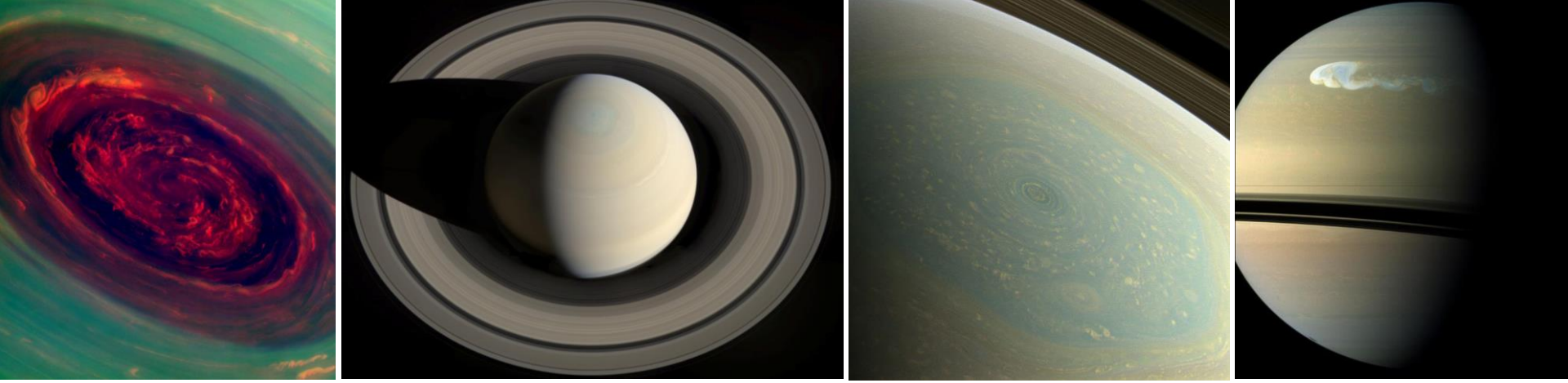


Science Planning & Sequence Team
CASSINI

SATURN TARGET WORKING TEAM

Rev 34 Segment Legacy Package

Segment Boundary: December 01, 2006 – December 02, 2006
2006-335T08:31 – 2006-336T08:31 (SCET)

Integration Began 01/06/2003
Segment Delivered to S26 Sequence 04/07/2003
Lead Integrator was Scott Edgington

Legacy Package Assembled by Kyle Cloutier

Table of Contents

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

Segment Overview and Final Products

Segment Summary

- Saturn 34 is a 1 day long Prime Mission segment, inbound to periapse. Phase angles decrease as the spacecraft moves to southerly latitudes.
- Saturn science includes a VIMS (with ISS, UVIS, CIRS) thermal global map and a CIRS (with VIMS, UVIS) regional map of atmospheric composition. MIMI images the dynamics of the inner magnetosphere.

Final Sequenced SPASS

Request	Riders	Start (SCET)	Start (Epoch)	Duration	End	Primary	Secondary	Comments
SATURN rev 34 Segment		2006-335T08:31:00		001T00:00:00	2006-336T08:31:00			
SP_034SA_WAYPTTURN335_PRIME		2006-335T08:31:00		000T00:30:00	2006-335T09:01:00	ISS_NAC to Saturn	POS_Z to NSP	
NEW WAYPOINT		**2006-335T09:01:00**		**000T23:59:00**	**2006-336T09:00:00**	**ISS_NAC to Saturn**	**POS_Z to NSP**	
VIMS_034SA_THRCYLMAP001_PRIME	C, I, U	2006-335T09:01:00		000T11:00:00	2006-335T20:01:00	ISS_NAC to Saturn	POS_Z to North_Pole_Dir	
CIRS_034SA_REGMAP006_PRIME	M, U, V	2006-335T20:01:00		000T06:00:00	2006-336T02:01:00	CIRS_FPB to Saturn	POS_Z to NSP	
SP_034SA_DLTURN536_PRIME	M	2006-336T02:01:00		000T00:19:00	2006-336T02:20:00	XBAND to 0.0/0.0	NEG_X to 189.5/-71.8	
SP_034SA_DLTURN336_PRIME	M	2006-336T02:20:00		000T00:11:00	2006-336T02:31:00	XBAND to Earth	NEG_X to 189.5/-71.8	
SP_034EA_M34HEFNON336_PRIME	C, M	2006-336T02:31:00		000T03:30:00	2006-336T06:01:00	XBAND to Earth	NEG_X to 189.5/-71.8	Secondary choosen by CDA and MIMI. Roll to be shortened if necessary for SID suspend.
SP_034EA_G70METNON336_PRIME	C, M	2006-336T06:01:00		000T02:30:00	2006-336T08:31:00	XBAND to Earth	NEG_X to 189.5/-71.8	Secondary choosen by CDA and MIMI. Roll to be shortened if necessary for SID suspend.

Final Sequenced SMT and Data Volume

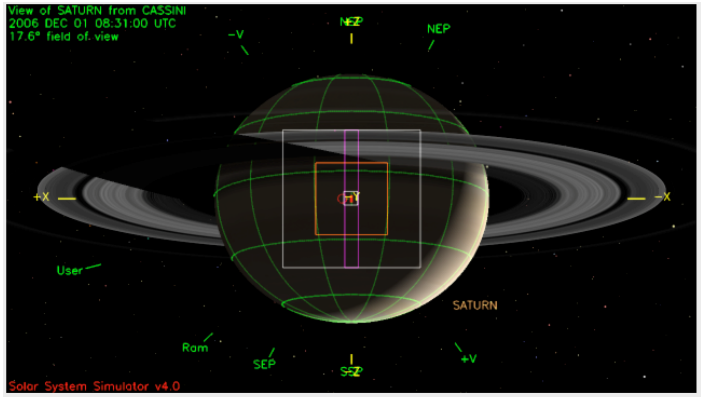
DATA VOLUME SUMMARY --- TRANSFER FRAME OVERHEAD INCLUDED (80 BITS PER 8800-BIT FRAME)

			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)	NET_MARGN (%)	CAROVR (Mb)
SP_034EA_M34HEFNON336_PRIME	336 02:31	336 06:01	0	1151	61	1212	3516	2304	0	95	21	1328	421	-908	0	0%	907
SP_034EA_G70METNON336_PRIME	336 06:01	336 08:31	907	0	0	907	3516	2609	0	76	15	998	966	-32	0	0%	32

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	335 08:31	336 02:31	57.8	12.9	165.6	3.2	229.8	38.9	61.0	0.0	64.9	46.4	460.0	0.0	0.0	1140.5
SP_034EA_M34HEFNON336_PRIME	336 02:31	336 06:01	11.2	3.8	39.6	0.6	0.0	7.6	15.1	0.0	16.5	0.0	0.0	0.0	0.0	94.4
SP_034EA_G70METNON336_PRIME	336 06:01	336 08:31	8.0	2.7	36.0	0.5	0.0	5.4	10.8	0.0	11.8	0.0	0.0	0.0	0.0	75.2
DAILY TOTAL SCIENCE	335 08:31	336 08:31	77.1	19.3	241.2	4.3	229.8	51.8	87.0	0.0	93.2	46.4	460.0	0.0		

Segment Geometry




```
Rev 034   INBOUND
2006 -   335T08:31:00 SCET
2006 DEC 01 08:31:00 SCET
2006 DEC 01 09:44:55 ERT
Apoapse__034 + 004T10:11:28
Periapse_034 - 001T13:07:53
Light time:    73.9 min
Orbit period:  11.9 days
Radius      981548 km      16.29 Rs
Rad_cyl     963726 km      15.99 Rs
Z_ht_cyl   -186194 km      -3.09 Rs
Mag_L          16.89
Semi_axs   1007974 km      16.72 Rs
Eccentricity    0.721
Inclination    55.01 deg
Sun_range       9.18 AU
Earth_range     8.89 AU
--- DSN ELEV -- D/L -- U/L --------
Goldstone      41.9   11.9
Canberra      -50.2  -68.8
Madrid         28.6   54.6
------- LOOK DIRECTION INFO -------
FOV            17.6 deg  306.6 mrad
RA              3.259 deg
DEC             5.813 deg
Crosses_RP_0    0.000 Rs
EPS             5.987 deg *
SEP           103.929 deg
ORS b/s angle  46.6 deg
ORS rad angle 127.6 deg
```

Point NEG_Y at SATURN and align POS_Z = Up with NSP

User vector - RA: +81.514 DEC: -17.304 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

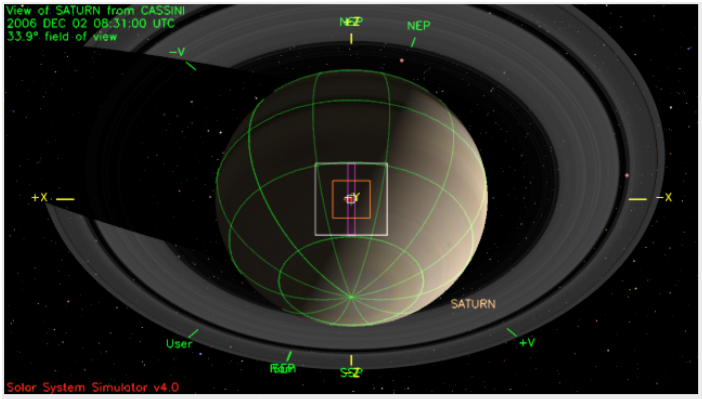
Year / Month / Day / Hour / Minute / Second

Turn analyzer: SATURN to EARTH about Z on RWA = 6.0 min / 40.6 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	ALON [deg]	VREL [km/s]	Z_HGHT [km]	ANGLE_FROM SATRN	ANGLE_FROM EARTH	ANGLE_FROM RAM
SATURN	--	--	981548	16.29	921485	15.29	133.4	7.04	122.88	255	-11	0	6.3	0	0.0	40.6	48.3
MIMAS	--	--	1163638	19.31	1163431	19.30	134.7	0.02	0.36	356	-8	-177	17.6	4374	1.6	39.3	47.7
ENCELADUS	--	--	998538	16.57	998287	16.56	121.5	0.03	0.51	83	-11	87	18.1	-30	13.7	52.5	39.4
TETHYS	--	--	1195315	19.83	1194778	19.82	143.0	0.05	0.90	323	-8	-132	11.0	5009	10.7	31.2	55.4
DIONE	--	--	1010517	16.77	1009956	16.76	149.5	0.06	1.12	285	-11	-83	5.7	102	21.8	25.5	65.5
RHEA	--	--	727790	12.08	727027	12.06	149.6	0.12	2.11	261	-15	-46	4.3	70	31.7	27.1	76.2
TITAN	--	--	1662791	27.59	1660216	27.55	158.0	0.18	3.10	325	-6	-99	4.4	-7786	45.6	22.1	84.5
HYPERION	--	--	2372414	39.36	2372280	39.36	149.7	0.01	0.14	242	25	-155	7.9	-16755	16.6	24.4	56.3
IAPETUS	--	--	2811842	46.66	2811095	46.64	15.1	0.03	0.53	9	-6	17	6.5	631038	143.7	169.3	124.4
PHOEBE	--	--	14657712	243.21	14657602	243.21	121.8	0.00	0.02	290	-21	164	5.4	1644715	14.9	51.7	36.1
SATURN	--	--	981548	16.29	921485	15.29	133.4	7.04	122.88	255	-11	0	6.3	0	0.0	40.6	48.3

Segment Start: 2006-335T08:31

Segment End: 2006-336T08:31




```
Rev 034   INBOUND
2006 -   336T08:31:00 SCET
2006 DEC 02 08:31:00 SCET
2006 DEC 02 09:44:45 ERT
Apoapse__034 + 005T10:11:28
Periapse_034 - 13:07:53
Light time:    73.7 min
Orbit period:  11.9 days
Radius      506835 km      8.41 Rs
Rad_cyl     377922 km      6.27 Rs
Z_ht_cyl   -337723 km     -5.60 Rs
Mag_L          15.13
Semi_axs   1007731 km     16.72 Rs
Eccentricity    0.721
Inclination    55.01 deg
Sun_range       9.17 AU
Earth_range     8.87 AU
--- DSN ELEV -- D/L -- U/L --------
Goldstone      42.6   12.7
Canberra      -49.5  -68.8
Madrid         27.9   54.0
------- LOOK DIRECTION INFO -------
FOV            33.9 deg  591.8 mrad
RA             34.222 deg
DEC            35.366 deg
Crosses_RP_0    0.000 Rs
EPS             5.961 deg *
SEP           104.941 deg
ORS b/s angle  85.7 deg
ORS rad angle 155.4 deg
```

Point NEG_Y at SATURN and align POS_Z = Up with NSP

User vector - RA: +81.514 DEC: -17.304 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 = 8.9 min / 80.1 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	ALON [deg]	VREL [km/s]	Z_HGHT [km]	ANGLE_FROM SATRN	ANGLE_FROM EARTH	ANGLE_FROM RAM
SATURN	--	--	506835	8.41	449147	7.45	94.3	13.66	238.39	315	-42	0	10.6	0	0.0	80.1	42.4
MIMAS	--	--	657310	10.91	657107	10.90	101.6	0.04	0.63	350	-30	-168	21.0	5037	10.8	72.5	34.7
ENCELADUS	--	--	677215	11.24	676961	11.23	109.7	0.04	0.76	343	-30	-144	16.8	-7	16.3	64.5	39.1
TETHYS	--	--	509151	8.45	508620	8.44	61.2	0.12	2.12	67	-40	69	19.1	-5390	33.7	113.0	48.2
DIONE	--	--	827726	13.73	827163	13.72	99.8	0.08	1.36	2	-24	176	18.8	-39	17.8	74.2	25.7
RHEA	--	--	749683	12.44	748918	12.43	134.9	0.12	2.05	329	-27	-94	7.1	-3231	44.5	40.8	67.9
TITAN	--	--	1302649	21.61	1300074	21.57	150.5	0.23	3.95	342	-15	-92	7.2	-7517	66.2	27.7	85.3
HYPERION	--	--	1839595	30.52	1839465	30.52	134.5	0.01	0.18	298	33	-141	11.1	-10164	42.1	39.5	46.8
IAPETUS	--	--	3468256	57.55	3467509	57.53	20.7	0.02	0.43	8	-5	44	11.5	573505	107.5	164.3	115.5
PHOEBE	--	--	14092218	233.83	14092106	233.82	120.8	0.00	0.02	141	-21	-164	10.4	1579009	36.6	52.8	30.4
SATURN	--	--	506835	8.41	449147	7.45	94.3	13.66	238.39	315	-42	0	10.6	0	0.0	80.1	42.4

	Saturn Range	Phase Angle	Sub-S/C Lat.
Segment Start	16.29 Rs	133.4 deg	-11
Segment End	8.41 Rs	94.3 deg	-42

Solar Geometry – ORS Boresight Concerns

No ORS Boresight Solar Constraints on Science Pointing.

Daily Science Highlights

On DOY 335, the Visual and Infrared Mapping Spectrometer (VIMS) conducted an 11-hour long thermal cylindrical map of Saturn. The rest of the optical remote sensing (ORS) instruments simultaneously took data as well. CIRS, with VIMS and UVIS, collected data to produce a regional map of atmospheric composition at about 12RS. MIMI imaged the dynamics of the inner magnetosphere in ENA by sampling energetic ions with the MIMI/INCA sensor as part of the MAPS IM/DYN campaign.

Segment Integration Planning

Timeline Gaps and Suggested Observations

Activity	Start	Duration	Pointing	Notes
Segment Start/Turn to Waypoint	2006-335T08:31:00	00:30:00		
VIMS Thermal Cylindrical Map	335T09:01:00	11:00:00	NAC to Saturn; +/-Z to POLE_DIR	
CIRS Regional Map	335T20:01:00	06:00:00	NAC to Saturn; +X to POLE_DIR	UVIS Ring Occ???
Turn to Downlink	336T02:01:00	00:30:00		
Downlink	336T02:31:00	06:00:00		70 m available

Initial SMT and Data Volume

Beginning of Integration:

DATA VOLUME SUMMARY

			OBSERVATION_PERIOD								DOWNLINK_PASS						
			P4						P5	RECORDED	PLAYBACK						
	Start	End	START	SCI	HK+E	TOTAL	CPACTY	MARGIN	OPNAV	SCI	ENGR	TOTAL	CPACTY	MARGIN		CAROVR	
DOWNLINK PASS NAME	doy hh:mm	doy hh:mm	(Mb)	(Mb)	(Mb)	(Mb)	(Mb)	(Mb)	(%)	(Mb)	(Mb)	(Mb)	(Mb)	(Mb)	(Mb)	(%)	(Mb)
SP_034EA_M34HEFNON335_PRIME	336 02:31	336 08:31	0	1372	51	1423	3569	2146	60%	0	170	35	1627	690	-937	-136%	937

DATA VOLUME REPORT

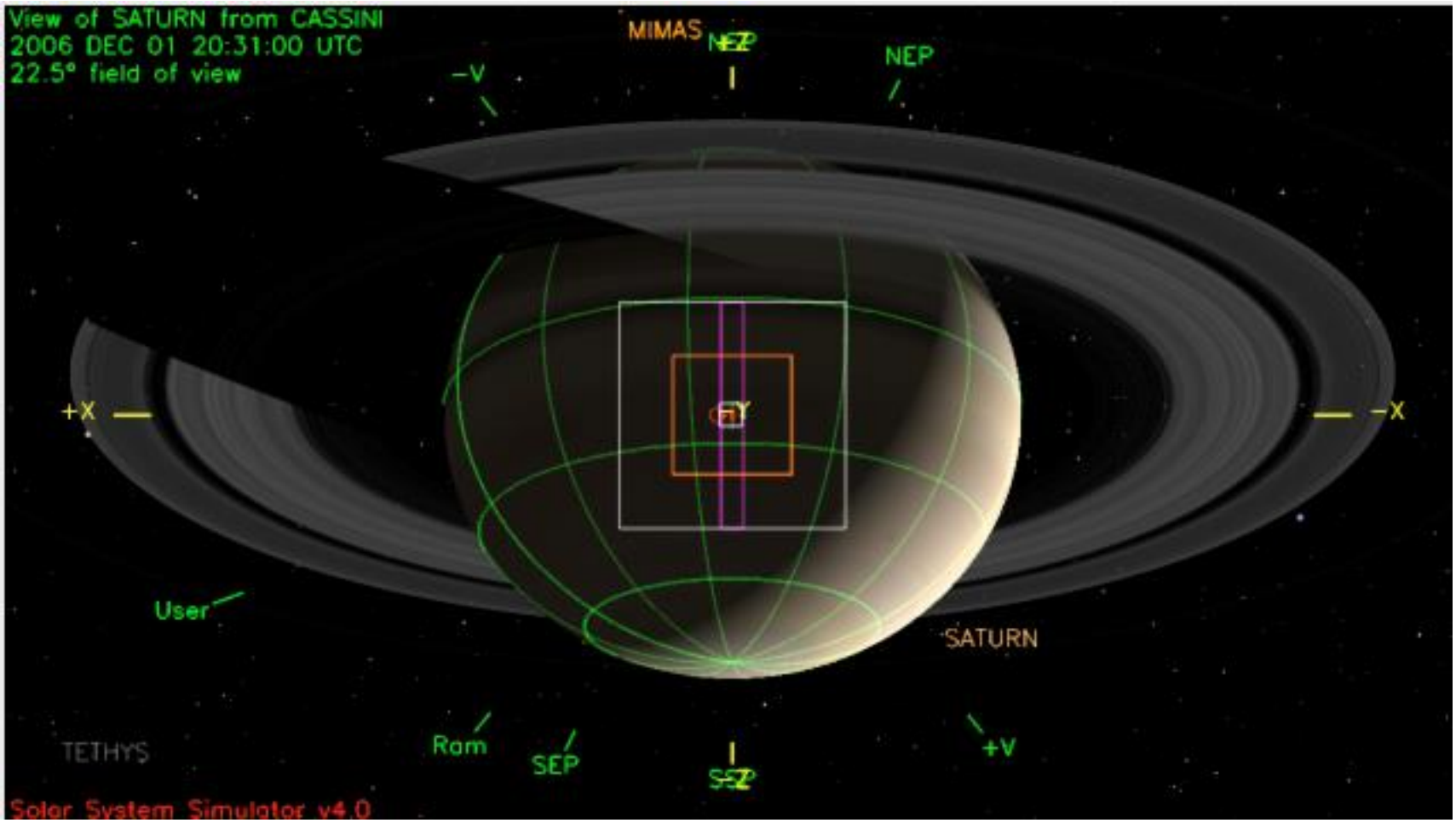
Event	Start doy hh:mm	End doy hh:mm	CAPS (Mb)	CDA (Mb)	CIRS (Mb)	INMS (Mb)	ISS (Mb)	MAG (Mb)	MIMI (Mb)	RADAR (Mb)	RPWS (Mb)	UVIS (Mb)	VIMS (Mb)	PROBE (Mb)	ENGR (Mb)	TOTAL (Mb)
OBSERVATION_NOR	335 08:31	336 02:31	64.8	12.9	86.4	3.2	0.0	38.9	61.0	0.0	84.9	0.0	1020.0	0.0	0.0	1372.1
SP_034EA_M34HEFNON335_PRIME	336 02:31	336 08:31	21.6	4.3	75.6	1.1	0.0	13.0	25.9	0.0	28.3	0.0	0.0	0.0	0.0	169.7

Waypoint Selection

Activity	Start	Duration	Pointing	Notes
Segment Start/Turn to Waypoint	2006-335T08:31:00	00:30:00		
Waypoint			NAC to Saturn; +Z to POLE_DIR	Safe; NAC to Saturn; +X to NEP is also safe

Waypoints Chosen

Waypoint 1 (2006-335T08:31 – 336T08:31):
NAC to Saturn, POS_Z to NSP



Notes & Liens

- **Pointing Issues**
  - If downlink pointing changes, then notify CDA and MIMI
- **Data Volume Issues**
  - None
- **Telemetry Mode Issues**
  - None
- **CIMS Issues**
  - None
- **Power/OPMODE Issues**
  - OPMODE is DFWP-Normal; no transitions in this period; if previous TWT has not handed off in DFWP-Normal, then insert at the beginning
- **Flight Rule/Mission Planning Guideline and Constraint Issues**
  - None
- **Other Issues**
  - None