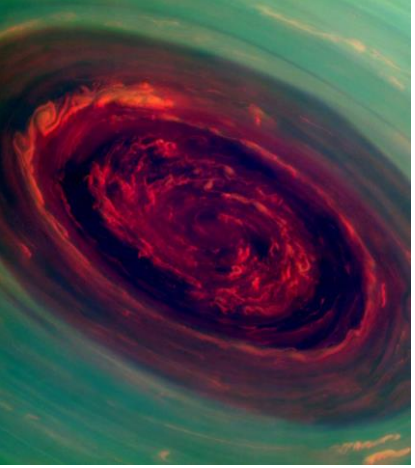
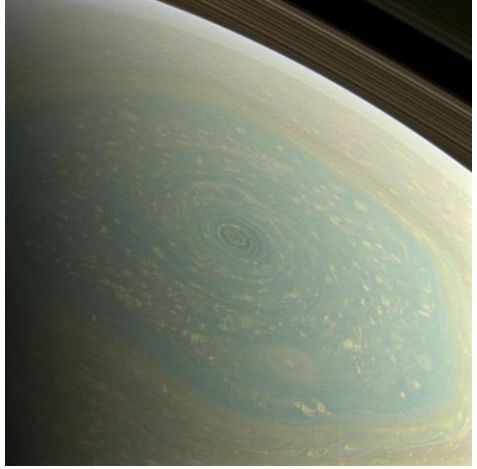
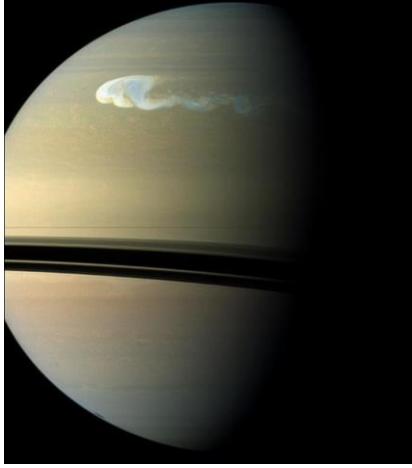


Science Planning & Sequence Team
CASSINI

SATURN TARGET WORKING TEAM

Rev 28 Segment Legacy Package

Segment Boundary: September 11, 2006 – September 12, 2006
2006-254T21:00:00 – 2006-255T21:00:00 (SCET)

Integration Began 12/16/2002
Segment Delivered to S23 Sequence 01/22/2003
Lead Integrator was Jerod Gross

Legacy Package Assembled by Shawn Boll

Table of Contents

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

Segment Overview and Final Products

Segment Summary

- This was a very short one day long segment outbound from Periapse, during an inclined orbit.
- The view of Saturn was of the northern hemisphere at high phase angles.
- Saturn science included VIMS thermal mapping and ISS WAC Photopolarimetry.
- ISS took high phase images of the rings, and UVIS looked at Tethys.

Final Sequenced SPASS

Request	Riders	Start (SCET)	Start (Epoch)	Duration	End (SCET)	Primary	Secondary	Comments
Sequence S023, length = 39 ...		2006-231T22:06:00	E027_SEQUENCE_023+000T00:00:00	031T22:16:00	2006-263T20:22:00			
SATURN rev 28 Segment		2006-254T21:00:00		001T00:00:00	2006-255T21:00:00			
SP_028SA_WAYPTTURN254_PRIME		2006-254T21:00:00		000T00:30:00	2006-254T21:30:00	ISS_NAC to Saturn	NEG_Z to NSP	
NEW WAYPOINT		**2006-254T21:30:00**		**000T14:30:00**	**2006-255T12:00:00**	**ISS_NAC to Saturn**	**NEG_Z to NSP**	
VIMS_028SA_THRMAP001_PRIME		2006-254T21:30:00		000T01:00:00	2006-254T22:30:00	ISS_NAC to Saturn	NEG_Z to NSP	
ISS_028SA_1X4NPH160001_PRIME		2006-254T22:30:00		000T01:00:00	2006-254T23:30:00	ISS_NAC to Saturn	NEG_Z to NSP	
VIMS_028SA_THRMAP002_PRIME	C, I, M, U	2006-254T23:30:00		000T09:00:00	2006-255T08:30:00	ISS_NAC to Saturn	NEG_Z to NSP	
ISS_028RI_HIPHASA001_PRIME	M	2006-255T08:30:00		000T00:30:00	2006-255T09:00:00	ISS_NAC to Rings	NEG_Z to NSP	Must look at Right Ansa to avoid FR problems.
UVIS_028TE_ICYATM001_PRIME	I, M, R, V	2006-255T09:00:00		000T02:30:00	2006-255T11:30:00	UVIS_FUV to Tethys	NEG_Z to NSP	
SP_028EA_DLTURN255_PRIME	M, R	2006-255T11:30:00		000T00:30:00	2006-255T12:00:00	XBAND to Earth	POS_X to NEP	
NEW WAYPOINT		**2006-255T12:00:00**		**000T15:50:00**	**2006-256T03:50:00**	**XBAND to Earth**	**POS_X to NEP**	
SP_028EA_G70METNON255_PRIME	C, M, R	2006-255T12:00:00		000T09:00:00	2006-255T21:00:00	XBAND to Earth	Rolling	slow roll

Final Sequenced SMT and Data Volume

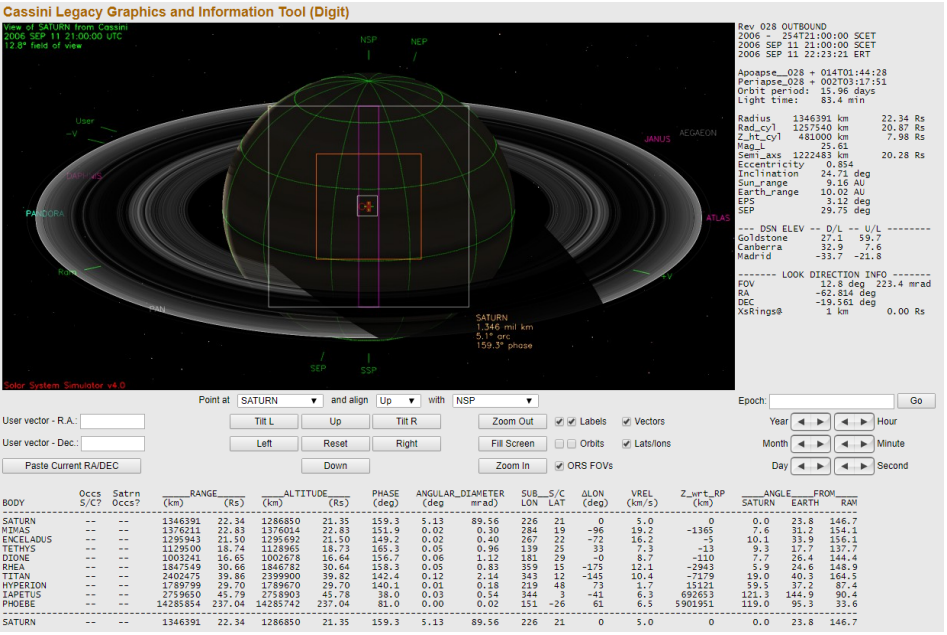
DATA VOLUME SUMMARY --- TRANSFER FRAME OVERHEAD INCLUDED (80 BITS PER 8800-BIT FRAME)

			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_028EA_G70METNON255_PRIME	255 12:00	255 21:00	833	2182	51	3066	3513	448	0	652	53	3770	3375	-395	882	8%	395

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	254 21:00	255 12:00	144.3	16.2	129.6	3.3	896.2	50.1	60.3	0.0	218.3	208.3	435.0	0.0	0.0	2161.7
SP_028EA_G70METNON255_PRIME	255 12:00	255 21:00	259.2	9.7	86.4	3.2	0.0	64.0	58.6	0.0	162.0	2.5	0.0	0.0	0.0	645.7
DAILY TOTAL SCIENCE	254 21:00	255 21:00	403.5	25.9	216.0	6.6	896.2	114.2	119.0	0.0	380.3	210.8	435.0	0.0		

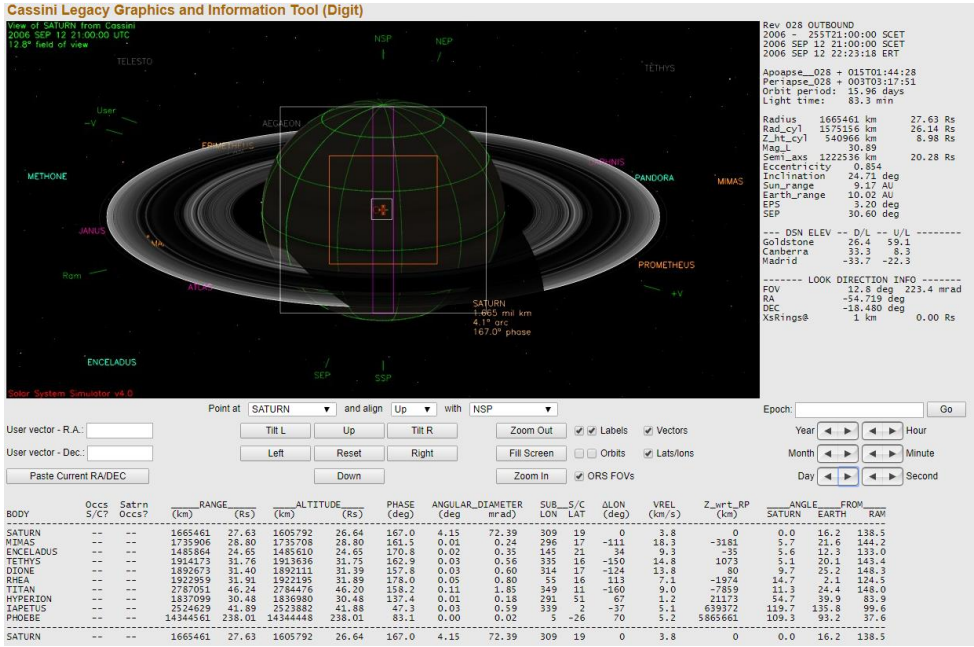
Segment Geometry



BODY	Occs S/C?	Satrn Occs?	RANGE (km)	RANGE (Rs)	ALTITUDE (km)	ALTITUDE (Rs)	PHASE (deg)	ANGULAR_DIAMETER (deg)	ANGULAR_DIAMETER (mrad)	SUB_S/C LON	SUB_S/C LAT	ΔLON (deg)	VREL (km/s)	Z_wrt_RP (km)	ANGLE FROM SATURN	ANGLE FROM EARTH	ANGLE FROM RAM
SATURN	--	--	1346391	22.34	1286850	21.35	159.3	5.13	89.56	226	21	0	5.0	0	0.0	23.8	146.7
MIMAS	--	--	1376211	22.83	1376014	22.83	151.9	0.02	0.30	284	19	-96	19.2	-1365	7.6	31.2	154.1
ENCELADUS	--	--	1295943	21.50	1295692	21.50	149.2	0.02	0.40	267	22	-72	16.2	-5	10.1	33.9	156.1
TETHYS	--	--	1129500	18.74	1128965	18.73	165.3	0.05	0.96	139	25	33	7.3	-13	9.3	17.7	137.7
DIONE	--	--	1003241	16.65	1002678	16.64	156.7	0.06	1.12	181	29	-0	8.7	-110	7.7	26.4	144.4
RHEA	--	--	1847549	30.66	1846782	30.64	158.3	0.05	0.83	359	15	-175	12.1	-2943	5.9	24.6	148.9
TITAN	--	--	2402475	39.86	2399900	39.82	142.4	0.12	2.14	343	12	-145	10.4	-7179	19.0	40.3	164.5
HYPERION	--	--	1789799	29.70	1789670	29.70	140.1	0.01	0.18	219	48	-73	1.7	15121	59.5	37.2	87.4
IAPETUS	--	--	2759650	45.79	2758903	45.78	38.0	0.03	0.54	344	3	-41	6.3	692653	121.3	144.9	90.4
PHOEBE	--	--	14285854	237.04	14285742	237.04	81.0	0.00	0.02	151	-26	61	6.5	5901951	119.0	95.3	33.6
SATURN	--	--	1346391	22.34	1286850	21.35	159.3	5.13	89.56	226	21	0	5.0	0	0.0	23.8	146.7

← Seg Start (Left)

↓ Seg End (below)



BODY	Occs S/C?	Satrn Occs?	RANGE (km)	RANGE (Rs)	ALTITUDE (km)	ALTITUDE (Rs)	PHASE (deg)	ANGULAR_DIAMETER (deg)	ANGULAR_DIAMETER (mrad)	SUB_S/C LON	SUB_S/C LAT	ΔLON (deg)	VREL (km/s)	Z_wrt_RP (km)	ANGLE FROM SATURN	ANGLE FROM EARTH	ANGLE FROM RAM
SATURN	--	--	1665461	27.63	1605792	26.64	167.0	4.15	72.39	309	19	0	3.8	0	0.0	16.2	138.5
MIMAS	--	--	1735906	28.80	1735708	28.80	161.5	0.01	0.24	296	17	-111	18.3	-3181	5.7	21.6	144.2
ENCELADUS	--	--	1485864	24.65	1485610	24.65	170.8	0.02	0.35	145	21	34	9.3	-35	5.6	12.3	133.0
TETHYS	--	--	1914173	31.76	1913636	31.75	162.9	0.03	0.56	335	16	-150	14.8	1073	5.1	20.1	143.4
DIONE	--	--	1892673	31.40	1892111	31.39	157.8	0.03	0.60	314	17	-124	13.8	80	9.7	25.2	148.3
RHEA	--	--	1922959	31.91	1922195	31.89	178.0	0.05	0.80	55	16	113	7.1	-1974	14.7	2.1	124.5
TITAN	--	--	2787051	46.24	2784476	46.20	158.2	0.11	1.85	349	11	-160	9.0	-7859	11.3	24.4	148.0
HYPERION	--	--	1837099	30.48	1836980	30.48	137.4	0.01	0.18	291	51	67	1.2	21173	54.7	39.9	83.9
IAPETUS	--	--	2524629	41.89	2523882	41.88	47.3	0.03	0.59	339	2	-37	5.1	639372	119.7	135.8	99.6
PHOEBE	--	--	14344561	238.01	14344448	238.01	83.1	0.00	0.02	5	-26	70	5.2	5865661	109.3	93.2	37.6
SATURN	--	--	1665461	27.63	1605792	26.64	167.0	4.15	72.39	309	19	0	3.8	0	0.0	16.2	138.5

	Saturn Range	Phase Angle	Sub-S/C Lat.
Segment Start	22.34 Rs	159.3	21
Segment End	27.63 Rs	167.0	19

Solar Geometry – ORS Boresight Concerns

With Saturn viewing at such high phase angles, it is possible that there were some potential solar-boresight issues. However, with an ansa-pointed high phase ring observation strategically placed, no flight rule violations were encountered.

Daily Science Highlights

Science Highlights were not available for the days in this segment.

Segment Integration Planning

Rev 28 Outbound v.1 Strawman TOL

- **Strawman**

Request	Start	Dur	End	Original Request Start
SP Turn	254T21:00	0:30	254T21:30	
VIMS_028SA_THRMAP001_PRIME	254T22:00	11:00	255T09:00	
UVIS_028RI_IMPACT002_PRIME	255T09:00	2:30	255T11:30	254T23:43; (Dur was 6:00)
SP Turn	255T11:30	0:30	255T12:00	
Gold HEF	255T12:00	9:00	255T21:00	

- **Questions**
  - Do we need to do any OpNavs in this segment?
  - Can UVIS live with 2.5-hour Ring Impact (was 6:00; moved 09:17 later)?

Initial SMT and Data Volume

First Look During Integration:

Rev 28 SMT Results

- On the HEF we were 1189 Mb oversubscribed, so I upgraded to the 70-m. Does MP agree?
  - If so, there's another ~1.0 Gb available to add
- Also, does anyone need anything other than S_N_ER_3?

DATA VOLUME SUMMARY

			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)	MARGIN (Mb)	MARGIN (%)	OPNAV (Mb)	SCI (Mb)	ENGR (Mb)	TOTAL (Mb)	CPACTY (Mb)	MARGIN (Mb)	MARGIN (%)	CAROVR (Mb)	
SP_028EA_G70METNON255_PRIME	255 12:00	255 21:00	0	1446	51	1496	3564	2067	58%	0	509	53	2058	3285	1227	37%	0	

DATA VOLUME REPORT

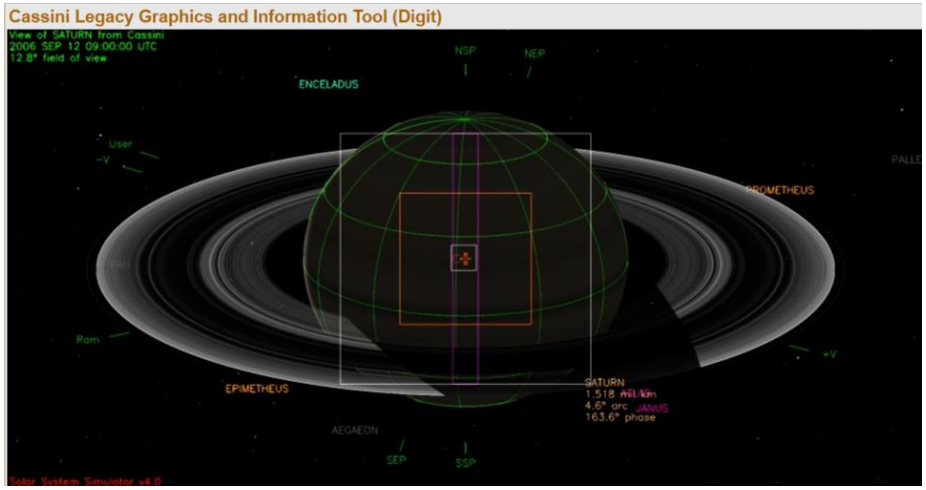
Event	Start doy hh:mm	End doy hh:mm	CAPS (Mb)	CDA (Mb)	CIRS (Mb)	INMS (Mb)	ISS (Mb)	MAG (Mb)	MIMI (Mb)	RADAR (Mb)	RPWS (Mb)	UVIS (Mb)	VIMS (Mb)	PROBE (Mb)	ENGR (Mb)	TOTAL (Mb)
OBSERVATION_NOR	254 21:00	255 12:00	92.7	8.1	64.8	3.3	321.7	50.1	60.3	0.0	118.3	91.5	635.0	0.0	0.0	1445.9
SP_028EA_G34HEFNON255_PRIME	255 12:00	255 21:00	129.6	4.9	86.4	3.2	0.0	64.0	58.6	0.0	162.0	0.0	0.0	0.0	0.0	508.8

Waypoint Selection

- **FR-Safe Waypoint Attitude Choices**
  - NAC to Saturn, +Z to NSP
  - NAC to Saturn, -X to NSP

Waypoints Chosen

Waypoint 1 (Whole Segment): ISS_NAC to Saturn; NEG_Z to NSP



Saturn Rev 28 Periapse Notes & Open Issues (as of 01/22/03)

- **Pointing**
  - All waypoints have been verified as being Flight Rule-safe.
    - The waypoint between 254T21:30 and 255T21:00 actually starts to violate radiator FRs around 255T13:10, but this is during the DSN pass, so we will never return to the waypoint attitude after it starts to violate.
  - All downlink attitudes have been verified as being Flight-Rule safe.
  - All SP turns have been allocated enough time and are Flight Rule-safe.
  - ISS (M. Evans)and UVIS (J. Cuzzi) agreed to forgo analyzing the turns for ISS_028RI_HIPHASA001_PRIME and UVIS_028RI_IMPACT002_PRIME, respectively. Any problems that may arise during implementation will be resolved from each instrument's current allocation of time.
  - To avoid FR violations, ISS will need to target the right ansa in ISS_028RI_HIPHASA001_PRIME.
- **Data Volume**
  - No issues. Only pass in the segment is Gold 70-m pass that currently has 5% margin.
- **CIMS**
  - All of the expected requests for this delivery are approved in CIMS.
- **OpModes**
  - All OpMode transitions are in the CIMS delivery. No issues at this time.
- **Flight Rule / Mission Planning Guideline & Constraint Issues**
  - None known at this time.
- **DSN**
  - No DSN schedule conflicts.
  - NAV & MP approve of DSN plan