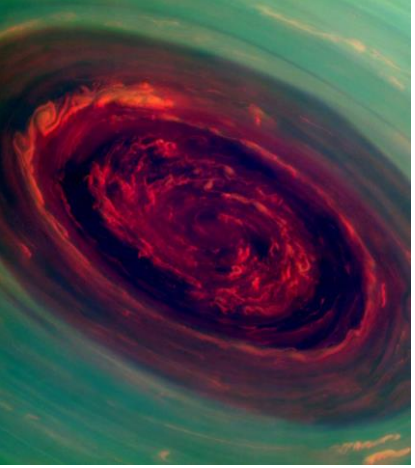

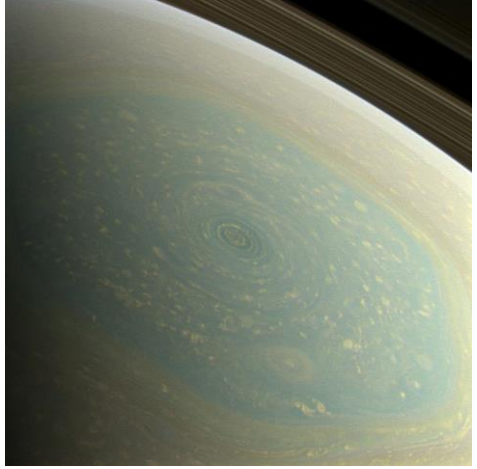
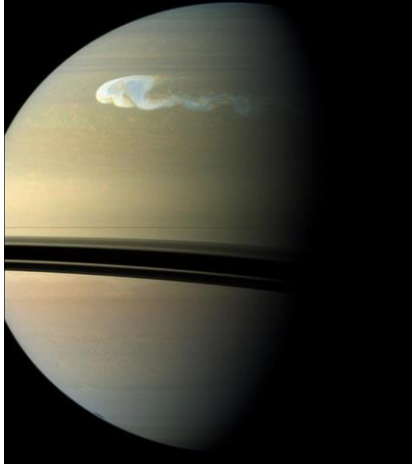

Science Planning & Sequence Team
CASSINI

SATURN TARGET WORKING TEAM

Rev 9 Segment Legacy Package

Segment Boundary: June 9, 2005 – June 12, 2005
2005-160T17:21– 2005-163T01:25 (SCET)

Integration Began 11/05/2001
Segment Delivered to S11 Sequence 01/16/2002
Lead Integrator was Jerod Gross

Legacy Package Assembled by Kyle Cloutier

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

Segment Overview and Final Products

Segment Summary

- Saturn 9 is an outbound segment, beginning ~1.3 days after periapse.
- This rev was originally a Rings segment but a trade was made in exchange for time on Revs 7, 8, & 10
- Segment end boundary was extended into the following Cross-Discipline segment to cover the Hyperion campaign, on the condition that the campaign include time for the VIMS ring occultation.
- In addition to the Hyperion campaign (Hyperion closest approach 2005-161T23:58), VIMS observed the Omicron Ceti stellar occultation of the rings, and there were 2 OPNAVs planned (Tethys (162T13:40) and Dione (162T14:10)).

Final Sequenced SPASS

Request	Riders	Start (SCET)	Start (Epoch)	Duration	End (SCET)	Primary	Secondary	Comments
SATURN rev 9 Segment		2005-160T17:21:00		002T08:04:00	2005-163T01:25:00			
SP_009SA_WAYPTTURN160_PRIME	R	2005-160T17:21:00		000T00:24:00	2005-160T17:45:00	ISS_NAC to Saturn	POS_Z to NSP	
ISS_009HY_ROTCOL001_PRIME	C, U	2005-160T17:45:00		000T01:30:00	2005-160T19:15:00	ISS_NAC to Hyperion (0.0,-50.0,0.0 deg. offset)	POS_Z to NSP	In the middle of the observing period, CIRS will scan in the X direction at 8 microrad/sec centered with NAC to Hyperion, followed by a 5 minute stare with CIRS FP1 centered on Hyperion.
VIMS_009SA_REGAURMAP001_PRIME		2005-160T19:16:00		000T04:20:00	2005-160T23:36:00	ISS_NAC to Saturn	POS_Z to NSP	
ISS_009HY_ROTCOL002_PRIME	C, U	2005-160T23:40:00		000T01:30:00	2005-161T01:10:00	ISS_NAC to Hyperion (0.0,-50.0,0.0 deg. offset)	POS_Z to NSP	In the middle of the observing period, CIRS will scan in the X direction at 8 microrad/sec centered with NAC to Hyperion, followed by a 5 minute stare with CIRS FP1 centered on Hyperion.
ISS_009SA_1X2WPH120001_PRIME	V	2005-161T01:10:00		000T00:50:00	2005-161T02:00:00	ISS_NAC to Saturn	NEG_X to Sun	
ISS_009SA_1X2WPH120002_PRIME	V	2005-161T02:10:00		000T00:50:00	2005-161T03:00:00	ISS_NAC to Saturn	NEG_X to Sun	
ISS_009SA_1X2WPH120003_PRIME	V	2005-161T03:10:00		000T00:50:00	2005-161T04:00:00	ISS_NAC to Saturn	NEG_X to Sun	
ISS_009HY_ROTCOL003_PRIME	C, U, V	2005-161T04:00:00		000T01:30:00	2005-161T05:30:00	ISS_NAC to Hyperion (0.0,-50.0,0.0 deg. offset)	POS_Z to NSP	In the middle of the observing period, CIRS will scan in the X direction at 8 microrad/sec centered with NAC to Hyperion, followed by a 5 minute stare with CIRS FP1 centered on Hyperion.
ISS_009SA_1X2WPH110001_PRIME	V	2005-161T05:30:00		000T00:50:00	2005-161T06:20:00	ISS_NAC to Saturn	NEG_X to Sun	
ISS_009SA_1X2WPH110002_PRIME	V	2005-161T06:30:00		000T00:50:00	2005-161T07:20:00	ISS_NAC to Saturn	NEG_X to Sun	
ISS_009SA_1X2WPH110003_PRIME	V	2005-161T07:30:00		000T00:50:00	2005-161T08:20:00	ISS_NAC to Saturn	NEG_X to Sun	
ISS_009HY_ROTCOL004_PRIME	C, U, V	2005-161T09:10:00		000T01:20:00	2005-161T10:30:00	ISS_NAC to Hyperion (0.0,-40.0,0.0 deg. offset)	POS_Z to NSP	In the middle of the observing period, CIRS will scan in the X direction at 8 microrad/sec centered with NAC to Hyperion, followed by a 5 minute stare with CIRS FP1 centered on Hyperion.
SP_009EA_DLTURN161_PRIME		2005-161T10:30:00		000T00:30:00	2005-161T11:00:00	XBAND to Earth	POS_X to NEP	
SP_009EA_M70METNON161_PRIME		2005-161T11:00:00		000T05:00:00	2005-161T16:00:00	XBAND to Earth	2_Hr_Rolling	
SP_009SA_WAYPTTURN161_PRIME		2005-161T16:00:00		000T00:30:00	2005-161T16:30:00	ISS_NAC to Saturn	POS_Z to NSP	
ISS_009HY_ROTCOL005_PRIME	C, U, V	2005-161T16:30:00		000T01:20:00	2005-161T17:50:00	ISS_NAC to Hyperion	POS_Z to NSP	In the middle of the observing period, CIRS will scan in the X direction at 8 microrad/sec centered with NAC to Hyperion, followed by a 5 minute stare with CIRS FP1 centered on Hyperion.
ISS_009SA_1X2WPH100001_PRIME	V	2005-161T17:50:00		000T00:50:00	2005-161T18:40:00	ISS_NAC to Saturn	NEG_X to Sun	
ISS_009SA_1X2WPH100002_PRIME	V	2005-161T18:50:00		000T00:50:00	2005-161T19:40:00	ISS_NAC to Saturn	NEG_X to Sun	
ISS_009HY_ROTCOL006_PRIME	C, U, V	2005-161T20:30:00		000T01:10:00	2005-161T21:40:00	ISS_NAC to Hyperion	POS_Z to NSP	In the middle of the observing period, CIRS will scan in the X direction at 8 microrad/sec centered with NAC to Hyperion, followed by a 5 minute stare with CIRS FP1 centered on Hyperion.
ISS_009HY_ROTCOL007_PRIME	C, U, V	2005-161T23:45:00		000T01:10:00	2005-162T00:55:00	ISS_NAC to Hyperion	POS_Z to NSP	In the middle of the observing period, CIRS will scan in the X direction at 8 microrad/sec centered with NAC to Hyperion, followed by a 5 minute stare with CIRS FP1 centered on Hyperion.
ISS_009HY_ROTCOL008_PRIME	C, U, V	2005-162T03:00:00		000T01:10:00	2005-162T04:10:00	ISS_NAC to Hyperion	POS_Z to NSP	In the middle of the observing period, CIRS will scan in the X direction at 8 microrad/sec centered with NAC to Hyperion, followed by a 5 minute stare with CIRS FP1 centered on Hyperion.
ISS_009SA_1X2WPH120004_PRIME	V	2005-162T04:10:00		000T00:50:00	2005-162T05:00:00	ISS_NAC to Saturn	NEG_X to Sun	
ISS_009HY_ROTCOL009_PRIME	C, U, V	2005-162T06:15:00		000T01:10:00	2005-162T07:25:00	ISS_NAC to Hyperion	POS_Z to NSP	In the middle of the observing period, CIRS will scan in the X direction at 8 microrad/sec centered with NAC to Hyperion, followed by a 5 minute stare with CIRS FP1 centered on Hyperion.
VIMS_009ST_OMICETOCC001_PRIME		2005-162T07:25:00		000T04:10:01	2005-162T11:35:01	VIMS_IR to 34.836/-2.978	POS_Z to NSP	
ISS_009HY_ROTCOL010_PRIME	C, U, V	2005-162T12:30:00		000T01:10:00	2005-162T13:40:00	ISS_NAC to Hyperion	POS_Z to NSP	In the middle of the observing period, CIRS will scan in the X direction at 8 microrad/sec centered with NAC to Hyperion, followed by a 5 minute stare with CIRS FP1 centered on Hyperion.
NAV_009SK_OPNAV621_PRIME	N	2005-162T13:40:00		000T01:24:00	2005-162T15:04:00	ISS_NAC to Satellites	POS_Z to NSP	
ISS_009HY_ROTCOL011_PRIME	C, U, V	2005-162T15:05:00		000T00:50:00	2005-162T15:55:00	ISS_NAC to Hyperion	POS_Z to NSP	At the end of the observing period, CIRS will scan in the X direction at 8 microrad/sec centered with NAC to Hyperion, followed by a 5 minute stare with CIRS FP1 centered on Hyperion.
SP_009EA_DLTURN162_PRIME		2005-162T15:55:00		000T00:30:00	2005-162T16:25:00	XBAND to Earth	POS_X to NEP	
SP_009EA_G34BWGNON162_PRIME	M, X	2005-162T16:25:00		000T09:00:00	2005-163T01:25:00	XBAND to Earth	5_Hr_Rolling	Reduced to 5_Hr_Rolling due to ENGR DSAT

Final Sequenced SMT and Data Volume

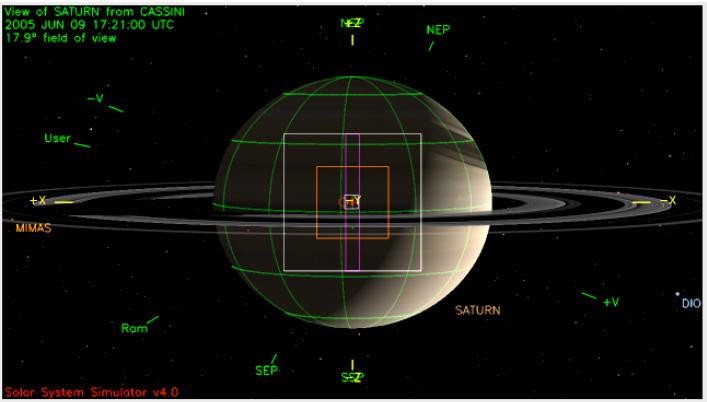
DATA VOLUME SUMMARY --- TRANSFER FRAME OVERHEAD INCLUDED (80 BITS PER 8800-BIT FRAME)

			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_009EA_M70METNON161_PRIME	161 11:00	161 16:00	474	1836	60	2369	3395	1025	0	74	29	2473	2054	-419	152	1%	419
SP_009EA_G34BWGNON162_PRIME	162 16:25	163 01:25	419	1487	83	1990	3395	1405	27	346	53	2415	694	-1720	152	1%	1721

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	160 17:21	161 11:00	63.5	26.2	84.0	3.2	769.3	38.1	57.2	0.0	83.2	105.7	588.4	0.0	0.0	1818.9
SP_009EA_M70METNON161_PRIME	161 11:00	161 16:00	18.0	2.7	0.0	0.9	0.0	10.8	16.2	0.0	23.6	1.4	0.0	0.0	0.0	73.5
DAILY TOTAL SCIENCE	160 17:21	161 16:00	81.5	28.9	84.0	4.1	769.3	48.9	73.4	0.0	106.8	107.1	588.4	0.0		
OBSERVATION_NOR	161 16:00	162 16:25	87.9	13.2	115.2	4.4	573.4	52.7	79.1	0.0	115.2	144.9	287.8	0.0	0.0	1473.8
OBSERVATION_OPN	161 16:00	162 16:25	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_009EA_G34BWGNON162_PRIME	162 16:25	163 01:25	135.3	4.9	0.0	2.4	0.0	19.4	42.4	0.0	135.6	2.5	0.0	0.0	0.0	342.4
DAILY TOTAL SCIENCE	161 16:00	163 01:25	223.2	18.0	115.2	6.8	573.4	72.2	121.5	0.0	250.8	147.4	287.8	0.0		

Segment Geometry

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2005 -  160T17:21:00 SCET
2005 JUN 09 17:21:00 SCET
2005 JUN 09 18:43:07 ERT
Apoapse__009 + 010T09:00:00
Periapse_009 + 001T06:44:45
Light time:    82.1 min
Orbit period:  18.2 days
Radius      963221 km       15.98 Rs
Rad_cyl     961074 km       15.95 Rs
Z_ht_cyl     64282 km        1.07 Rs
Mag_L          16.05
Semi_axs   1334583 km       22.14 Rs
Eccentricity    0.838
Inclination    21.87 deg
Sun_range       9.08 AU
Earth_range     9.87 AU
--- DSN ELEV -- D/L -- U/L --------
Goldstone      39.8    7.0
Canberra      -59.9  -73.0
Madrid         38.3   66.5
-------- LOOK DIRECTION INFO -------
FOV            17.9 deg  312.4 mrad
RA             11.734 deg
DEC            -9.499 deg
Crosses_RP_0    0.000 Rs
EPS             3.820 deg
SEP            36.562 deg
ORS b/s angle  68.3 deg
ORS rad angle 149.8 deg
```

Point NEG_Y at SATURN and align POS_Z = Up with NSP

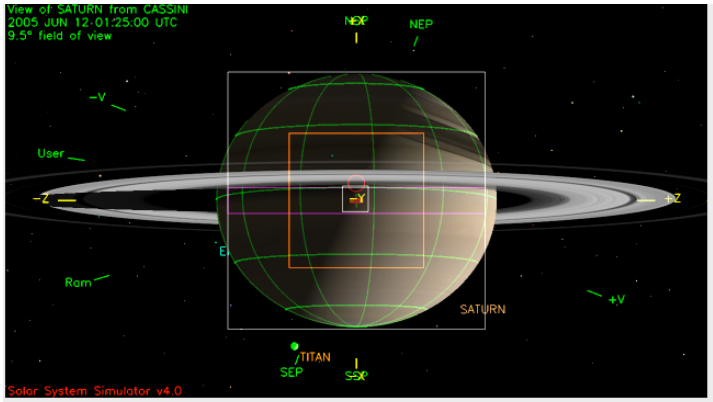
User vector - RA: +77.924 DEC: +4.360 Paste Current RA/DEC | Tilt L Up Tilt R / Left Reset Right / Image Down Hi Res | Zoom Out Fill Screen Zoom In | Labels Axes / Orbits Vectors / FOVs Lat/lons | Year Month Day Hour Minute Second

Turn analyzer: SATURN to EARTH about Z on RWA = 8.3 min / 72.0 deg Event

BODY	S/C OCC?	SAT OCC?	RANGE (km)	RANGE (Rs)	ALTITUDE (km)	ALTITUDE (Rs)	PHASE (deg)	ANGLR_DIAMETER (deg	mrad)	SUB_S/C LON	LAT	ΔLON (deg)	VREL (km/s)	Z_HGHT (km)	ANGLE_FROM_ SATRN	EARTH	RAM
SATURN	--	--	963221	15.98	902979	14.98	111.7	7.17	125.22	115	4	0	7.1	0	0.0	72.0	153.4
MIMAS	--	--	841905	13.97	841705	13.97	103.7	0.03	0.49	126	3	44	8.0	2468	8.7	79.9	145.4
ENCELADUS	--	--	782312	12.98	782058	12.98	102.5	0.04	0.66	139	5	36	6.8	25	10.2	81.1	143.9
TETHYS	--	--	1256516	20.85	1255976	20.84	112.4	0.05	0.86	357	2	-175	16.6	947	1.5	71.3	154.8
DIONE	--	--	604219	10.03	603655	10.02	120.3	0.11	1.87	202	6	-13	10.3	-116	8.6	63.4	158.5
RHEA	--	--	1347083	22.35	1346317	22.34	94.3	0.07	1.14	37	3	127	9.0	122	18.2	89.2	137.0
TITAN	--	--	2072875	34.39	2070300	34.35	126.5	0.14	2.48	344	2	-149	12.5	-4763	17.1	57.2	167.0
HYPERION	--	--	581775	9.65	581647	9.65	43.2	0.03	0.56	92	-17	13	5.6	8470	145.1	133.1	11.3
IAPETUS	--	--	2967068	49.23	2966321	49.22	120.3	0.03	0.50	354	0	-39	8.1	-449036	127.6	56.0	72.5
PHOEBE	--	--	14390606	238.78	14390496	238.78	108.7	0.00	0.02	114	-18	-180	6.2	839859	6.9	74.5	156.5
SATURN	--	--	963221	15.98	902979	14.98	111.7	7.17	125.22	115	4	0	7.1	0	0.0	72.0	153.4

Seg Start (Left) 2005-160T17:21

Seg End (below) 2005-163T01:25

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Rev 009 OUTBOUND
2005 -  163T01:25:00 SCET
2005 JUN 12 01:25:00 SCET
2005 JUN 12 02:47:17 ERT
Apoapse__009 + 012T17:04:00
Periapse_009 + 003T14:48:45
Light time:    82.3 min
Orbit period:  18.2 days
Radius     1807330 km       29.99 Rs
Rad_cyl    1800194 km       29.87 Rs
Z_ht_cyl   -160451 km       -2.66 Rs
Mag_L          30.23
Semi_axs   1334740 km       22.15 Rs
Eccentricity    0.838
Inclination    21.87 deg
Sun_range       9.08 AU
Earth_range     9.89 AU
--- DSN ELEV -- D/L -- U/L --------
Goldstone      30.0   63.0
Canberra       28.0    4.4
Madrid        -28.4  -17.5
-------- LOOK DIRECTION INFO -------
FOV             9.5 deg  166.7 mrad
RA             34.545 deg
DEC            -1.334 deg
Crosses_RP_0    0.000 Rs
EPS             3.645 deg
SEP            34.627 deg
ORS b/s angle  92.3 deg
ORS rad angle 111.3 deg
```

Point NEG_Y at SATURN and align POS_X = Up with NSP

User vector - RA: +77.924 DEC: +4.360 Paste Current RA/DEC | Tilt L Up Tilt R / Left Reset Right / Image Down Hi Res | Zoom Out Fill Screen Zoom In | Labels Axes / Orbits Vectors / FOVs Lat/lons | Year Month Day Hour Minute Second

Turn analyzer: SATURN to EARTH about Z on RWA = 10.1 min / 95.8 deg Event

BODY	S/C OCC?	SAT OCC?	RANGE (km)	RANGE (Rs)	ALTITUDE (km)	ALTITUDE (Rs)	PHASE (deg)	ANGLR_DIAMETER (deg	mrad)	SUB_S/C LON	LAT	ΔLON (deg)	VREL (km/s)	Z_HGHT (km)	ANGLE_FROM_ SATRN	EARTH	RAM
SATURN	--	--	1807330	29.99	1747107	28.99	87.6	3.82	66.71	187	-5	0	3.7	0	0.0	95.8	138.0
MIMAS	--	--	1858806	30.84	1858608	30.84	93.0	0.01	0.22	291	-6	-103	17.4	-1899	5.7	90.5	143.3
ENCELADUS	--	--	2036836	33.80	2036580	33.79	86.1	0.01	0.25	19	-5	163	14.1	41	2.0	97.4	136.0
TETHYS	--	--	1978193	32.82	1977658	32.81	81.0	0.03	0.55	51	-5	122	10.5	5588	7.3	102.4	130.9
DIONE	--	--	1664512	27.62	1663951	27.61	76.7	0.04	0.68	107	-6	62	6.6	-133	11.5	106.7	127.0
RHEA	--	--	1421213	23.58	1420448	23.57	99.0	0.06	1.08	232	-7	-37	9.4	-462	12.9	84.6	150.6
TITAN	--	--	3007361	49.90	3004786	49.86	87.5	0.10	1.71	356	-3	178	8.2	2487	2.2	95.8	136.6
HYPERION	--	--	505448	8.39	505312	8.38	103.1	0.04	0.65	47	34	-8	5.4	-11036	25.2	80.5	161.7
IAPETUS	--	--	2162740	35.89	2161992	35.87	139.6	0.04	0.69	344	-2	-26	4.5	-593095	131.5	37.1	87.2
PHOEBE	--	--	15050458	249.73	15050346	249.72	107.4	0.00	0.02	129	-18	-156	2.3	682212	21.2	75.6	156.7
SATURN	--	--	1807330	29.99	1747107	28.99	87.6	3.82	66.71	187	-5	0	3.7	0	0.0	95.8	138.0

	Saturn Range	Phase Angle	Sub-S/C Lat.
Segment Start	16.12	111.3	4
Segment End	29.99	87.6	-5

Note: Periapse: 2005-159T09:59

Solar Geometry – ORS Boresight Concerns

No ORS Boresight Solar Constraints on Science Pointing Noted.

Daily Science Highlights

The Optical Remote Sensing (ORS) instruments performed joint observations of Hyperion - including thermal measurements, rotation studies and color determination - and of the Omicron Ceti stellar occultation of the rings. The Magnetospheric and Plasma Science (MAPS) instruments simultaneously performed low-rate magnetospheric surveys. Individual observations included a Visual and Infrared Mapping Spectrometer (VIMS) regional aurora map, and Cosmic Dust Analyzer (CDA) particle flux detection during a ring plane crossing on June 10. Optical Navigation observations were also performed.

Segment Integration Planning

Timeline Gaps and Suggested Observations

Suggested observations consisted mainly of Hyperion observations, interspersed with ISS Saturn Photometry observations. OPNAVs were also discussed as well as a VIMS Omi Ceti occultation

Observation	Start Time	Dur	End Time	Data Vol (Mb)
ORS Hyperion	160T18:00	1:10	160T19:10	
ORS Hyperion	160T23:00	1:10	161T00:10	
ISS Saturn Photom	161T01:10	0:50	161T02:00	
ISS Saturn Photom	161T02:10	0:50	161T03:00	
ISS Saturn Photom	161T03:10	0:50	161T04:00	
ORS Hyperion	161T04:00	1:10	161T05:10	
ISS Saturn Photom	161T05:10	0:50	161T06:00	
ISS Saturn Photom	161T06:10	0:50	161T07:00	
ISS Saturn Photom	161T07:10	0:50	161T08:00	
ORS Hyperion	161T09:10	1:10	161T10:20	
Turn to Earth	161T10:30	0;30	161T11:00	
Madrid Pass for Nav	161T11:00	5:00	161T16:00	~486 Mb capability
Turn to waypoint	161T16:00	0;30	161T16:30	
ORS Hyperion	161T16:30	1:10	161T17:40	
ORS Hyperion	161T20:30	1:10	161T21:40	
ORS Hyperion	161T23:45	1:10	162T00:55	
Hyperion c/a	162T23:58	0:00	162T23:58	
ORS Hyperion	162T03:00	1:10	162T04:10	
ORS Hyperion	162T06:55	0:50	162T07:45	
VIMS Omi Cet Occultation	162T07:45	4:43	162T12:28	
ORS Hyperion	162T12:30	1:10	162T13:40	
OPNAV Window	162T13:40	1:25	162T15:05	
ORS Hyperion	162T15:05	0:50	162T15:55	
Turn to Earth	162T15:55	0;30	162T16:25	
Downlink & CIRS Cal	162T16:25	9:00	163T01:25	~3400 Mb capability

Initial SMT and Data Volume

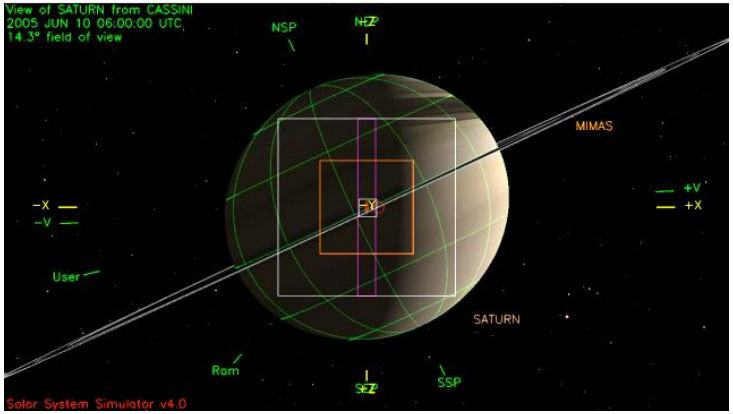
Beginning of Integration:

No Initial SMT Report Available.

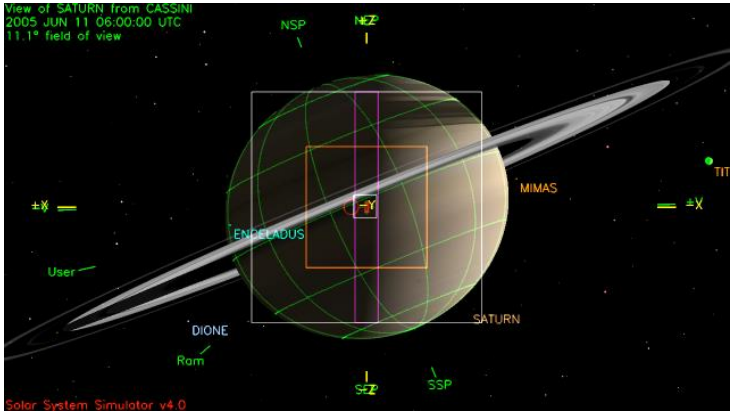
Waypoint Selection

Waypoint options considered:

NAC to Saturn, NEG_Z to NEP (160T17:45-161T20:10)

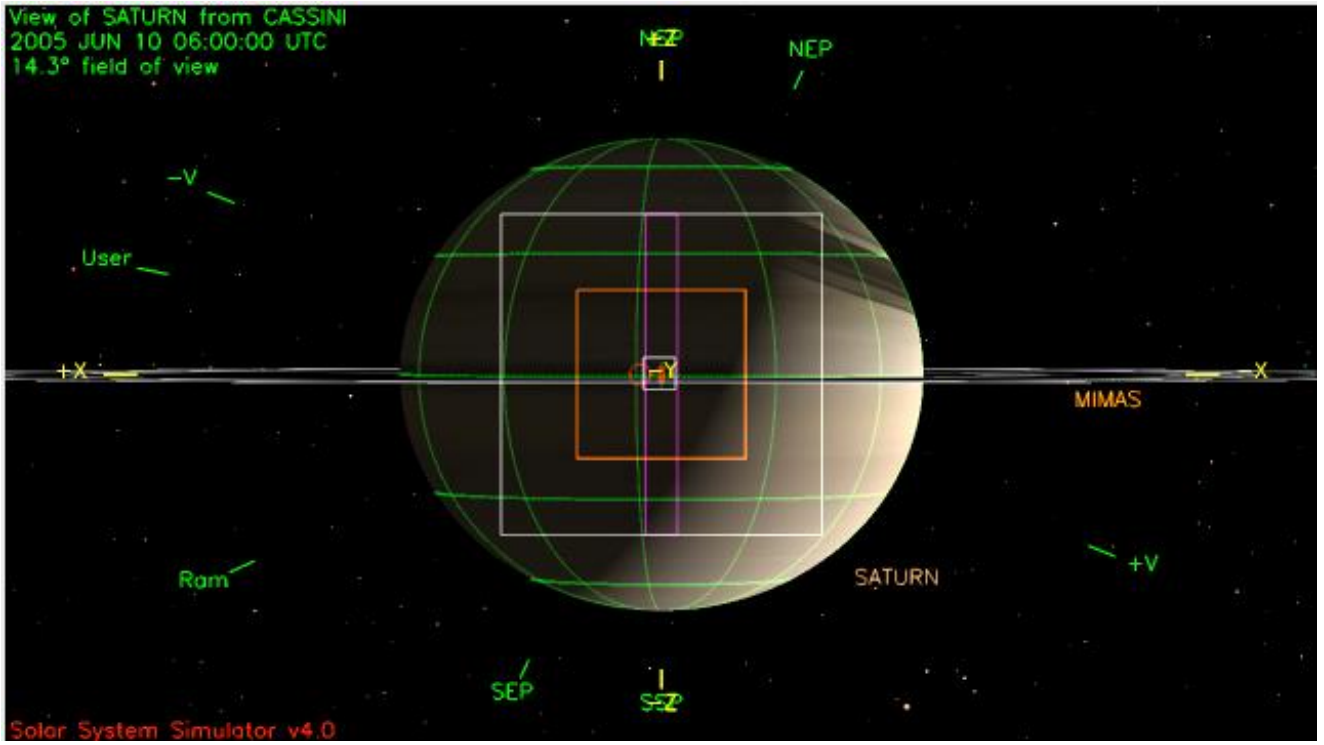


NAC to Saturn, POS_Z to NEP (161T20:10-163T01:55)



Waypoints Chosen

Waypoint NAC to Saturn, POS_Z to NSP used throughout the entire segment (2005-160T17:21-163T01:25)
(defined prior to start of segment)



Rev 9 Saturn Segment Open Issues (as of 12/03/01)

- **Pointing Issues**
  - Waypoint
    - 2005-160T17:45 to 2005-161T20:10: NAC to Saturn, -Z to NEP
    - 2005-161T20:10 to 2005-163T01:55: NAC to Saturn, +Z to NEP
    - There is a disagreement in the TWT as to whether or not the 180° flip at 161T20:10 is really necessary or not; it will be bookkept for now, but deleted later if deemed unnecessary
  - No moveable blocks
  - No epoch-relative prime observations
- **Data Volume Issues**
  - 95 Mb of excess margin still available to use
  - 2 OpNavs requested (Tethys at 162T13:40, Dione at 162T14:10); X-D needs to accommodate playing these back a 2nd time
  - No high value science requested; any OpNav or high-value science coming from Rings TWT?
  - No Support Imaging requests
- **CIMS Issues**
  - SP turns and downlink rate info are not currently represented in CIMS
  - 8 redundant UVIS Survey riders at 2005-162T16:25; is this intentional?
- **Power Issues**
  - None
- **Flight Rule / Mission Plan Guidelines and Constraint Issues**
  - None
- **Other Issues**
  - None