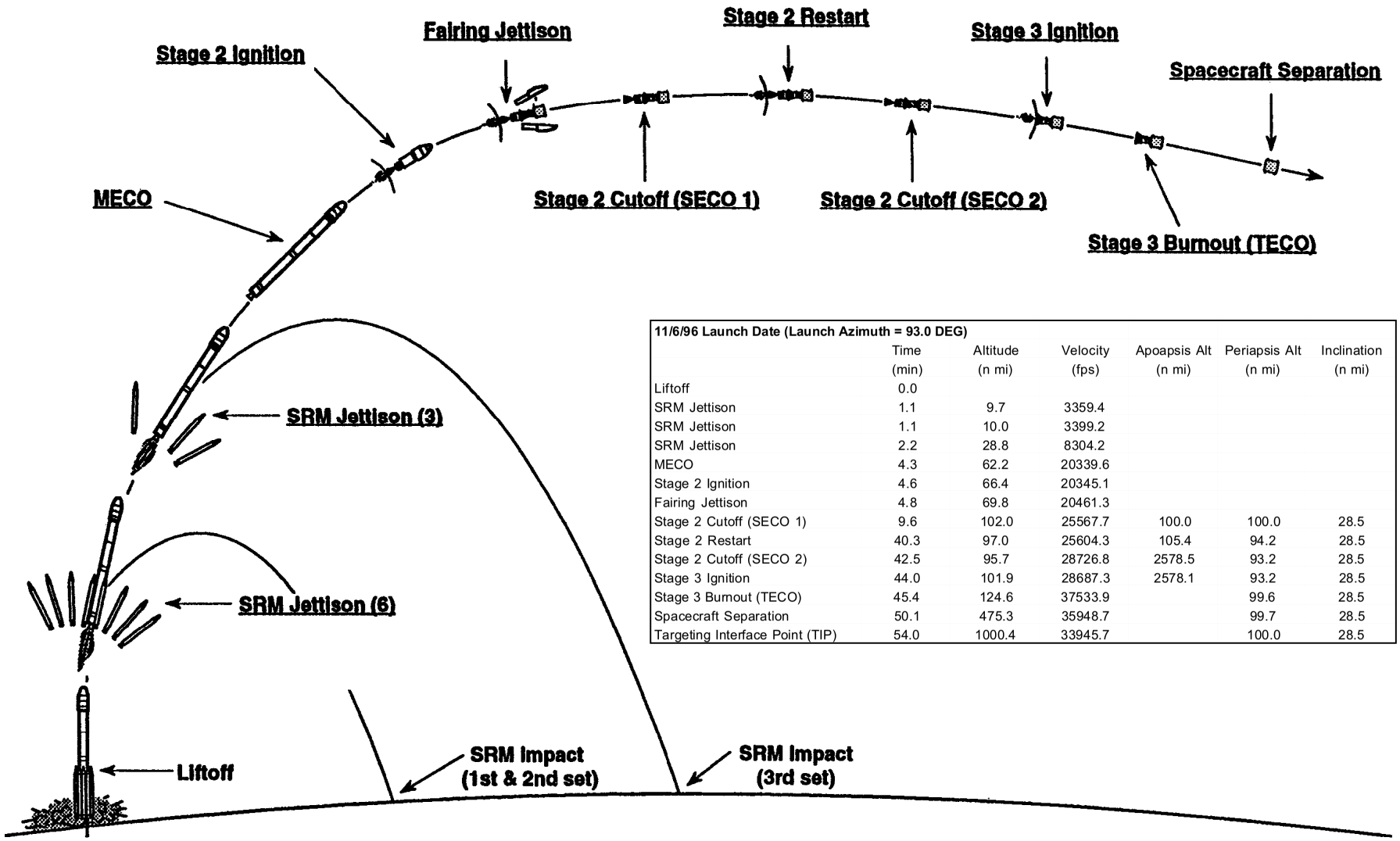
- LAUNCH VEHICLE CONTRACTOR HAS INDICATED THAT AS MUCH AS AN ADDITIONAL 6.0 KG OF INJECTED MASS PERFORMANCE MAY BE AVAILABLE TO THE PROJECT DUE TO PRELIMINARY THIRD STAGE TAG VALUES
  - AN ASSESSMENT OF THE USE OF THIS CAPABILITY IS IN PROGRESS - MISSION ΔV IMPACTS UNDER REVIEW
  - DOES NOT ALTER THE PCS VALUES

- CONCERNS HAVE ARISEN OVER THE OXIDIZER TANK FILL LEVEL AND ITS RELATIONSHIP TO THE NUTATION TIME CONSTANT DURING THE DELTA THIRD STAGE INJECTION BURN
  - MISSION ΔV IMPACTS UNDER REVIEW

=> SPACECRAFT BALLAST/PROPELLANT LOADING FINAL DECISION MEETING SCHEDULED FOR 9/13/96

LAUNCH OVERVIEW

DELTA II 7925A FLIGHT PROFILE OVERVIEW

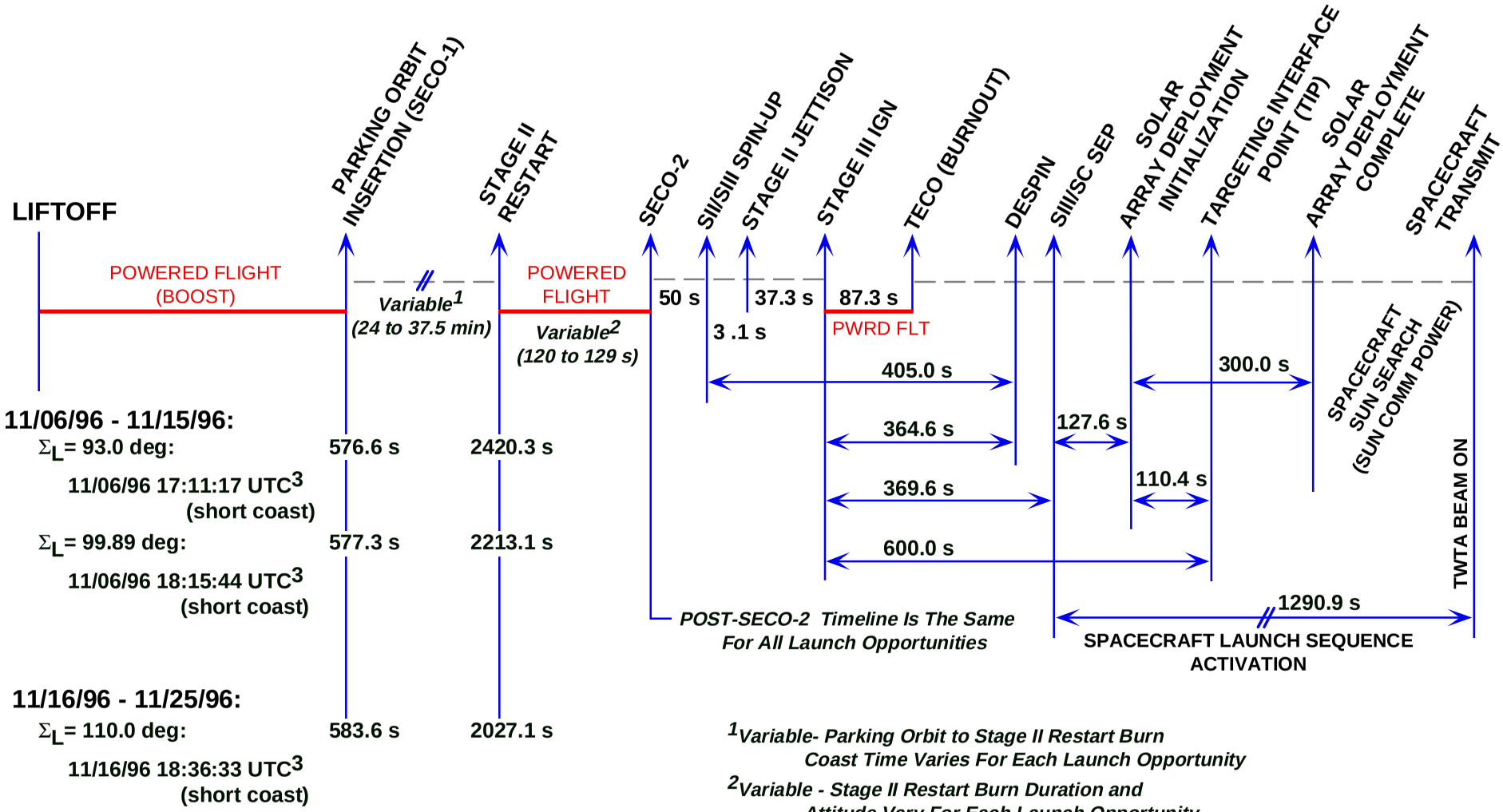


11/6/96 Launch Date (Launch Azimuth = 93.0 DEG)

	Time (min)	Altitude (n mi)	Velocity (fps)	Apoapsis Alt (n mi)	Periapsis Alt (n mi)	Inclination (n mi)
Liftoff	0.0					
SRM Jettison	1.1	9.7	3359.4			
SRM Jettison	1.1	10.0	3399.2			
SRM Jettison	2.2	28.8	8304.2			
MECO	4.3	62.2	20339.6			
Stage 2 Ignition	4.6	66.4	20345.1			
Fairing Jettison	4.8	69.8	20461.3			
Stage 2 Cutoff (SECO 1)	9.6	102.0	25567.7	100.0	100.0	28.5
Stage 2 Restart	40.3	97.0	25604.3	105.4	94.2	28.5
Stage 2 Cutoff (SECO 2)	42.5	95.7	28726.8	2578.5	93.2	28.5
Stage 3 Ignition	44.0	101.9	28687.3	2578.1	93.2	28.5
Stage 3 Burnout (TECO)	45.4	124.6	37533.9		99.6	28.5
Spacecraft Separation	50.1	475.3	35948.7		99.7	28.5
Targeting Interface Point (TIP)	54.0	1000.4	33945.7		100.0	28.5

LAUNCH OVERVIEW

DELTA II 7925A FLIGHT PROFILE TIMELINE



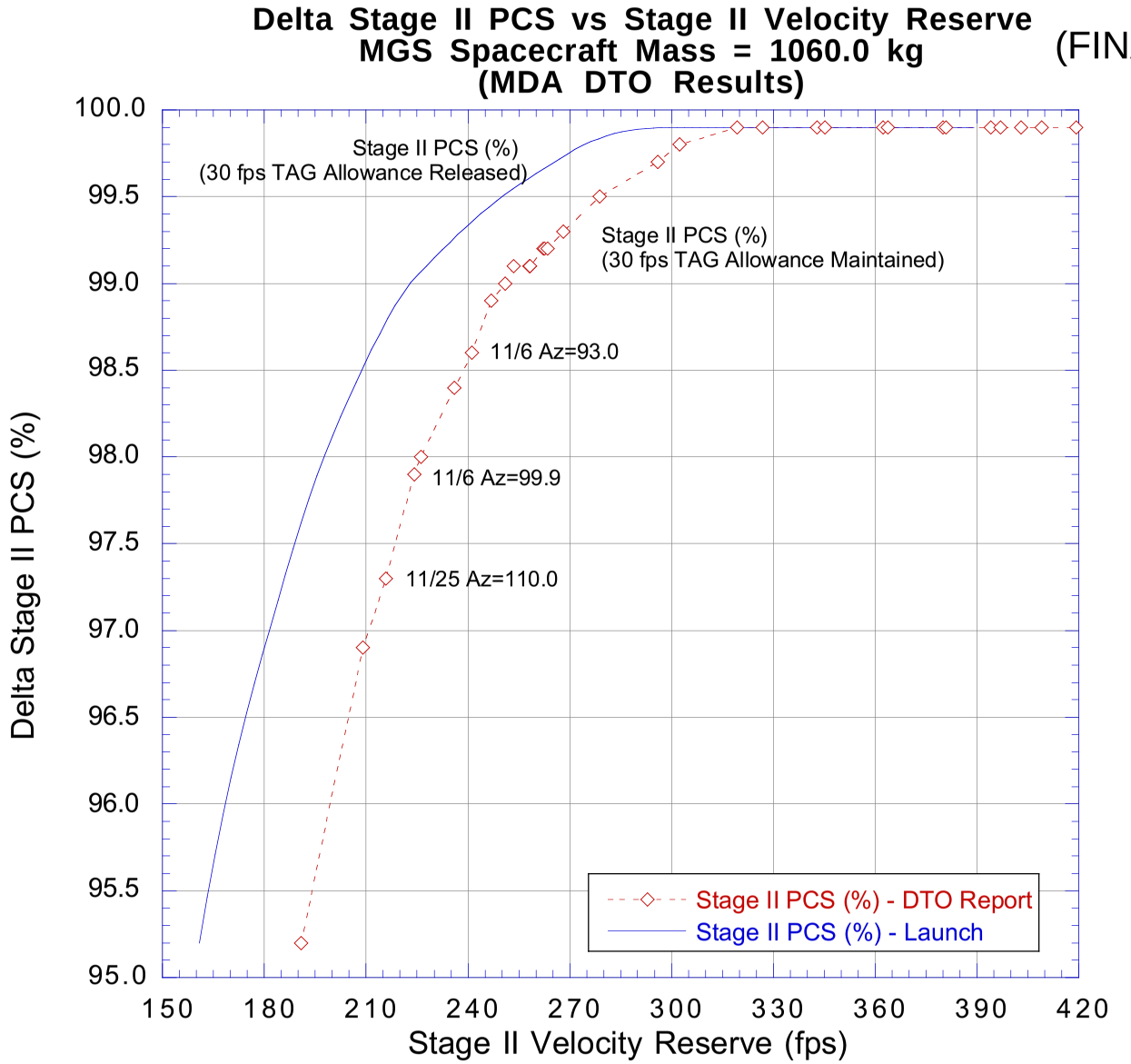
1Variable- Parking Orbit to Stage II Restart Burn Coast Time Varies For Each Launch Opportunity

2Variable - Stage II Restart Burn Duration and Attitude Vary For Each Launch Opportunity

3An opportunity to launch will exist 30 seconds prior to the nominal liftoff time and will only be used in the event the Eastern Test Range (ETR) issues a collision avoidance (COLA) warning

SPECIAL MISSION REQUIREMENTS

(FINAL TS SEC 3.4)



B-PLANE TARGET SETS ACHIEVED

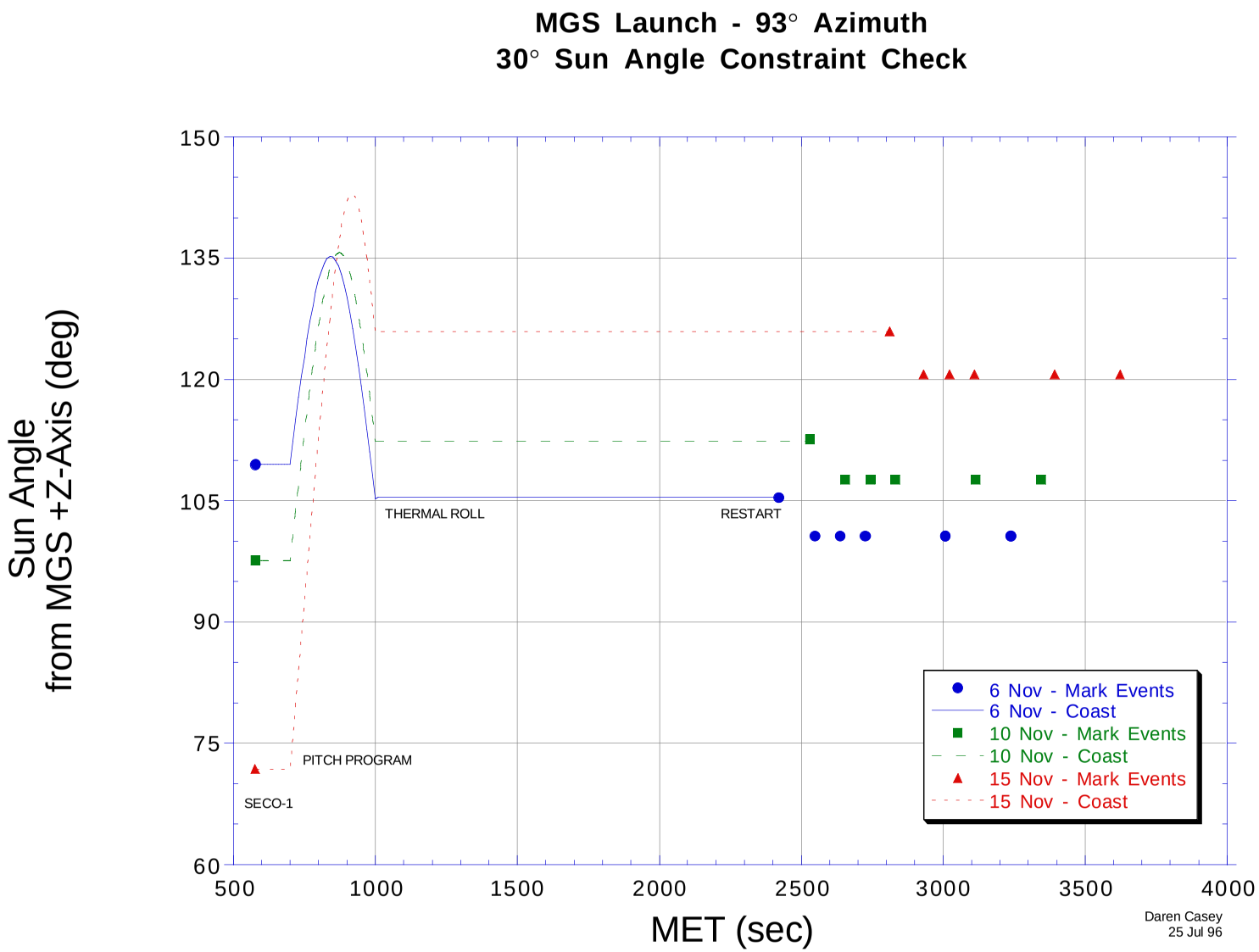
DTO TIP State - Integration to Mars					PQ Biased Target				B-Plane Errors			
File	Date ET	Time ET	B*T (km)	B*R (km)	Arrival Date	Arrival Time	B•T (km)	B•R (km)	ΔArrival (hr)	ΔB•T (km)	ΔB•R (km)	ΔΘ (deg)
05az93.out	11-Sep-97	03:19:02.7	-55528.5	-49923.4	11-Sep-97	03:27:53.0	-55000.	-50000.	0.15	528.	-77.	-8.2
05az99.out	11-Sep-97	13:38:12.6	-55433.9	-49960.9	11-Sep-97	**13:45:25.9 ***	-55000.	-50000.	**0.12 ***	434.	-39.	-5.1
06az93.out	11-Sep-97	04:17:37.0	-44584.5	-51934.4	11-Sep-97	04:27:53.0	-44000.	-52000.	0.17	585.	-66.	-6.4
06az99.out	11-Sep-97	04:24:25.9	-44160.6	-51983.1	11-Sep-97	04:27:53.0	-44000.	-52000.	0.06	161.	-17.	-6.0
07az93.out	12-Sep-97	06:15:10.6	-34595.6	-53948.3	12-Sep-97	06:26:09.0	-34000.	-54000.	0.18	596.	-52.	-5.0
07az99.out	12-Sep-97	06:15:33.8	-34615.1	-53951.2	12-Sep-97	06:26:09.0	-34000.	-54000.	0.18	615.	-49.	-4.5
08az93.out	12-Sep-97	07:14:39.5	-23682.2	-54965.8	12-Sep-97	07:26:09.0	-23000.	-55000.	0.19	682.	-34.	-2.9
08az99.out	12-Sep-97	07:15:12.8	-23581.3	-54965.4	12-Sep-97	07:26:09.0	-23000.	-55000.	0.18	581.	-35.	-3.4
09az93.out	13-Sep-97	08:16:38.0	-13420.8	-54994.8	13-Sep-97	08:24:28.0	-13000.	-55000.	0.13	421.	-5.	-0.7
09az99.out	13-Sep-97	08:13:21.3	-13669.6	-54985.3	13-Sep-97	08:24:28.0	-13000.	-55000.	0.19	670.	-15.	-1.3
10az93.out	13-Sep-97	09:13:31.4	-2618.9	-54994.0	13-Sep-97	09:24:28.0	-2000.	-55000.	0.18	619.	-6.	-0.6
10az99.out	13-Sep-97	09:14:53.3	-2540.6	-55003.2	13-Sep-97	09:24:28.0	-2000.	-55000.	0.16	541.	3.	0.3
11az93.out	14-Sep-97	10:13:50.2	8467.8	-55015.7	14-Sep-97	10:22:47.0	9000.	-55000.	0.15	532.	16.	1.7
11az99.out	14-Sep-97	10:14:45.0	8527.9	-55028.6	14-Sep-97	10:22:47.0	9000.	-55000.	0.13	472.	29.	3.5
12az93.out	14-Sep-97	11:09:09.5	18186.5	-55040.0	14-Sep-97	11:22:47.0	19000.	-55000.	0.23	813.	40.	2.8
12az99.out	14-Sep-97	11:12:07.0	18363.8	-55039.4	14-Sep-97	11:22:47.0	19000.	-55000.	0.18	636.	39.	3.5
13az93.out	14-Sep-97	11:12:05.6	34409.4	-54034.8	14-Sep-97	11:22:47.0	35000.	-54000.	0.18	591.	35.	3.4
13az99.out	14-Sep-97	11:13:34.9	34465.6	-54037.7	14-Sep-97	11:22:47.0	35000.	-54000.	0.15	534.	38.	4.0
14az93.out	15-Sep-97	11:13:01.8	49500.3	-53051.5	15-Sep-97	11:21:07.0	50000.	-53000.	0.13	500.	51.	5.9
14az99.out	12-Sep-97	13:15:17.0	49391.7	-53074.6	**12-Sep-97 ***	**13:27:37.4 ***	50000.	-53000.	**0.21 ***	608.	75.	7.0
15az93.out	15-Sep-97	13:10:43.8	65398.3	-50083.5	15-Sep-97	13:21:07.0	66000.	-50000.	0.17	602.	84.	7.9
15az99.out	11-Sep-97	12:36:26.9	65427.7	-50102.5	**11-Sep-97 ***	**12:48:46.1 ***	66000.	-50000.	**0.21 ***	572.	103.	10.2
16az110.out	16-Sep-97	17:15:15.5	115737.3	-46048.4	16-Sep-97	17:19:29.0	116000.	-46000.	0.07	263.	48.	10.4
17az110.out	16-Sep-97	19:11:24.8	131469.0	-41082.7	16-Sep-97	19:19:29.0	132000.	-41000.	0.13	531.	83.	8.9
18az110.out	17-Sep-97	20:14:16.4	147764.3	-35048.0	17-Sep-97	20:17:52.0	148000.	-35000.	0.06	236.	48.	11.5
19az110.out	18-Sep-97	19:12:34.6	137704.8	-35064.7	18-Sep-97	19:16:14.0	138000.	-35000.	0.06	295.	65.	12.4
20az110.out	18-Sep-97	18:11:49.4	128667.4	-35085.2	18-Sep-97	18:16:14.0	129000.	-35000.	0.07	333.	85.	14.4
21az110.out	19-Sep-97	16:05:24.5	118293.9	-37161.6	19-Sep-97	16:14:40.0	119000.	-37000.	0.15	706.	162.	12.9
22az110.out	20-Sep-97	15:07:50.0	109579.3	-39108.9	20-Sep-97	15:13:05.0	110000.	-39000.	0.09	421.	109.	14.5
23az110.out	20-Sep-97	14:07:04.5	100515.6	-42123.3	20-Sep-97	14:13:05.0	101000.	-42000.	0.10	484.	123.	14.3
24az110.out	21-Sep-97	12:54:03.8	89708.2	-45407.8	21-Sep-97	13:11:32.0	91000.	-45000.	0.29	1292.	408.	17.5
25az110.out	22-Sep-97	10:54:27.9	80650.3	-49513.9	22-Sep-97	11:10:01.0	82000.	-49000.	0.26	1350.	514.	20.8

**Arrival Date/time was not targeted*

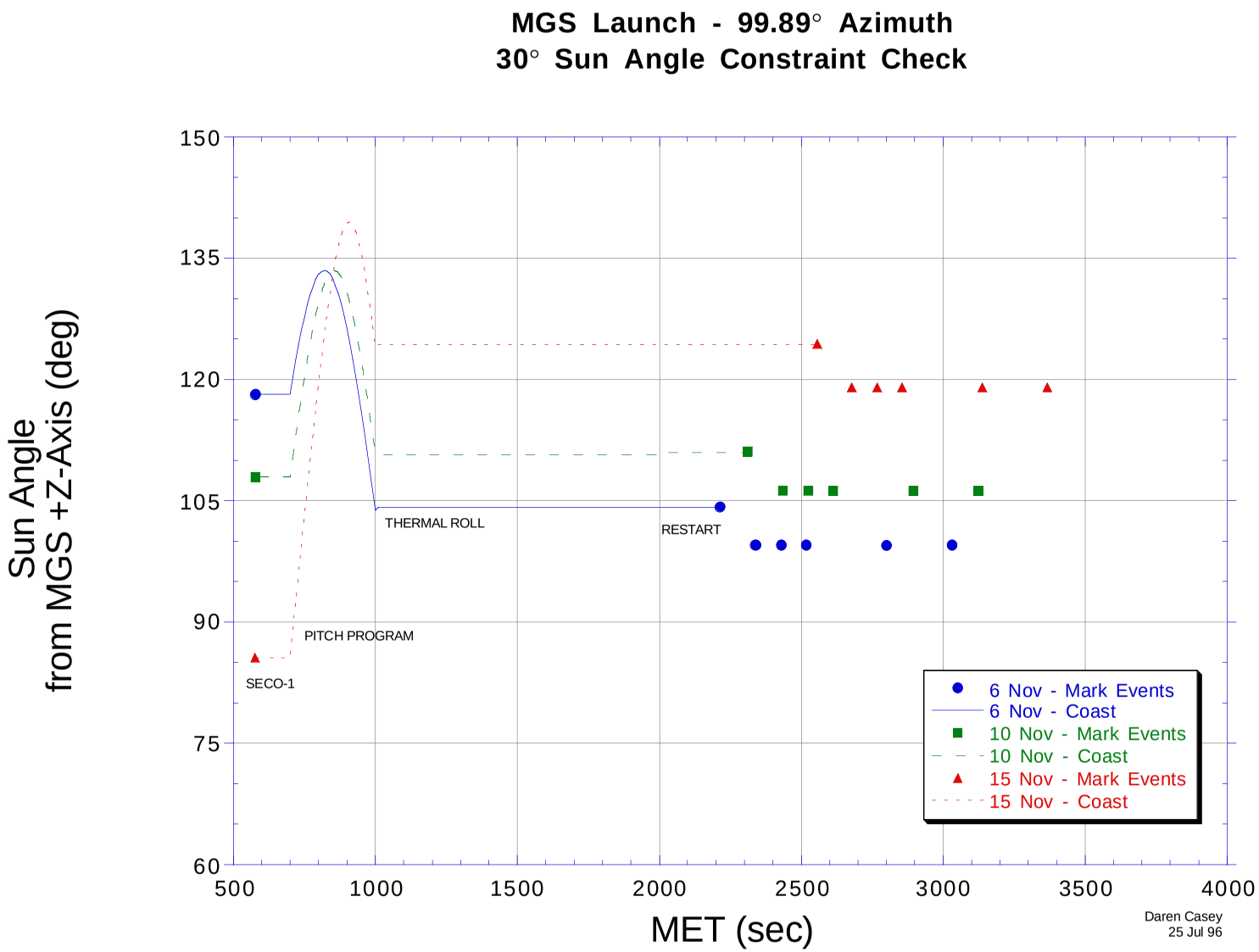
**Difference based on untargeted arrival time*
Using nominal biased arrival time:

Launch	*Arrival (hr)*
5-Nov-96	*-10.17*
14-Nov-96	*70.1*
15-Nov-96	*96.74*

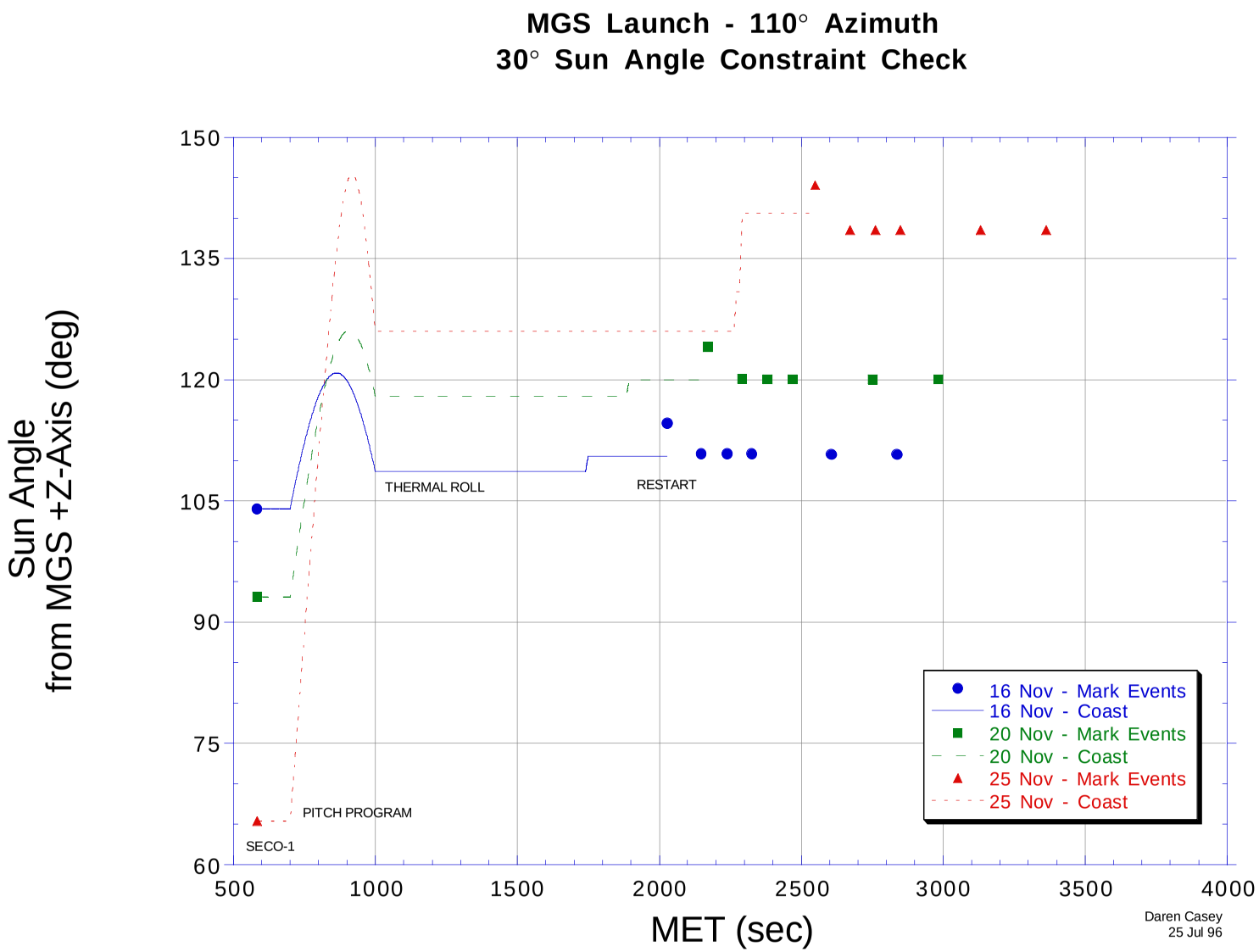
SUN ANGLE - 93° LAUNCH AZIMUTH



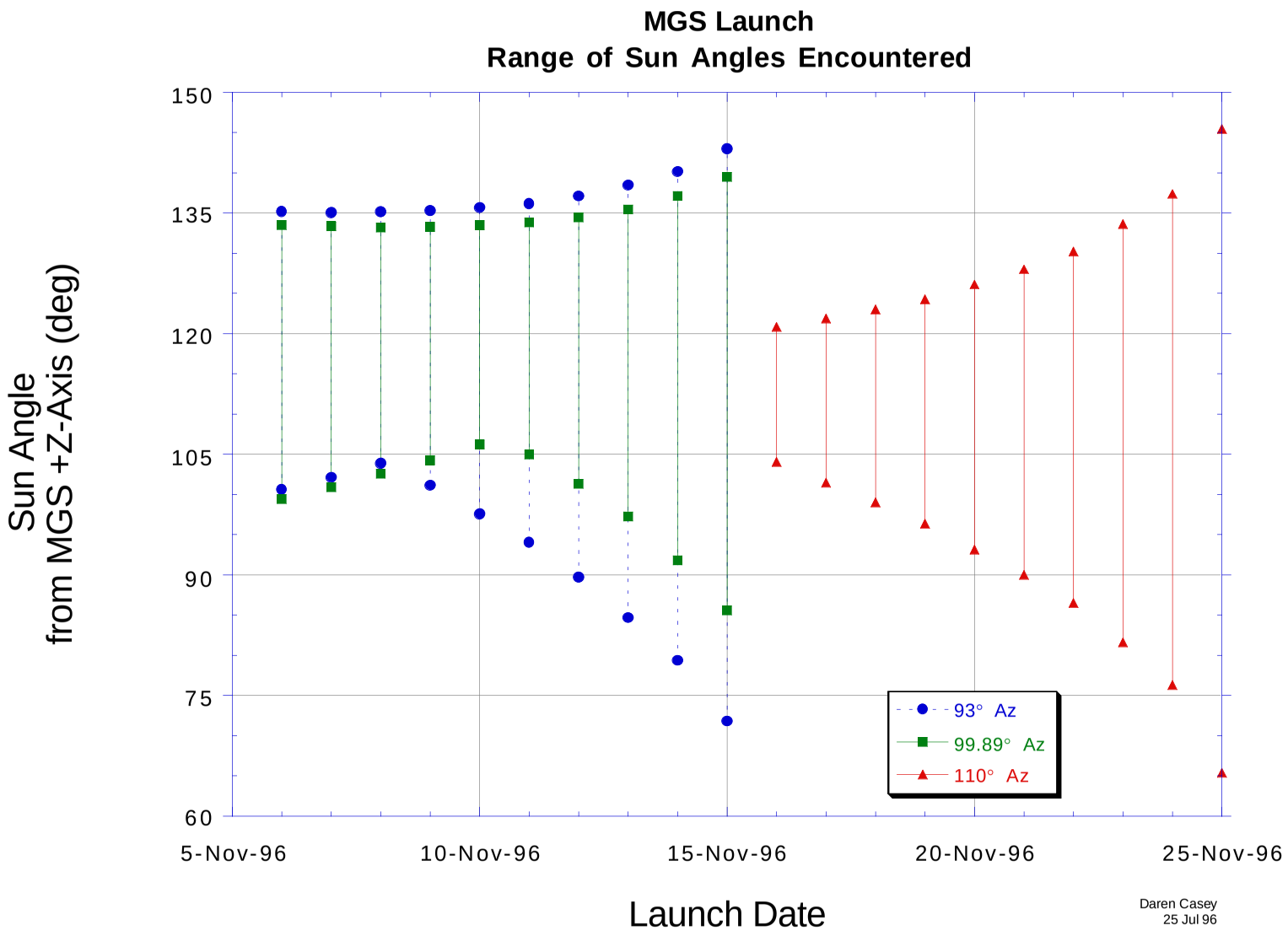
SUN ANGLE - 99.89° LAUNCH AZIMUTH



SUN ANGLE - 110° LAUNCH AZIMUTH

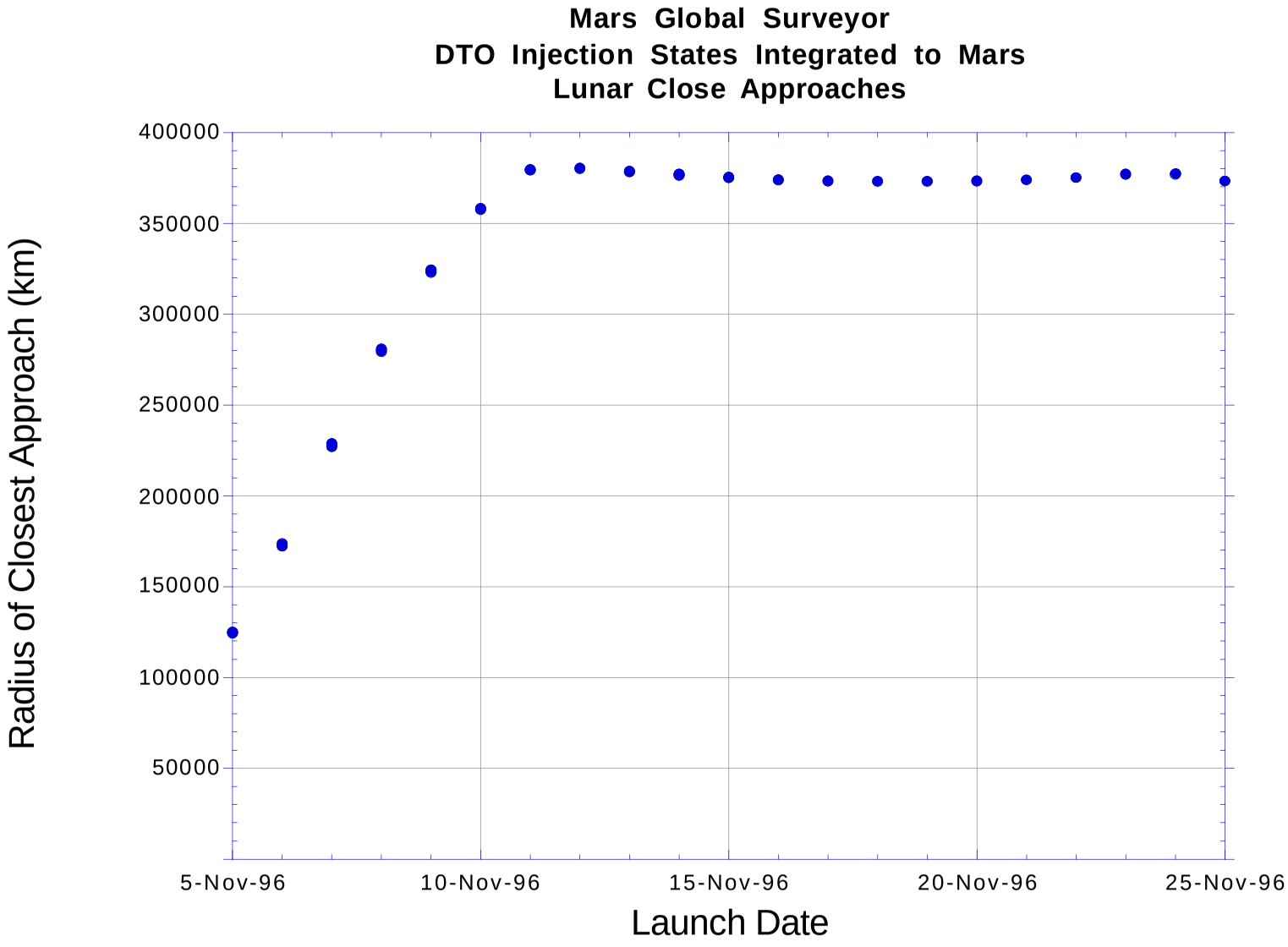


SUN ANGLE - EXTREMES



Daren Casey
25 Jul 96

LUNAR CLOSE APPROACHES



MGS DELTA II FLIGHT PROFILE

LAUNCH PERIOD				LAUNCH WINDOW				LIFTOFF TIMES	
Launch Day	1996 Launch Date DD-MM	Launch Azimuth (deg)	Parking Orbit Inc (deg)	*MDA DTO Short Coast Liftoff Time wrt Midnight UTC (secs)*	MDA DTO Short Coast COLA Liftoff Time (UTC) HH:MM:SS.S	MDA DTO Short Coast Desired Liftoff Time (UTC) HH:MM:SS.S	Liftoff Time Separation ΔT HH:MM:SS.S	MDA DTO Short Coast Desired Liftoff Time (Eastern) HH:MM:SS.S	MDA DTO Short Coast Desired Liftoff Time (Pacifc) HH:MM:SS.S
~~*1*~~	~~*05-Nov*~~	~~*93.00*~~	~~*28.470*~~	~~*62489.820*~~	~~*17:20:59.8*~~	~~*17:21:29.820*~~	~~–~~	~~*12:21:29.8*~~	~~*09:21:29.8*~~
~~*1*~~	~~*05-Nov*~~	~~*99.89*~~	~~*29.818*~~	~~*66342.180*~~	~~*18:25:12.2*~~	~~*18:25:42.180*~~	~~*01:04:12.4*~~	~~*13:25:42.2*~~	~~*10:25:42.2*~~
1	06-Nov	93.00	28.470	61876.703	17:10:46.7	17:11:16.703	-	12:11:16.7	09:11:16.7
1	06-Nov	99.89	29.818	65744.259	18:15:14.3	18:15:44.259	01:04:27.6	13:15:44.3	10:15:44.3
2	07-Nov	93.00	28.470	61249.868	17:00:19.9	17:00:49.868	-	12:00:49.9	09:00:49.9
2	07-Nov	99.89	29.818	65156.373	18:05:26.4	18:05:56.373	01:05:06.5	13:05:56.4	10:05:56.4
3	08-Nov	93.00	28.470	60491.067	16:47:41.1	16:48:11.067	-	11:48:11.1	08:48:11.1
3	08-Nov	99.89	29.818	64449.165	17:53:39.2	17:54:09.165	01:05:58.1	12:54:09.2	09:54:09.2
4	09-Nov	93.00	28.470	59720.282	16:34:50.3	16:35:20.282	-	11:35:20.3	08:35:20.3
4	09-Nov	99.89	29.818	63738.843	17:41:48.8	17:42:18.843	01:06:58.6	12:42:18.8	09:42:18.8
5	10-Nov	93.00	28.470	58805.070	16:19:35.1	16:20:05.070	-	11:20:05.1	08:20:05.1
5	10-Nov	99.89	29.818	62902.767	17:27:52.8	17:28:22.767	01:08:17.7	12:28:22.8	09:28:22.8
6	11-Nov	93.00	28.470	57886.636	16:04:16.6	16:04:46.636	-	11:04:46.6	08:04:46.6
6	11-Nov	99.89	29.818	62076.737	17:14:06.7	17:14:36.737	01:09:50.1	12:14:36.7	09:14:36.7
7	12-Nov	93.00	28.470	56774.298	15:45:44.3	15:46:14.298	-	10:46:14.3	07:46:14.3
7	12-Nov	99.89	29.818	61094.522	16:57:44.5	16:58:14.522	01:12:00.2	11:58:14.5	08:58:14.5
8	13-Nov	93.00	28.470	55490.394	15:24:20.4	15:24:50.394	-	10:24:50.4	07:24:50.4
8	13-Nov	99.89	29.818	59997.063	16:39:27.1	16:39:57.063	01:15:06.7	11:39:57.1	08:39:57.1
9	14-Nov	93.00	28.470	54135.572	15:01:45.6	15:02:15.572	-	10:02:15.6	07:02:15.6
9	14-Nov	99.89	29.818	58521.110	16:14:51.1	16:15:21.110	01:13:05.5	11:15:21.1	08:15:21.1
10	15-Nov	93.00	28.470	52198.334	14:29:28.3	14:29:58.334	-	09:29:58.3	06:29:58.3
10	15-Nov	99.89	29.818	56846.984	15:46:57.0	15:47:26.984	01:17:28.7	10:47:27.0	07:47:27.0
11	16-Nov	110.00	36.500	66992.739	18:36:02.7	18:36:32.739	-	13:36:32.7	10:36:32.7
12	17-Nov	110.00	36.500	66077.203	18:20:47.2	18:21:17.203	-	13:21:17.2	10:21:17.2
13	18-Nov	110.00	36.500	65223.814	18:06:33.8	18:07:03.814	-	13:07:03.8	10:07:03.8
14	19-Nov	110.00	36.500	64360.260	17:52:10.3	17:52:40.260	-	12:52:40.3	09:52:40.3
15	20-Nov	110.00	36.500	63266.737	17:33:56.7	17:34:26.737	-	12:34:26.7	09:34:26.7
16	21-Nov	110.00	36.500	62257.190	17:17:07.2	17:17:37.190	-	12:17:37.2	09:17:37.2
17	22-Nov	110.00	36.500	61157.494	16:58:47.5	16:59:17.494	-	11:59:17.5	08:59:17.5
18	23-Nov	110.00	36.500	59583.787	16:32:33.8	16:33:03.787	-	11:33:03.8	08:33:03.8
19	24-Nov	110.00	36.500	57943.703	16:05:13.7	16:05:43.703	-	11:05:43.7	08:05:43.7
20	25-Nov	110.00	36.500	54585.010	15:09:15.0	15:09:45.010	-	10:09:45.0	07:09:45.0
	Italics - Data Entries				COLA ΔT 30			UTC-EST 5	EST-PST 3

08/02/96

MGS DELTA II FLIGHT PROFILE

PARKING ORBIT INSERTION / SECO-1			DELTA STAGE II RESTART BURN / SECO-2							
First Cutoff Delta Stage II (SECO-1) [secs from liftoff]	First Cutoff Delta Stage II (SECO-1) [mins from liftoff]	First Cutoff Delta Stage II (SECO-1) (UTC) HH:MM:SS.S	Parking Orbit Coast [mins]	*Restart Delta Stage II [secs from liftoff]*	Restart Delta Stage II [mins from liftoff]	Restart Delta Stage II (UTC) HH:MM:SS.S	*Second Cutoff Delta Stage II (SECO-2) [secs from liftoff]*	Second Cutoff Delta Stage II (SECO-2) [mins from liftoff]	Second Cutoff Delta Stage II (SECO-2) (UTC) HH:MM:SS.S	Delta Stage II Restart Burn Duration [mins]
~~576.952~~	~~9.616~~	~~17:31:06.8~~	~~30.441~~	~~2403.415~~	~~40.057~~	~~18:01:33.2~~	~~2532.128~~	~~42.202~~	~~18:03:41.9~~	~~2.145~~
~~577.324~~	~~9.622~~	~~18:35:19.5~~	~~27.007~~	~~2197.731~~	~~36.629~~	~~19:02:19.9~~	~~2326.465~~	~~38.774~~	~~19:04:28.6~~	~~2.146~~
576.952	9.616	17:20:53.7	30.722	2420.297	40.338	17:51:37.0	2547.750	42.463	17:53:44.5	2.124
577.324	9.622	18:25:21.6	27.263	2213.096	36.885	18:52:37.4	2340.527	39.009	18:54:44.8	2.124
576.952	9.616	17:10:26.8	31.072	2441.245	40.687	17:41:31.1	2567.642	42.794	17:43:37.5	2.107
577.324	9.622	18:15:33.7	27.578	2231.984	37.200	18:43:08.4	2358.362	39.306	18:45:14.7	2.106
576.952	9.616	16:57:48.0	31.510	2467.522	41.125	17:29:18.6	2592.829	43.214	17:31:23.9	2.088
577.324	9.622	18:03:46.5	27.970	2255.497	37.592	18:31:44.7	2380.786	39.680	18:33:50.0	2.088
576.952	9.616	16:44:57.2	31.987	2496.150	41.603	17:16:56.4	2620.534	43.676	17:19:00.8	2.073
577.324	9.622	17:51:56.2	28.393	2280.891	38.015	18:20:19.7	2405.258	40.088	18:22:24.1	2.073
576.952	9.616	16:29:42.0	32.560	2530.524	42.175	17:02:15.6	2653.980	44.233	17:04:19.0	2.058
577.324	9.622	17:38:00.1	28.895	2311.025	38.517	18:06:53.8	2434.465	40.574	18:08:57.2	2.057
576.952	9.616	16:14:23.6	33.159	2566.483	42.775	16:47:33.1	2689.177	44.820	16:49:35.8	2.045
577.324	9.622	17:24:14.1	29.414	2342.143	39.036	17:53:38.9	2464.822	41.080	17:55:41.6	2.045
576.952	9.616	15:55:51.3	33.903	2611.155	43.519	16:29:45.5	2733.116	45.552	16:31:47.4	2.033
577.324	9.622	17:07:51.8	30.040	2379.739	39.662	17:37:54.3	2501.685	41.695	17:39:56.2	2.032
576.952	9.616	15:34:27.3	34.794	2664.603	44.410	16:09:15.0	2785.933	46.432	16:11:16.3	2.022
577.324	9.622	16:49:34.4	30.765	2423.210	40.387	17:20:20.3	2544.525	42.409	17:22:21.6	2.022
576.952	9.616	15:11:52.5	35.772	2723.285	45.388	15:47:38.9	2844.139	47.402	15:49:39.7	2.014
577.324	9.622	16:24:58.4	31.779	2484.078	41.401	16:56:45.2	2604.835	43.414	16:58:45.9	2.013
576.952	9.616	14:39:35.3	37.243	2811.551	46.859	15:16:49.9	2932.005	48.867	15:18:50.3	2.008
577.324	9.622	15:57:04.3	32.995	2557.039	42.617	16:30:04.0	2677.439	44.624	16:32:04.4	2.007
583.573	9.726	18:46:16.3	24.059	2027.137	33.786	19:10:19.9	2147.364	35.789	19:12:20.1	2.004
583.573	9.726	18:31:00.8	24.636	2061.751	34.363	18:55:39.0	2181.822	36.364	18:57:39.0	2.001
583.573	9.726	18:16:47.4	25.180	2094.345	34.906	18:41:58.2	2214.362	36.906	18:43:58.2	2.000
583.573	9.726	18:02:23.8	25.733	2127.571	35.460	18:28:07.8	2247.630	37.461	18:30:07.9	2.001
583.573	9.726	17:44:10.3	26.466	2171.541	36.192	18:10:38.3	2291.762	38.196	18:12:38.5	2.004
583.573	9.726	17:27:20.8	27.139	2211.937	36.866	17:54:29.1	2332.353	38.873	17:56:29.5	2.007
583.573	9.726	17:09:01.1	27.886	2256.727	37.612	17:36:54.2	2377.399	39.623	17:38:54.9	2.011
583.573	9.726	16:42:47.4	29.011	2324.243	38.737	17:11:48.0	2445.340	40.756	17:13:49.1	2.018
583.573	9.726	16:15:27.3	30.193	2395.168	39.919	16:45:38.9	2516.654	41.944	16:47:40.4	2.025
583.573	9.726	15:19:28.6	32.771	2549.852	42.498	15:52:14.9	2671.742	44.529	15:54:16.8	2.032

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MGS LAUNCH PERIOD / INJECTION TARGETS

Delta Stage III Injection [mins from liftoff]	*Targeting Interface Point (TIP) [secs from liftoff]*	Targeting Interface Point (TIP) [mins from liftoff]	TIP Time (SIII Ign + 10 Min) (UTC) HH:MM:SS.S	PQ Biased DPTRAJ C3 (TIP) (km^2/s^2)	PQ Biased DPTRAJ DLA (TIP) EME2000 (deg)	PQ Biased DPTRAJ RLA (TIP) EME2000 (deg)	PQ Biased DPTRAJ DLA (TIP) ETEDate (deg)	PQ Biased DPTRAJ RLA (TIP) ETEDate (deg)	PQ Biased Lunar Closest Approach (km)
	TARGETING INTERFACE POINT								
~~45.164~~	~~3222.508~~	~~53.708~~	~~18:15:12.3~~	~~10.3826~~	~~20.8129~~	~~173.4556~~	~~20.8300~~	~~173.4136~~	~~124413~~
~~41.736~~	~~3016.845~~	~~50.281~~	~~19:15:59.0~~	~~10.3793~~	~~20.8287~~	~~173.5053~~	~~20.8458~~	~~173.4633~~	~~125157~~
45.424	3238.130	53.969	18:05:14.8	10.1656	21.2815	173.2868	21.2986	173.2447	172134
41.970	3030.907	50.515	19:06:15.2	10.1551	21.3062	173.2849	21.3232	173.2428	173722
45.756	3258.022	54.300	17:55:07.9	9.9846	21.8151	173.3121	21.8321	173.2700	227112
42.268	3048.742	50.812	18:56:45.1	9.9747	21.8430	173.3104	21.8601	173.2683	228758
46.175	3283.209	54.720	17:42:54.3	9.7984	22.4474	173.1808	22.4645	173.1386	279307
42.641	3071.166	51.186	18:45:20.3	9.7890	22.4782	173.1780	22.4952	173.1359	280740
46.637	3310.914	55.182	17:30:31.2	9.6412	23.0918	173.1528	23.1088	173.1106	323229
43.049	3095.638	51.594	18:33:54.5	9.6324	23.1246	173.1488	23.1417	173.1066	324315
47.195	3344.360	55.739	17:15:49.4	9.4837	23.8150	172.9559	23.8320	172.9136	357447
43.536	3124.845	52.081	18:20:27.6	9.4755	23.8502	172.9506	23.8672	172.9083	358090
47.781	3379.557	56.326	17:01:06.2	9.3549	24.5143	172.8633	24.5313	172.8210	379294
44.042	3155.202	52.587	18:07:11.9	9.3473	24.5515	172.8567	24.5685	172.8144	379412
48.513	3423.496	57.058	16:43:17.8	9.2314	25.2983	172.6072	25.3153	172.5648	377823
44.656	3192.065	53.201	17:51:26.6	9.2246	25.3382	172.5995	25.3552	172.5571	377533
49.394	3476.313	57.939	16:22:46.7	9.1257	26.1236	172.3150	26.1405	172.2725	374541
45.370	3234.905	53.915	17:33:52.0	9.1198	26.1667	172.3063	26.1836	172.2638	374285
50.364	3534.519	58.909	16:01:10.1	9.0466	26.8873	172.1402	26.9042	172.0976	371915
46.375	3295.215	54.920	17:10:16.3	9.0287	27.1824	171.7576	27.1992	171.7150	371694
51.828	3622.385	60.373	15:30:20.7	8.9811	27.7543	171.8299	27.7711	171.7873	369941
47.585	3367.819	56.130	16:43:34.8	8.9725	28.1834	171.3326	28.2002	171.2898	369772
38.751	2837.744	47.296	19:23:50.5	8.9162	28.7341	171.5835	28.7509	171.5398	368342
39.325	2872.202	47.870	19:09:09.4	8.8939	29.6635	171.2614	29.6802	171.2186	367928
39.868	2904.742	48.412	18:55:28.6	8.8888	30.4871	171.0732	30.5037	171.0303	368110
40.422	2938.010	48.967	18:41:38.3	8.9003	31.2739	170.9072	31.2906	170.8641	368880
41.158	2982.142	49.702	18:24:08.9	8.9336	32.2347	170.6113	32.2514	170.5681	370248
41.834	3022.733	50.379	18:07:59.9	8.9721	33.0381	170.4474	33.0547	170.4041	372265
42.585	3067.779	51.130	17:50:25.3	9.0213	33.8373	170.2947	33.8539	170.2512	374871
43.717	3135.720	52.262	17:25:19.5	9.1017	34.8534	170.0216	34.8699	169.9779	376881
44.906	3207.034	53.451	16:59:10.7	9.1758	35.6671	169.8820	35.6836	169.8383	377337
47.491	3362.122	56.035	16:05:47.1	9.2576	36.4706	169.7374	36.4871	169.6936	373437

[1]Final Tgt Sp DE-403 GEM-T2 8x8 Mars 50c 8x8

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COMPLETE SET OF LAUNCH VEHICLE TRAJECTORY CERTIFICATION VUGRAPHS ARE AVAILABLE ON THE MGS COLLABORATIVE SERVER:

JPL PERSONAL / JOHNSTON, DAN / LAUNCH (FINAL)