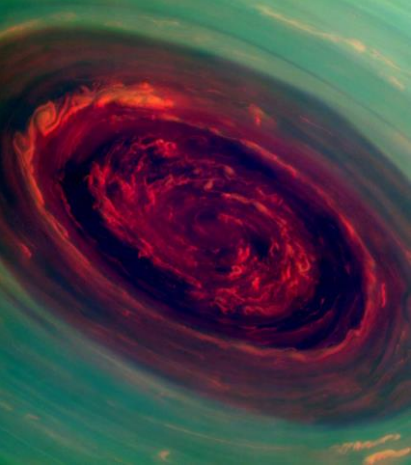
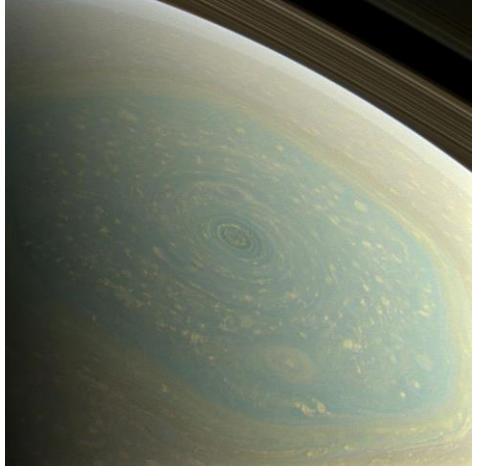
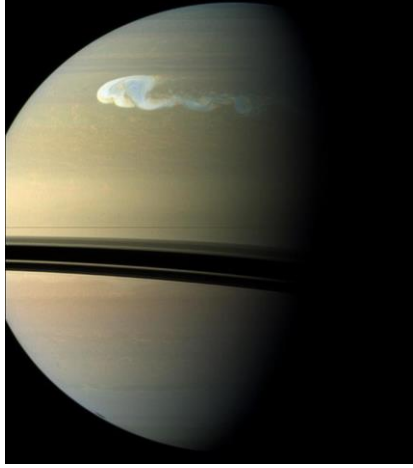


Science Planning & Sequence Team
CASSINI

SATURN TARGET WORKING TEAM

Rev 75_77 Segment Legacy Package

Segment Boundary: July 10, 2008 – July 20, 2008
2008-192T02:07:00 – 2008-202T01:21:00 (SCET)

Integration Began 09/10/2007
Segment Delivered to S42 Sequence 01/25/2008
Lead Integrator was Shawn Boll

Legacy Package Assembled by Shawn Boll

Table of Contents

- **Segment Overview and Final Products** **3 - 11**
  - Summary 4
  - Final Sequenced SPASS (Science Planning Attitude Strategy Spreadsheet) 5
  - Final Sequenced SMT (SSR Management Tool) Reports 6 - 7
  - Segment Geometry 8 - 10
    - Overview 8 - 9
    - Solar Geometry ORS Boresight Concerns 10
  - Daily Science Highlights 11

- **Segment Integration Planning** **12 - 19**
  - Timeline Gaps & Suggested Observations (N.A.*) 13
  - Initial SMT (SSR Management Tool) Reports 14
  - Waypoint Selection 15 - 18
    - Options Considered 15
    - Waypoints Chosen 16 - 18
  - Sequence handoff Notes & Liens on sequence development/execution 19

*** N.A. = Slide present but content not available.**

Segment Overview and Final Products

Segment Summary

- This was a 10 day segment in the early part of the Equinox Mission, during a period of inclined orbits. The segment began just before Rev 76 apoapse, covered Rev 76 periapse, and ended a couple days after Rev 77 apoapse, encompassing over an entire orbit.

- Saturn science at apoapse focused heavily on UVIS-led aurora studies of both poles and CIRS Far-IR mapping. At periapse, UVIS observed a solar occultation of Saturn. ISS recorded a south pole movie on the outbound leg.

- Most of the periapse time, outside the solar occultation, was given to several icy satellite observations (Enceladus, Rhea, Janus, Mimas) and a VIMS high-phase look at the rings.

- A set of images for optical navigation were also taken at Rev 77 apoapse.

- A significant amount of data volume requested had to be cut from the plan in order to fit on the SSRs.

- The position of the sun made the waypoint strategy and turn planning difficult, however no constraint management was required. Science during the critical time of low solar boresight angles w.r.t. Saturn center was focused on the solar-port pointed observation of the solar occultation and the high-phase rings observation.

Final Sequenced SPASS

Request	Riders	Start (SCET)	Start (Epoch)	Duration	End (SCET)	Primary	Secondary	Comments
Sequence S42, length = 40 days		2008-183T19:08:00		040T05:12:00	2008-224T00:20:00			
SATURN_75_77 Segment		2008-192T02:07:00		009T23:14:00	2008-202T01:21:00			
SP_075SA_WAYPTTURN192_PRIME		2008-192T02:07:00		000T00:30:00	2008-192T02:37:00	ISS_NAC to Saturn (0.0,-45.0,0.0 deg. offset)	POS_Z to NSP	SP Turn to Waypoint
NEW WAYPOINT		**2008-192T02:37:00**		**003T23:30:00**	**2008-196T02:07:00**	**ISS_NAC to Saturn (0.0,-45.0,0.0 deg. offset)**	**POS_Z to NSP**	
CIRS_075SA_FIRMAPA002_PRIME	C, V	2008-192T02:37:00		000T11:00:00	2008-192T13:37:00	CIRS_FP1 to Saturn	POS_X to NSP	
UVIS_075SA_AURORA001_PRIME		2008-192T13:37:00		000T03:00:00	2008-192T16:37:00	ISS_NAC to Saturn	NEG_X to Sun	
SP_075EA_DLTURN192_PRIME		2008-192T16:37:00		000T00:30:00	2008-192T17:07:00	XBAND to Earth	POS_X to NSP	SP Turn to Earth
SP_075EA_G34BWGNON192_PRIME	C, M	2008-192T17:07:00		000T09:00:00	2008-193T02:07:00	XBAND to Earth	Rolling/Bias	
Apoapse Per = 7.0 d, inc =...		2008-192T22:20:57		000T00:00:01	2008-192T22:20:58			
SP_076SA_WAYPTTURN193_PRIME	M	2008-193T02:07:00		000T00:30:00	2008-193T02:37:00	ISS_NAC to Saturn (0.0,-45.0,0.0 deg. offset)	POS_Z to NSP	SP Turn to Waypoint
CIRS_076SA_FIRMAPB002_PRIME	C, M, V	2008-193T02:37:00		000T11:00:00	2008-193T13:37:00	CIRS_FP1 to Saturn	POS_X to NSP	
UVIS_076SA_AURORA001_PRIME	M	2008-193T13:37:00		000T02:45:00	2008-193T16:22:00	ISS_NAC to Saturn	NEG_X to Sun	
SP_076EA_DLTURN193_PRIME	M	2008-193T16:22:00		000T00:30:00	2008-193T16:52:00	XBAND to Earth	POS_X to NSP	SP Turn to Earth
SP_076EA_G34HEFNON193_PRIME	C, M	2008-193T16:52:00		000T09:00:00	2008-194T01:52:00	XBAND to Earth	Rolling/Bias	
SP_076SA_WAYPTTURN194_PRIME	M	2008-194T01:52:00		000T00:30:00	2008-194T02:22:00	ISS_NAC to Saturn (0.0,-45.0,0.0 deg. offset)	POS_Z to NSP	SP Turn to Waypoint
CIRS_076SA_FIRMAPC002_PRIME	C, M, V	2008-194T02:22:00		000T11:00:00	2008-194T13:22:00	CIRS_FP1 to Saturn	POS_X to NSP	
UVIS_076SA_AURORA002_PRIME	M	2008-194T13:22:00		000T02:00:00	2008-194T15:22:00	ISS_NAC to Saturn	NEG_X to Sun	
SP_076EA_DLTURN194_PRIME	M	2008-194T15:22:00		000T00:30:00	2008-194T15:52:00	XBAND to Earth	POS_X to NSP	
SP_076EA_G70METNON194_PRIME	C, M	2008-194T15:52:00		000T09:55:00	2008-195T01:47:00	XBAND to Earth	Rolling/Bias	
SP_076SA_WAYPTTURN195_PRIME	C, M	2008-195T01:52:00		000T00:30:00	2008-195T02:22:00	ISS_NAC to Saturn (0.0,-45.0,0.0 deg. offset)	POS_Z to NSP	SP Turn to Waypoint
UVIS_076SA_AURORA003_PRIME	I, M, V	2008-195T02:22:00		000T10:00:00	2008-195T12:22:00	ISS_NAC to Saturn	NEG_X to Sun	
CIRS_076RI_SUBMU45MP001_PRIME	C, M	2008-195T12:22:00		000T03:00:00	2008-195T15:22:00	CIRS_FP1 to Rings	POS_Z to NSP	
SP_076EA_DLTURN195_PRIME	C, M	2008-195T15:22:00		000T00:30:00	2008-195T15:52:00	XBAND to Earth	POS_X to NSP	
SP_076EA_G70METNON195_PRIME	C, M	2008-195T15:52:00		000T09:45:00	2008-196T01:37:00	XBAND to Earth	5_Hr_Rolling	
SP_076SA_WAYPTTURN196_PRIME	C, M	2008-196T01:37:00		000T00:30:00	2008-196T02:07:00	ISS_NAC to Sun (-20.0,0.0,-0.11 deg. offset)	NEG_X to Saturn	UVIS_SOLAR to sun
NEW WAYPOINT		**2008-196T02:07:00**		**001T00:58:00**	**2008-197T03:05:00**	**ISS_NAC to Sun (-20.0,0.0,-0.11 deg. offset)**	**NEG_X to Saturn**	
CIRS_076EN_ORSSECLNX001_PRIME	C, I, M, U	2008-196T02:07:00		000T03:53:00	2008-196T06:00:00	CIRS_FP3 to Enceladus (0.0,20.0,0.0 deg. offset)	NEG_X to Saturn	Secondary chosen by MAG
CIRS_076JA_ORSJANUS001_PRIME	C, I, M, U, V	2008-196T06:00:00		000T00:29:00	2008-196T06:29:00	UVIS_FUV to Janus	NEG_X to Saturn	
CIRS_076RH_FP1SECLN001_PRIME	C, I, M, U, V	2008-196T06:29:00		000T02:11:00	2008-196T08:40:00	ISS_NAC to Rhea	NEG_X to Saturn	CIRS prefers to control secondary (control by MAG no longer necessary).
SP_076SA_DEADTIME196_PRIME	**M**	**2008-196T08:40:00**		**000T00:13:51**	**2008-196T08:53:51**	**ISS_NAC to Sun (-20.0,0.0,-0.11 deg. offset)**	**NEG_X to Saturn**	
UVIS_076SU_USUNOCC001_PRIME	C, M, V	2008-196T08:53:52	GMB_E076_SATURN_SOLAR_OCC_1_ING-000T01:01:59	000T01:05:00	2008-196T09:58:52	ISS_NAC to Sun (-20.0,0.0,-0.11 deg. offset)	NEG_X to Saturn	
VIMS_076RI_HIPHASE001_PRIME	C, M	2008-196T09:58:52	GMB_E076_SATURN_SOLAR_OCC_1_ING+000T00:03:01	000T00:35:00	2008-196T10:33:52	VIMS_IR to L_ANSA_D	PIC	Secondary axis to accomodate MAG, if feasible.
UVIS_076SU_USUNOCC002_PRIME	M, V	2008-196T10:33:52	GMB_E076_SATURN_SOLAR_OCC_1_ING+000T00:38:01	000T00:50:00	2008-196T11:23:52	ISS_NAC to Sun (-20.0,0.0,-0.11 deg. offset)	NEG_X to Saturn	
Periapse R = 2.689 Rs, lat ...		2008-196T10:45:29		000T00:00:01	2008-196T10:45:30			
SP_076SA_DEADTIME496_PRIME	**M**	**2008-196T11:26:00**		**000T00:15:00**	**2008-196T11:41:00**	**ISS_NAC to Sun (-20.0,0.0,-0.11 deg. offset)**	**NEG_X to Saturn**	
SP_076SA_RWATURN196_PRIME	C, I, M, U, V	2008-196T11:41:00		000T00:31:00	2008-196T12:12:00	ISS_NAC to Sun (-20.0,0.0,-0.11 deg. offset)	NEG_X to -50.475/79.5	Inertial secondary for RWA offtrack bias
CIRS_076MI_ORSSECLN001_PRIME	C, I, M, U, V	2008-196T12:12:00		000T04:48:00	2008-196T17:00:00	CIRS_FP1 to Mimas	NEG_X to Sun	CIRS desires secondary axis control (secondary chosen by MAG no longer necessary).
ISS_076SA_SPOLRMOV001_PRIME	M, V	2008-196T17:00:00		000T03:05:00	2008-196T20:05:00	ISS_NAC to Saturn	NEG_X to Sun	
SP_076EA_DLTURN196_PRIME	M	2008-196T20:05:00		000T00:30:00	2008-196T20:35:00	XBAND to Earth	NEG_X to NSP	SP Turn to Earth
SP_076EA_G70METNON196_PRIME	C, M	2008-196T20:35:00		000T06:00:00	2008-197T02:35:00	XBAND to Earth	6_Hr_Delayed_Rolling	
SP_076SA_WAYPTTURN197_PRIME	M	2008-197T02:35:00		000T00:30:00	2008-197T03:05:00	ISS_NAC to Saturn	NEG_X to Sun	SP Turn to Waypoint
NEW WAYPOINT		**2008-197T03:05:00**		**001T00:02:00**	**2008-198T03:07:00**	**ISS_NAC to Saturn**	**NEG_X to Sun**	
UVIS_076SA_AURORA004_PRIME	I, M, V	2008-197T03:05:00		000T07:55:00	2008-197T11:00:00	ISS_NAC to Saturn	NEG_X to Sun	
CIRS_076SA_COMPSIT001_PRIME	I, M, V	2008-197T11:00:00		000T08:07:00	2008-197T19:07:00	ISS_NAC to Saturn	POS_Z to NSP	
SP_076EA_DLTURN197_PRIME	M	2008-197T19:07:00		000T00:30:00	2008-197T19:37:00	XBAND to Earth	NEG_X to NSP	SP Turn to Earth
SP_076EA_G34HEFNON197_PRIME	C, M	2008-197T19:37:00		000T07:00:00	2008-198T02:37:00	XBAND to Earth	Rolling/Bias	
SP_076SA_WAYPTTURN198_PRIME	M	2008-198T02:37:00		000T00:30:00	2008-198T03:07:00	ISS_NAC to Saturn (0.0,20.0,0.0 deg. offset)	POS_X to NSP	SP Turn to Waypoint
NEW WAYPOINT		**2008-198T03:07:00**		**000T22:59:00**	**2008-199T02:06:00**	**ISS_NAC to Saturn (0.0,20.0,0.0 deg. offset)**	**POS_X to NSP**	
CIRS_076SA_FIRMAPA001_PRIME	C, M, V	2008-198T03:07:00		000T12:59:00	2008-198T16:06:00	CIRS_FP1 to Saturn	POS_X to NEP	
SP_076EA_DLTURN198_PRIME	M	2008-198T16:06:00		000T00:30:00	2008-198T16:36:00	XBAND to Earth	NEG_X to NSP	
SP_076EA_G70METNON198_PRIME	C, M	2008-198T16:36:00		000T09:00:00	2008-199T01:36:00	XBAND to Earth	Rolling/Bias	
SP_076SA_WAYPTTURN199_PRIME	M	2008-199T01:36:00		000T00:30:00	2008-199T02:06:00	ISS_NAC to Saturn	POS_Z to NSP	SP Turn to Waypoint
NEW WAYPOINT		**2008-199T02:06:00**		**001T01:00:00**	**2008-200T03:06:00**	**ISS_NAC to Saturn**	**POS_Z to NSP**	
CIRS_076SA_FIRMAPB001_PRIME	C, M, V	2008-199T02:06:00		000T14:00:00	2008-199T16:06:00	CIRS_FP1 to Saturn	POS_X to NSP	
SP_076EA_DLTURN199_PRIME	M	2008-199T16:06:00		000T00:30:00	2008-199T16:36:00	XBAND to Earth	NEG_X to NSP	SP Turn to Earth
SP_076EA_G34BWGNON199_PRIME	C, M	2008-199T16:36:00		000T09:00:00	2008-200T01:36:00	XBAND to Earth	Rolling/Bias	
Apoapse Per = 7.0 d, inc =...		2008-199T23:11:57		000T00:00:01	2008-199T23:11:58			
NAV_077SK_OPNAV001_PRIME		2008-200T01:36:00		000T01:29:00	2008-200T03:05:00	ISS_NAC to Satellites	NEG_X to Sun	Starts at Earth point, ends at NEW waypoint
NAV_077SA_WAYPTTURN001_PRIME		2008-200T03:05:00		000T00:01:00	2008-200T03:06:00	ISS_NAC to Saturn	NEG_X to Sun	
NEW WAYPOINT		**2008-200T03:06:00**		**001T22:44:00**	**2008-202T01:50:00**	**ISS_NAC to Saturn**	**NEG_X to Sun**	
UVIS_077SA_AURORA001_PRIME	I, V	2008-200T03:06:00		000T13:00:00	2008-200T16:06:00	ISS_NAC to Saturn	NEG_X to Sun	
SP_077EA_DLTURN200_PRIME		2008-200T16:06:00		000T00:30:00	2008-200T16:36:00	XBAND to Earth	POS_X to NSP	SP Turn to Earth
SP_077EA_G34HEFNON200_PRIME	C	2008-200T16:36:00		000T09:00:00	2008-201T01:36:00	XBAND to Earth	Rolling/Bias	
SP_077SA_WAYPTTURN201_PRIME		2008-201T01:36:00		000T00:30:00	2008-201T02:06:00	ISS_NAC to Saturn	NEG_X to Sun	SP Turn to Waypoint
UVIS_077SA_AURORA002_PRIME	I, V	2008-201T02:06:00		000T12:45:00	2008-201T14:51:00	ISS_NAC to Saturn	NEG_X to Sun	
SP_077EA_DLTURN201_PRIME		2008-201T14:51:00		000T00:30:00	2008-201T15:21:00	XBAND to Earth	POS_X to NEP	
SP_077EA_G70METNON201_PRIME	C	2008-201T15:51:00		000T09:30:00	2008-202T01:21:00	XBAND to Earth	Rolling/Bias	

Final Sequenced SMT and Data Volume (1 of 2)

DATA VOLUME SUMMARY --- TRANSFER FRAME OVERHEAD INCLUDED (80 BITS PER 8800-BIT FRAME)

			OBSERVATION_PERIOD							DOWNLINK_PASS						
			P4					P5	RECORDED		PLAYBACK					
DOWNLINK PASS NAME	Start doy hh:mm	End doy hh:mm	START (Mb)	SCI (Mb)	HK+E (Mb)	TOTAL (Mb)	CPACTY (Mb)	MRGN (Mb)	OPNAV (Mb)	SCI (Mb)	ENGR (Mb)	TOTAL (Mb)	CPACTY (Mb)	MARGN (Mb)	NET_MARGN (Mb)	(%)	CAROVR (Mb)
SP_075EA_G34BWGNON192_PRIME	192 17:07	193 02:07	0	621	64	685	3499	2814	0	237	53	975	677	-298	1883	12%	298
SP_076EA_G34HEFNON193_PRIME	193 16:52	194 01:52	298	622	62	982	3499	2517	0	253	53	1288	831	-458	1883	12%	457
SP_076EA_G70METNON194_PRIME	194 15:52	195 01:47	457	1099	59	1616	3499	1883	0	618	58	2293	3732	1438	2491	14%	0
SP_076EA_G70METNON195_PRIME	195 15:52	196 01:37	0	1776	60	1836	3499	1663	0	764	57	2657	3533	876	1052	7%	0
SP_076EA_G70METNON196_PRIME	196 20:35	197 02:35	0	3243	80	3323	3499	176	0	264	35	3622	2172	-1451	234	2%	1451
SP_076EA_G34HEFNON197_PRIME	197 19:37	198 02:37	1451	1501	72	3023	3499	476	0	175	41	3239	626	-2614	234	2%	2613
SP_076EA_G70METNON198_PRIME	198 16:36	199 01:36	2613	593	59	3265	3499	234	0	209	53	3527	3331	-196	867	5%	196
SP_076EA_G34BWGNON199_PRIME	199 16:36	200 01:36	196	625	63	884	3499	2615	0	240	53	1177	664	-513	867	6%	512
SP_077EA_G34HEFNON200_PRIME	200 16:36	201 01:36	512	1092	63	1668	3499	1831	27	232	53	1980	822	-1158	867	6%	1158
SP_077EA_G70METNON201_PRIME	201 15:51	202 01:21	1158	1067	60	2285	3499	1214	0	242	56	2583	3500	917	867	6%	0

DATA VOLUME REPORT --- TRANSFER FRAME OVERHEAD NOT INCLUDED

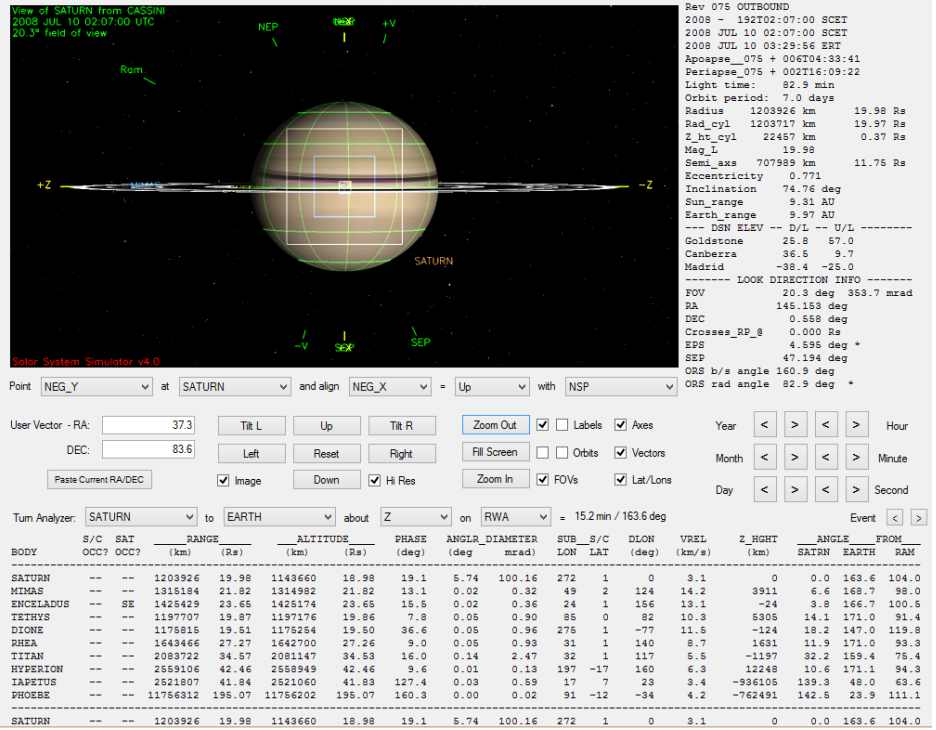
Event	Start doy hh:mm	End doy hh:mm	CAPS (Mb)	CDA (Mb)	CIRS (Mb)	INMS (Mb)	ISS (Mb)	MAG (Mb)	MIMI (Mb)	RADAR (Mb)	RPWS (Mb)	UVIS (Mb)	VIMS (Mb)	PROBE (Mb)	ENGR (Mb)	TOTAL (Mb)
OBSERVATION_NOR	192 01:52	192 17:07	54.9	11.5	158.4	5.5	0.0	32.9	65.9	0.0	71.4	54.4	150.0	0.0	12.5	617.4
OBSERVATION_SI	192 01:52	192 17:07	0.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0
SP_075EA_G34BWGNON192_PRIME	192 17:07	193 02:07	32.4	10.4	86.4	2.7	0.0	19.4	38.9	0.0	42.1	2.5	0.0	0.0	0.0	234.8
DAILY TOTAL SCIENCE	192 01:52	193 02:07	87.3	21.9	254.8	8.2	0.0	52.4	104.8	0.0	113.5	56.9	150.0	0.0		
OBSERVATION_NOR	193 02:07	193 16:52	53.1	27.8	158.4	2.7	0.0	31.9	63.7	0.0	69.0	49.8	150.0	0.0	12.1	618.5
OBSERVATION_SI	193 02:07	193 16:52	0.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0
SP_076EA_G34HEFNON193_PRIME	193 16:52	194 01:52	32.4	17.0	86.4	12.0	0.0	19.4	38.9	0.0	42.1	2.5	0.0	0.0	0.0	250.7
DAILY TOTAL SCIENCE	193 02:07	194 01:52	85.5	44.8	254.8	14.7	0.0	51.3	102.6	0.0	111.1	52.3	150.0	0.0		
OBSERVATION_NOR	194 01:52	194 15:52	50.4	26.4	158.4	2.5	0.0	30.2	60.5	0.0	564.8	36.2	150.0	0.0	11.4	1090.9
OBSERVATION_SI	194 01:52	194 15:52	0.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0
SP_076EA_G70METNON194_PRIME	194 15:52	195 01:47	35.7	18.7	86.4	1.8	0.0	21.4	42.8	0.0	403.5	2.4	0.0	0.0	0.0	612.7
DAILY TOTAL SCIENCE	194 01:52	195 01:47	86.1	45.1	254.8	4.3	0.0	51.7	103.3	0.0	968.2	38.7	150.0	0.0		
OBSERVATION_NOR	195 01:47	195 15:52	238.8	26.6	57.6	2.5	500.0	30.4	60.8	0.0	573.0	181.2	75.0	0.0	11.5	1757.5
OBSERVATION_SI	195 01:47	195 15:52	0.0	0.0	14.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.0
SP_076EA_G70METNON195_PRIME	195 15:52	196 01:37	122.4	18.4	86.4	2.2	0.0	29.1	43.3	0.0	453.1	2.4	0.0	0.0	0.0	757.2
DAILY TOTAL SCIENCE	195 01:47	196 01:37	361.2	45.0	158.0	4.7	500.0	59.5	104.1	0.0	1026.1	183.6	75.0	0.0		

Final Sequenced SMT and Data Volume (2 of 2)

DATA VOLUME REPORT --- TRANSFER FRAME OVERHEAD NOT INCLUDED

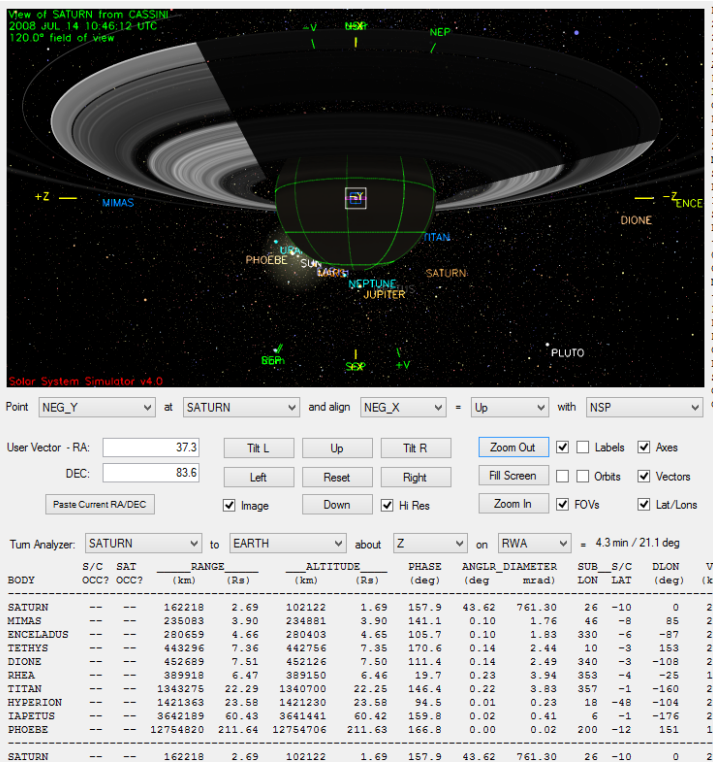
Event	Start doy hh:mm	End doy hh:mm	CAPS (Mb)	CDA (Mb)	CIRS (Mb)	INMS (Mb)	ISS (Mb)	MAG (Mb)	MIMI (Mb)	RADAR (Mb)	RPWS (Mb)	UVIS (Mb)	VIMS (Mb)	PROBE (Mb)	ENGR (Mb)	TOTAL (Mb)
OBSERVATION_NOR	196 01:37	196 20:35	778.1	35.8	105.5	16.9	298.5	134.9	100.3	0.0	1322.6	173.7	237.1	0.0	15.5	3218.8
OBSERVATION_SI	196 01:37	196 20:35	0.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0
SP_076EA_G70METNON196_PRIME	196 20:35	197 02:35	71.1	11.3	54.0	1.5	0.0	17.5	27.9	0.0	76.6	1.6	0.0	0.0	0.0	261.6
DAILY TOTAL SCIENCE	196 01:37	197 02:35	849.2	47.1	169.5	18.4	298.5	152.4	128.2	0.0	1399.2	175.3	237.1	0.0		
OBSERVATION_NOR	197 02:35	197 19:37	61.3	32.1	116.9	3.1	640.0	36.8	73.6	0.0	79.7	143.4	300.0	0.0	13.9	1500.8
SP_076EA_G34HEFNON197_PRIME	197 19:37	198 02:37	25.2	13.2	54.0	1.3	0.0	15.1	30.2	0.0	32.8	1.6	0.0	0.0	0.0	173.4
DAILY TOTAL SCIENCE	197 02:35	198 02:37	86.5	45.3	170.9	4.3	640.0	51.9	103.8	0.0	112.5	145.1	300.0	0.0		
OBSERVATION_NOR	198 02:37	198 16:36	50.3	26.4	187.0	2.5	0.0	30.2	60.4	0.0	65.4	0.0	150.0	0.0	11.4	583.7
OBSERVATION_SI	198 02:37	198 16:36	0.0	0.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.0
SP_076EA_G70METNON198_PRIME	198 16:36	199 01:36	32.4	17.0	54.0	1.6	0.0	19.4	38.9	0.0	42.1	1.6	0.0	0.0	0.0	207.1
DAILY TOTAL SCIENCE	198 02:37	199 01:36	82.7	43.4	256.0	4.1	0.0	49.6	99.3	0.0	107.6	1.6	150.0	0.0		
OBSERVATION_NOR	199 01:36	199 16:36	54.0	28.3	201.6	2.7	0.0	32.4	64.8	0.0	70.2	0.0	150.0	0.0	12.3	616.3
OBSERVATION_SI	199 01:36	199 16:36	0.0	0.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.0
SP_076EA_G34BWGNON199_PRIME	199 16:36	200 01:36	32.4	14.3	86.4	1.6	0.0	19.4	38.9	0.0	42.1	2.5	0.0	0.0	0.0	237.7
DAILY TOTAL SCIENCE	199 01:36	200 01:36	86.4	42.6	303.0	4.3	0.0	51.8	103.7	0.0	112.3	2.5	150.0	0.0		
OBSERVATION_NOR	200 01:36	200 16:36	54.0	11.3	0.0	14.3	500.0	32.4	64.8	0.0	70.2	235.5	100.0	0.0	12.3	1094.8
OBSERVATION_OPN	200 01:36	200 16:36	0.0	0.0	0.0	0.0	26.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.1
SP_077EA_G34HEFNON200_PRIME	200 16:36	201 01:36	32.4	6.8	86.4	1.6	0.0	19.4	38.9	0.0	42.1	2.5	0.0	0.0	0.0	230.1
DAILY TOTAL SCIENCE	200 01:36	201 01:36	86.4	18.1	86.4	15.9	500.0	51.8	103.7	0.0	112.3	238.0	100.0	0.0		
OBSERVATION_NOR	201 01:36	201 15:51	51.3	10.8	0.0	5.1	500.0	30.8	61.6	0.0	66.7	231.0	100.0	0.0	11.6	1068.8
SP_077EA_G70METNON201_PRIME	201 15:51	202 01:21	34.2	7.2	86.4	3.4	0.0	20.5	41.0	0.0	44.5	2.5	0.0	0.0	0.0	239.7
DAILY TOTAL SCIENCE	201 01:36	202 01:21	85.5	17.9	86.4	8.6	500.0	51.3	102.6	0.0	111.1	233.4	100.0	0.0		

Segment Geometry (1 of 2)



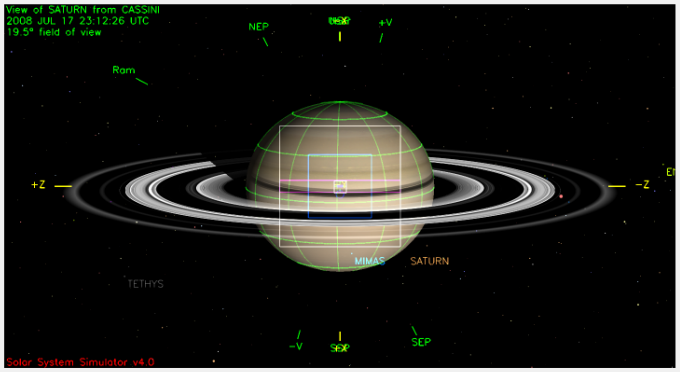
← Seg Start (Left)

↓ Rev 76 Periapse (below)



	Saturn Range	Phase Angle	Sub-S/C Lat.
Segment Start	19.98	19.1	1
Apoapse	20.81	22.0	10
Periapse	2.69	157.9	-10
Apoapse	20.81	22.1	10
Segment End	15.38	41.6	35

Segment Geometry (2 of 2)




```
Rev 077  INBOUND
2008 -  199T23:12:26 SCET
2008 JUL 17 23:12:26 SCET
2008 JUL 18 00:36:07 ERT
Apoapse__077 + 00:00:00
Periapse_077 - 003T12:27:08
Light time:    83.7 min
Orbit period:  7.0 days
Radius     1254263 km      20.81 Rs
Rad_cyl    1236547 km      20.52 Rs
Z_ht_cyl    210063 km       3.49 Rs
Mag_L          21.41
Semi_axs    708272 km      11.75 Rs
Eccentricity    0.771
Inclination    74.71 deg
Sun_range       9.31 AU
Earth_range    10.06 AU
--- DSN ELEV -- D/L -- U/L --------
Goldstone      53.5   63.0
Canberra       13.7  -19.5
Madrid        -28.0   -0.7
------- LOOK DIRECTION INFO -------
FOV            19.5 deg  339.5 mrad
RA            148.340 deg
DEC            -7.719 deg
Crosses_RP_@    0.000 Rs
EPS             4.064 deg
SEP            40.491 deg
ORS b/s angle 157.9 deg
ORS rad angle  74.7 deg  *
```

Point NEG_Y at SATURN and align NEG_X = Up with NSP

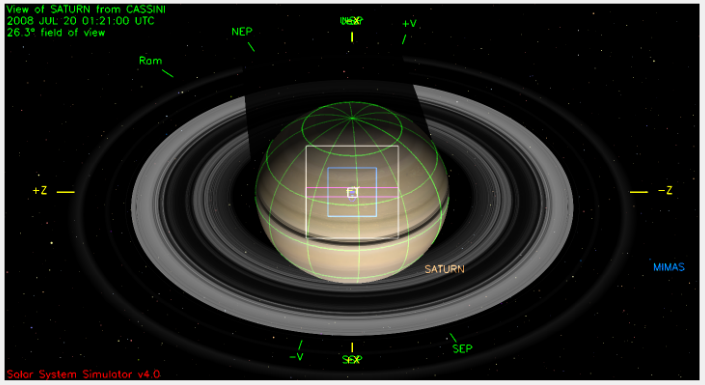
User Vector - RA: 37.3 DEC: 83.6 | Tilt L | Up | Tilt R | Left | Reset | Right | Paste Current RA/DEC | Image | Down | Hi Res | Zoom Out | Fill Screen | Zoom In | Labels | Orbits | FOVs | Axes | Vectors | Lat/Lons | Year | Month | Day | Hour | Minute | Second

Turn Analyzer: SATURN to EARTH about Z on RWA = 14.8 min / 158.9 deg Event

BODY	S/C OCC?	SAT OCC?	RANGE (km)	RANGE (Rs)	ALTITUDE (km)	ALTITUDE (Rs)	PHASE (deg)	ANGLR_DIAMETER (deg)	ANGLR_DIAMETER (mrad)	SUB_S/C LON	SUB_S/C LAT	DLON (deg)	VREL (km/s)	Z_HGHT (km)	ANGLE_FROM SATRN	ANGLE_FROM EARTH	ANGLE_FROM RAM
SATURN	--	--	1254263	20.81	1194154	19.81	22.1	5.51	96.14	178	10	0	2.6	0	0.0	158.9	90.0
MIMAS	--	--	1069523	17.75	1069316	17.74	23.8	0.02	0.39	183	13	-2	13.6	-5138	2.0	157.0	91.2
ENCELADUS	--	--	1361112	22.58	1360859	22.58	29.2	0.02	0.38	305	9	-112	12.7	-15	9.4	152.9	98.0
TETHYS	--	--	990983	16.44	990445	16.43	20.4	0.06	1.09	153	12	22	11.2	695	6.8	159.3	85.7
DIONE	--	--	956045	15.86	955483	15.85	33.2	0.07	1.18	223	13	-31	9.5	-71	12.1	148.6	101.9
RHEA	--	--	1615726	26.81	1614961	26.80	33.8	0.05	0.95	324	8	-126	8.9	2833	15.5	148.7	102.6
TITAN	--	--	1309165	21.72	1306590	21.68	73.6	0.23	3.93	296	9	-64	5.6	1553	55.8	109.6	139.4
HYPERION	--	--	451198	7.49	451067	7.48	109.5	0.04	0.73	284	-16	12	5.1	-23118	113.3	66.5	69.9
IAPETUS	--	--	2387000	39.61	2386254	39.59	164.1	0.04	0.63	1	12	-13	3.1	-659236	143.3	15.6	121.2
PHOEBE	--	--	11466598	190.26	11466487	190.26	165.9	0.00	0.02	237	-9	-27	4.0	-1291928	145.8	17.5	124.2
SATURN	--	--	1254263	20.81	1194154	19.81	22.1	5.51	96.14	178	10	0	2.6	0	0.0	158.9	90.0

← Rev 77 Apoapse (Left)

↓ Seg End (below)




```
Rev 077  INBOUND
2008 -  202T01:21:00 SCET
2008 JUL 20 01:21:00 SCET
2008 JUL 20 02:44:54 ERT
Apoapse__077 + 002T02:08:34
Periapse_077 - 001T10:18:34
Light time:    83.9 min
Orbit period:  7.0 days
Radius      926835 km      15.38 Rs
Rad_cyl     759211 km      12.60 Rs
Z_ht_cyl    531621 km       8.82 Rs
Mag_L          22.92
Semi_axs    708259 km      11.75 Rs
Eccentricity    0.771
Inclination    74.72 deg
Sun_range       9.32 AU
Earth_range    10.09 AU
--- DSN ELEV -- D/L -- U/L --------
Goldstone      27.5   58.4
Canberra       35.7    7.7
Madrid        -38.7  -23.7
------- LOOK DIRECTION INFO -------
FOV            26.3 deg  459.2 mrad
RA            159.583 deg
DEC           -32.053 deg
Crosses_RP_@    0.000 Rs
EPS             3.912 deg
SEP            38.712 deg
ORS b/s angle 138.4 deg
ORS rad angle  49.4 deg  *
```

Point NEG_Y at SATURN and align NEG_X = Up with NSP

User Vector - RA: 37.3 DEC: 83.6 | Tilt L | Up | Tilt R | Left | Reset | Right | Paste Current RA/DEC | Image | Down | Hi Res | Zoom Out | Fill Screen | Zoom In | Labels | Orbits | FOVs | Axes | Vectors | Lat/Lons | Year | Month | Day | Hour | Minute | Second

Turn Analyzer: SATURN to EARTH about Z on RWA = 13.2 min / 137.2 deg Event

BODY	S/C OCC?	SAT OCC?	RANGE (km)	RANGE (Rs)	ALTITUDE (km)	ALTITUDE (Rs)	PHASE (deg)	ANGLR_DIAMETER (deg	ANGLR_DIAMETER mrad)	SUB_S/C LON	SUB_S/C LAT	DLON (deg)	VREL (km/s)	Z_HGHT (km)	ANGLE_FROM SATRN	ANGLE_FROM EARTH	ANGLE_FROM RAM
SATURN	--	--	926835	15.38	868459	14.41	41.6	7.46	130.14	64	35	0	5.3	0	0.0	137.2	57.7
MIMAS	--	--	891533	14.79	891339	14.79	47.2	0.03	0.47	267	38	-69	9.0	-1546	11.6	132.5	68.6
ENCELADUS	--	--	882135	14.64	881884	14.63	44.2	0.03	0.58	98	37	68	17.3	19	14.8	133.3	48.2
TETHYS	--	--	711709	11.81	711176	11.80	55.8	0.09	1.52	195	48	-8	10.7	-2946	14.2	123.1	68.5
DIONE	--	--	860128	14.27	859567	14.26	48.8	0.08	1.31	88	38	63	14.5	99	24.0	128.2	44.5
RHEA	--	--	975207	16.18	974444	16.17	49.2	0.09	1.57	67	33	76	13.5	-2345	32.0	127.3	37.6
TITAN	--	--	1671448	27.73	1668873	27.69	60.4	0.18	3.08	327	18	-104	2.4	6808	46.1	122.0	95.2
HYPERION	--	--	996620	16.54	996494	16.53	148.9	0.02	0.33	43	50	-12	5.7	-12185	108.4	31.4	144.5
IAPETUS	--	--	2899315	48.11	2898569	48.09	161.1	0.03	0.52	4	13	-14	4.9	-533877	120.8	19.8	148.4
PHOEBE	--	--	11826691	196.24	11826577	196.23	168.5	0.00	0.02	26	-7	-17	6.1	-1430606	132.2	14.4	152.5
SATURN	--	--	926835	15.38	868459	14.41	41.6	7.46	130.14	64	35	0	5.3	0	0.0	137.2	57.7

Solar Geometry – ORS Boresight Concerns

No ORS Boresight Solar Constraints on Science Pointing.

Daily Science Highlights

DOYs 192-194:
These days surrounding apoapse were each spent on Saturn mapping. CIRS began, with VIMS riding along, by performing Far-IR mapping of Saturn's northern hemisphere. UVIS then took over, along with ISS, and looked at Saturn's auroral zone at high latitude.

DOY 195:
This day was similar to the previous three. UVIS continued looking at Saturn aurorae, with the other ORS instruments riding along. CIRS finished the day with submillimeter scans of the rings.

DOY 196: High Priority Day
As the spacecraft approached periapse, CIRS led a series of joint ORS icy satellite observations. The targets included an Enceladus solar eclipse of Rhea. UVIS then observed the ingress of a solar occultation of Saturn just prior to periapse, followed by VIMS taking high-phase images of the rings. Afterwards, UVIS observed the Saturn-Solar occultation egress. Following periapse, CIRS turned the spacecraft's attention to a solar occultation of Mimas. The other ORS teams rode along. ISS wrapped up the day imaging, along with VIMS, Saturn's south polar vortex.

DOY 197:
UVIS went back to its Saturn auroral campaign, with ISS and VIMS observing along side. CIRS followed with a long look at Saturn's south pole to determine composition, with VIMS and ISS continuing to ride along.

DOYs 198-199:
CIRS spent both of these days taking Far-IR maps of Saturn, with VIMS observing along side.

DOY 200-201:
Following apoapse, the OPNAV team snapped a few images for navigation purposes. UVIS then looked at Saturn's auroral zone at high latitude, with ISS and VIMS riding along. This auroral coverage continued in the same manner the following day.

Segment Integration Planning

Timeline Gaps and Suggested Observations

Info on Suggested Observations was Not Available.
Timeline may have been settled off-line prior to this segment's first appearance in a TWT meeting.

Initial SMT and Data Volume

Beginning of Integration:

DATA VOLUME SUMMARY --- TRANSFER FRAME OVERHEAD INCLUDED (80 BITS PER 8800-BIT FRAME)

			OBSERVATION_PERIOD							DOWNLINK_PASS							
			P4						P5	RECORDED		PLAYBACK					
DOWNLINK PASS NAME	Start doy hh:mm	End doy hh:mm	START (Mb)	SCI (Mb)	HK+E (Mb)	TOTAL (Mb)	CPACTY (Mb)	MRGN (Mb)	OPNAV (Mb)	SCI (Mb)	ENGR (Mb)	TOTAL (Mb)	CPACTY (Mb)	MARGN (Mb)	NET_MARGN (Mb)	(%)	CAROVE (Mb)
SP_075EA_G34BWGNON192_PRIME	192 17:07	193 02:07	0	1050	63	1114	3489	2376	0	238	53	1405	677	-728	-4447	-81%	728
SP_076EA_G34HEFNON193_PRIME	193 16:52	194 01:52	728	1389	62	2179	3489	1311	0	253	53	2485	831	-1655	-4447	-79%	1654
SP_076EA_G34HEFNON194_PRIME	194 16:52	195 01:52	1654	1253	63	2971	3489	519	0	281	53	3305	827	-2479	-4447	-79%	2478
SP_076EA_G34HEFNON195_PRIME	195 16:52	196 01:37	2478	1432	63	3974	3489	-484	0	535	52	4076	807	-3270	-4447	-92%	3270
SP_076EA_G34HEFNON196_PRIME	196 20:35	197 02:35	3270	4587	80	7937	3489	-4447	0	330	35	3855	531	-3325	-1215	-30%	3324
SP_076EA_G34HEFNON197_PRIME	197 19:37	198 01:37	3324	1309	72	4705	3489	-1215	0	158	35	3683	556	-3127	-894	-25%	3126
SP_076EA_G34HEFNON198_PRIME	198 19:36	199 01:36	3126	1037	76	4240	3489	-749	0	271	35	3796	557	-3240	-894	-30%	3239
SP_076EA_G34BWGNON199_PRIME	199 16:36	200 01:36	3239	959	63	4261	3489	-771	0	153	53	3696	664	-3032	-894	-38%	3032
SP_077EA_G34HEFNON200_PRIME	200 16:36	201 01:36	3032	516	63	3611	3489	-120	27	145	53	3714	822	-2892	-894	-53%	2892
SP_077EA_G34HEFNON201_PRIME	201 16:21	202 01:21	2892	1430	62	4384	3489	-894	0	234	53	3776	822	-2955	0	0%	2954

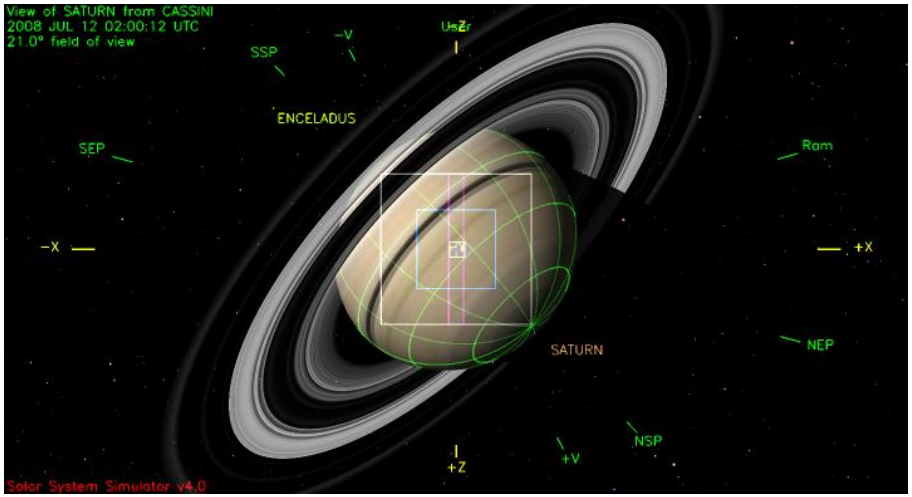
Waypoint Selection

•Waypoints:

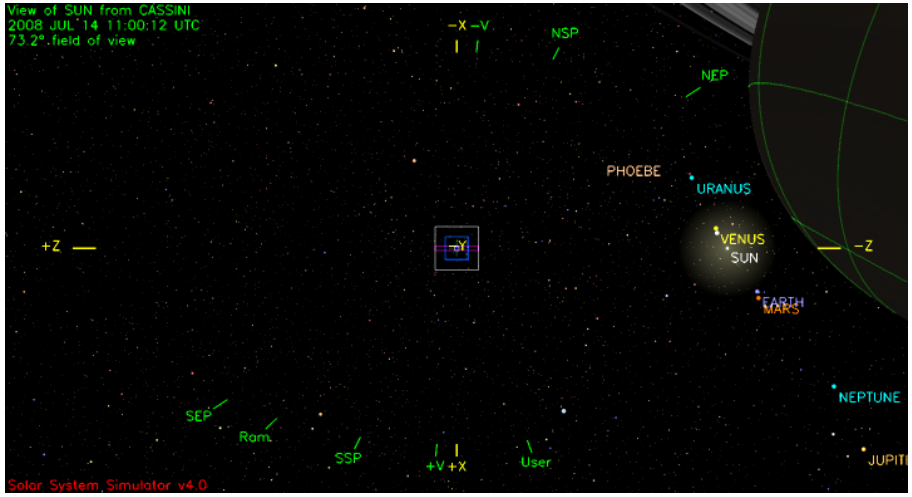
- Waypoint of ISS_NAC to Saturn (0,45,0); POS_Z to NSP from 192T02:37 to 195T16:52 is bad.
  - Changing the Y-axis offset to -45 will produce a safe waypoint.
- All other waypoints are safe.

Waypoints Chosen

Waypoint 1 (2008-192T02:37:00 – 2008-196T02:07:00): ISS_NAC to Saturn (0, -45, 0); POS_Z to NSP

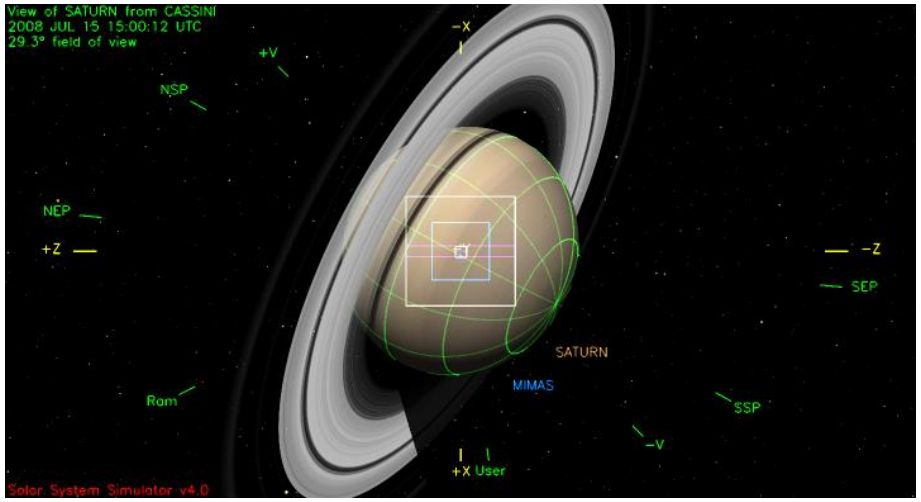


Waypoint 2 (2008-196T02:07:00 – 2008-197T03:05:00): ISS_NAC to Sun (-20,0,0.11); NEG_X to Saturn

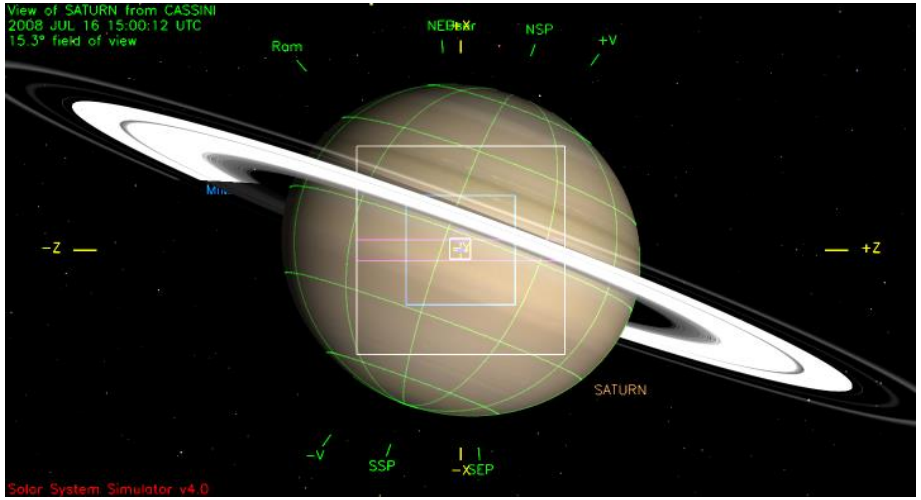


Waypoints Chosen

Waypoint 3 (2008-197T03:05:00 – 2008-198T03:07:00): ISS_NAC to Saturn; NEG_X to Sun

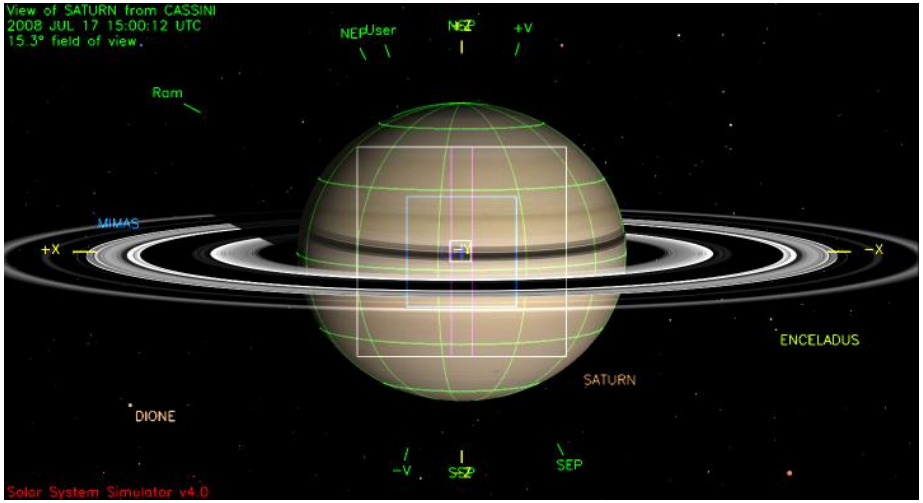


Waypoint 4 (2008-198T03:07:00 – 2008-199T02:06:00): ISS_NAC to Saturn (0,20,0); POS_X to NSP

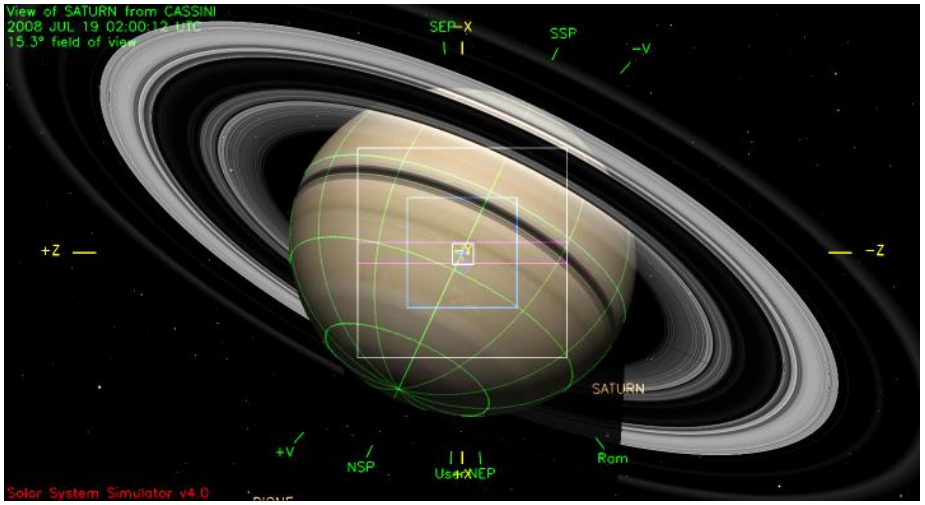


Waypoints Chosen

Waypoint 5 (2008-199T02:06:00 – 2008-200T03:06:00): ISS_NAC to Saturn; POS_Z to NSP



Waypoint 6 (2008-200T03:06:00 – 2008-202T01:50:00): ISS_NAC to Saturn; NEG_X to Sun



Notes & Liens

Notes:

- Pointing Issues:
  - Secondary axis was chosen for MAG on DOY 196.
- Data Volume Issues:
  - Negative SSR margin (-19) on DOY 198.
- Opmode Issues:
  - None
- Special Activities:
  - 1 GMB – Saturn Solar Occultation on DOY 196.

Sequence Liens:

- None

* Negative SSR margin noted above was resolved by DSN negotiations in sequence implementation.