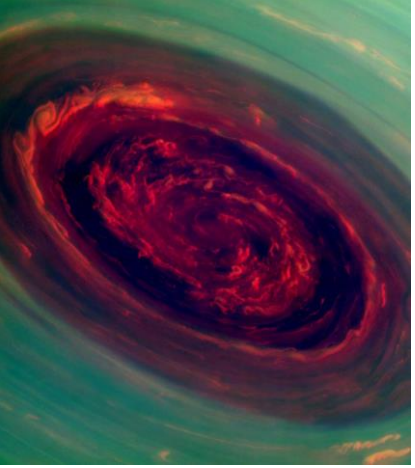

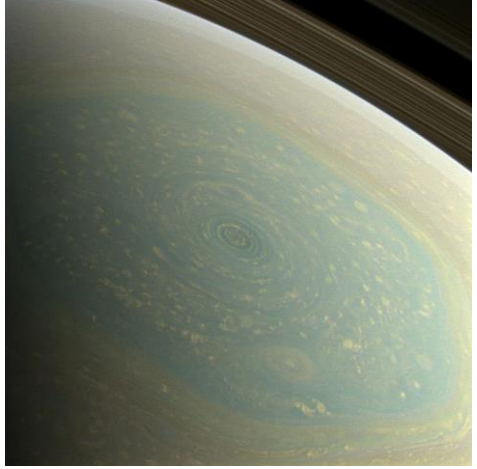
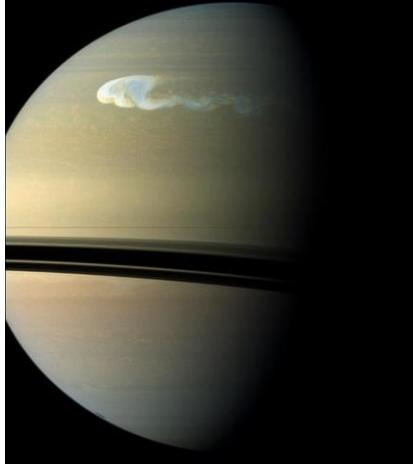

Science Planning & Sequence Team
CASSINI

SATURN TARGET WORKING TEAM

Rev 148 Segment Legacy Package

Segment Boundary: May 10, 2011 – May 13, 2011
2011-130T10:32:00 – 2011-133T08:32:00 (SCET)

Integration Began 08/23/2010
Segment Delivered to S68 Sequence 11/01/2010
Lead Integrator was Shawn Boll

Legacy Package Assembled by Shawn Boll

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

Segment Overview and Final Products

Segment Summary

- Rev 148 was a three day Saturn periapse segment in the first equatorial phase (EQ-1) of the Solstice Mission.

- Saturn science included a VIMS/CIRS Saturn-stellar (OMICET) occultation, auroral observations, a CIRS limb integration, and a VIMS north hemisphere map.

- Notable out-of-discipline activities included an ISS Enceladus plume observation and a VIMS look at the rings at ring plane crossing, which required a special trade negotiation.

  – The Saturn discipline traded Rings 6 hours from Saturn_148 (DOY 2011-132) in exchange for 6 hours from Rings_ 247 (DOY 2016-305), in which a CIRS Mid-IR map was placed. This was the first time that the XXM "New Discoveries" process was exercised.

- Since the RBOT (reaction wheel) friendly secondaries were very close to "NSP" they were compatible with the science being conducted and were utilized throughout the segment except where not safe in the first observation period due to ORS-solar viewing constraints.

- ORS solar geometry did impact the science planned just prior to periapse (see pg 8), but constraint management could not be requested since the Sun was never blocked by the planet. Targets other than Saturn-center were selected, including a look at the southern aurora which was outside the ORS "keep-out" zone.

Final Sequenced SPASS

Gap 1

Gap 2

Gap 3

Request	Riders	Start (SCET)	Start (Epoch)	Duration	End (SCET)	Primary	Secondary	Comments
Sequence S68, length = 69 days		2011-115T16:03:00		068T19:07:00	2011-184T11:10:00			
SATURN_148 Segment		2011-130T10:32:00		002T22:00:00	2011-133T08:32:00			
SP_148SA_WAYPTTURN130_PRIME	M	2011-130T10:32:00		000T00:40:00	2011-130T11:12:00	ISS_NAC to 34.836/-2.977	NEG_X to NSP	
NEW WAYPOINT		**2011-130T11:12:00**		**000T12:20:00**	**2011-130T23:32:00**	**ISS_NAC to 34.836/-2.977**	**NEG_X to NSP**	
UVIS_148SA_AURSTARE002_PRIME	C, I, M, V	2011-130T11:12:00		000T02:28:00	2011-130T13:40:00	UVIS_FUV to Saturn	NEG_X to NSP	Collaborative Rider(s): VIMS
VIMS_148SA_OMICETOCC001_PRIME	C	2011-130T13:40:00		000T01:20:00	2011-130T15:00:00	CIRS_FPB to 34.836/-2.978	PIC	Collaborative Rider(s): CIRS
ISS_148EN_PLMMPMR001_PIE	C, V	2011-130T15:00:00		000T01:30:00	2011-130T16:30:00	ISS_NAC to Enceladus	NEG_X to NSP	SOST PIE
CIRS_148SA_LIMBINT001_PIE	V	2011-130T16:52:00		000T06:00:00	2011-130T22:52:00	CIRS_FPB to Saturn	NEG_X to NSP	PIE
Periapse R = 5.888 Rs, lat ...		2011-130T20:43:54		000T00:00:01	2011-130T20:43:55			
SP_148EA_DLTURN130_PRIME		2011-130T22:52:00		000T00:40:00	2011-130T23:32:00	XBAND to Earth	POS_X to NEP	
NEW WAYPOINT		**2011-130T23:32:00**		**000T09:40:00**	**2011-131T09:12:00**	**XBAND to Earth**	**POS_X to NEP**	
SP_148EA_G34HEFNON130_PRIME	C	2011-130T23:32:00		000T09:00:00	2011-131T08:32:00	XBAND to Earth	POS_X to NEP	POS_X to NEP, CAPS
SP_148SA_WAYPTTURN131_PRIME		2011-131T08:32:00		000T00:30:00	2011-131T09:02:00	ISS_NAC to Saturn (0.0,-30.0,0.0 deg. offset)	NEG_X to 37.25/83.7	Part 1 of 2-part Turn
SP_148SA_WAYPTTURN431_PRIME		2011-131T09:02:00		000T00:10:00	2011-131T09:12:00	ISS_NAC to Saturn	NEG_X to 37.25/83.7	Part 2 of a 2-part Turn
NEW WAYPOINT		**2011-131T09:12:00**		**001T00:00:00**	**2011-132T09:12:00**	**ISS_NAC to Saturn**	**NEG_X to 37.25/83.7**	
ISS_148TI_M30R2CLD131_PRIME	C, V	2011-131T09:12:00	E148_M30R2CLD131+000T00:00:00	000T01:30:00	2011-131T10:42:00	ISS_NAC to Titan	NEG_X to 37.25/83.7	No Preference to secondary pointing
VIMS_148SA_NHEMMAP001_PRIME	C	2011-131T10:42:00		000T12:10:00	2011-131T22:52:00	ISS_NAC to Saturn (0.0,0.0,-4.87 deg. offset)	NEG_X to 37.25/83.7	
SP_148EA_DLTURN131_PRIME		2011-131T22:52:00		000T00:26:00	2011-131T23:18:00	XBAND to Earth	NEG_X to Sun	Part 1 of a 2-part Turn
SP_148EA_DLTURN431_PRIME		2011-131T23:18:00		000T00:14:00	2011-131T23:32:00	XBAND to Earth	POS_X to NEP	Part 2 of a 2-part Turn
SP_148EA_G34BWGOTP131_PRIME	C, E, N	2011-131T23:32:00		000T09:00:00	2011-132T08:32:00	XBAND to Earth	POS_X to NEP	POS_X to NEP, CAPS
SP_148SA_WAYPTTURN132_PRIME		2011-132T08:32:00		000T00:40:00	2011-132T09:12:00	ISS_NAC to Saturn	NEG_Z to 37.2/83.7	
NEW WAYPOINT		**2011-132T09:12:00**		**001T00:48:00**	**2011-133T10:00:00**	**ISS_NAC to Saturn**	**NEG_Z to 37.2/83.7**	
ISS_148TI_M30R3CLD132_PRIME	C, V	2011-132T09:12:00	E148_M30R3CLD132+000T00:00:00	000T01:30:00	2011-132T10:42:00	ISS_NAC to Titan	NEG_Z to 37.2/83.7	No Preference to secondary pointing
VIMS_148RI_RPX10PH001_PRIME	C, I	2011-132T10:42:00		000T06:18:00	2011-132T17:00:00	ISS_NAC to Rings	NEG_X to 37.2/83.7	
UVIS_148SA_AURSTARE003_PRIME	C, I, V	2011-132T17:00:00		000T05:52:00	2011-132T22:52:00	UVIS_FUV to Saturn	NEG_Z to 37.2/83.7	Collaborative Rider(s): VIMS
SP_148EA_DLTURN132_PRIME		2011-132T22:52:00		000T00:40:00	2011-132T23:32:00	XBAND to Earth	POS_X to NEP	
SP_148EA_G70METOTB132_PRIME	C, N	2011-132T23:32:00		000T09:00:00	2011-133T08:32:00	XBAND to Earth	POS_X to NEP	same as OTP pass, CAPS

Final Sequenced SMT and Data Volume

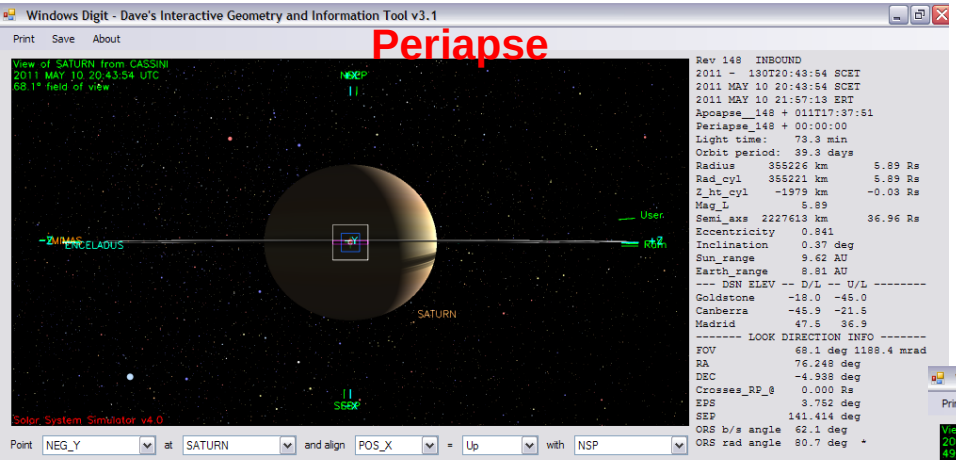
DATA VOLUME SUMMARY --- TRANSFER FRAME OVERHEAD INCLUDED (80 BITS PER 8800-BIT FRAME)

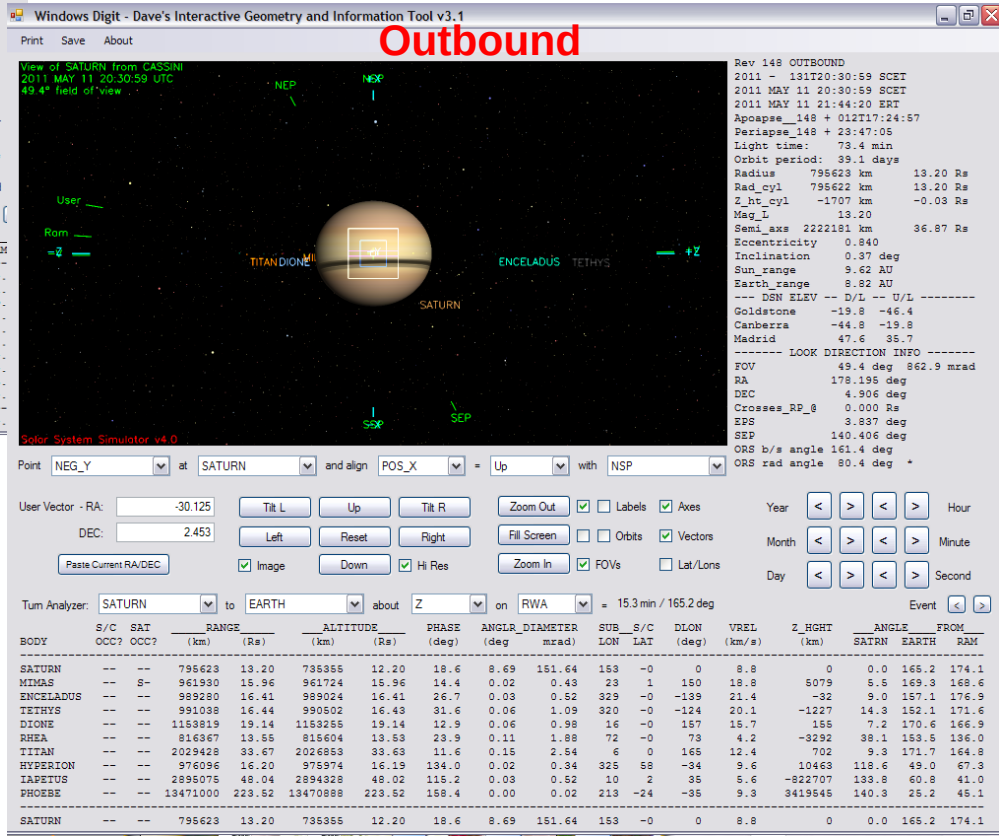
			OBSERVATION_PERIOD							DOWNLINK_PASS							
			P4						P5	RECORDED		PLAYBACK					
DOWNLINK PASS NAME	Start doy hh:mm	End doy hh:mm	START (Mb)	SCI (Mb)	HK+E (Mb)	TOTAL (Mb)	CPACTY (Mb)	MRGN (Mb)	OPNAV (Mb)	SCI (Mb)	ENGR (Mb)	TOTAL (Mb)	CPACTY (Mb)	MARGN (Mb)	NET_MARGN (Mb)	(%)	CAROVR (Mb)
SP_148EA_G34HEFNON130_PRIME	130 23:32	131 08:32	0	1726	55	1781	3322	1541	0	441	53	2275	1014	-1261	21	0%	1261
SP_148EA_G34BWGOTP131_PRIME	131 23:32	132 08:32	1261	1372	63	2696	3322	626	0	232	53	2981	711	-2271	21	0%	2270
SP_148EA_G70METOTB132_PRIME	132 23:32	133 08:32	2270	967	63	3301	3322	21	0	232	53	3586	4069	483	1017	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	130 10:32	130 23:32	46.8	196.2	154.1	14.7	232.0	23.1	39.8	0.0	488.9	44.7	470.0	0.0	54.3	1764.7
SP_148EA_G34HEFNON130_PRIME	130 23:32	131 08:32	32.4	135.8	86.4	3.2	0.0	16.0	27.5	0.0	130.8	4.9	0.0	0.0	0.0	437.1
DAILY TOTAL SCIENCE	130 10:32	131 08:32	79.2	332.0	240.5	18.0	232.0	39.1	67.3	0.0	619.7	49.6	470.0	0.0	54.3	
OBSERVATION_NOR	131 08:32	131 23:32	54.0	215.1	196.8	5.4	35.0	26.7	45.9	0.0	70.2	0.0	710.0	0.0	62.7	1421.8
SP_148EA_G34BWGOTP131_PRIME	131 23:32	132 08:32	32.4	17.0	86.4	3.2	0.0	16.0	27.5	0.0	42.4	4.9	0.0	0.0	0.0	229.9
DAILY TOTAL SCIENCE	131 08:32	132 08:32	86.4	232.1	283.2	8.6	35.0	42.7	73.4	0.0	112.6	4.9	710.0	0.0	62.7	
OBSERVATION_NOR	132 08:32	132 23:32	54.0	28.3	196.8	15.5	179.0	26.7	45.9	0.0	70.7	106.3	235.0	0.0	62.7	1020.8
SP_148EA_G70METOTB132_PRIME	132 23:32	133 08:32	32.4	17.0	86.4	3.2	0.0	16.0	27.5	0.0	42.4	4.9	0.0	0.0	0.0	229.9
DAILY TOTAL SCIENCE	132 08:32	133 08:32	86.4	45.3	283.2	18.7	179.0	42.7	73.4	0.0	113.2	111.2	235.0	0.0	62.7	

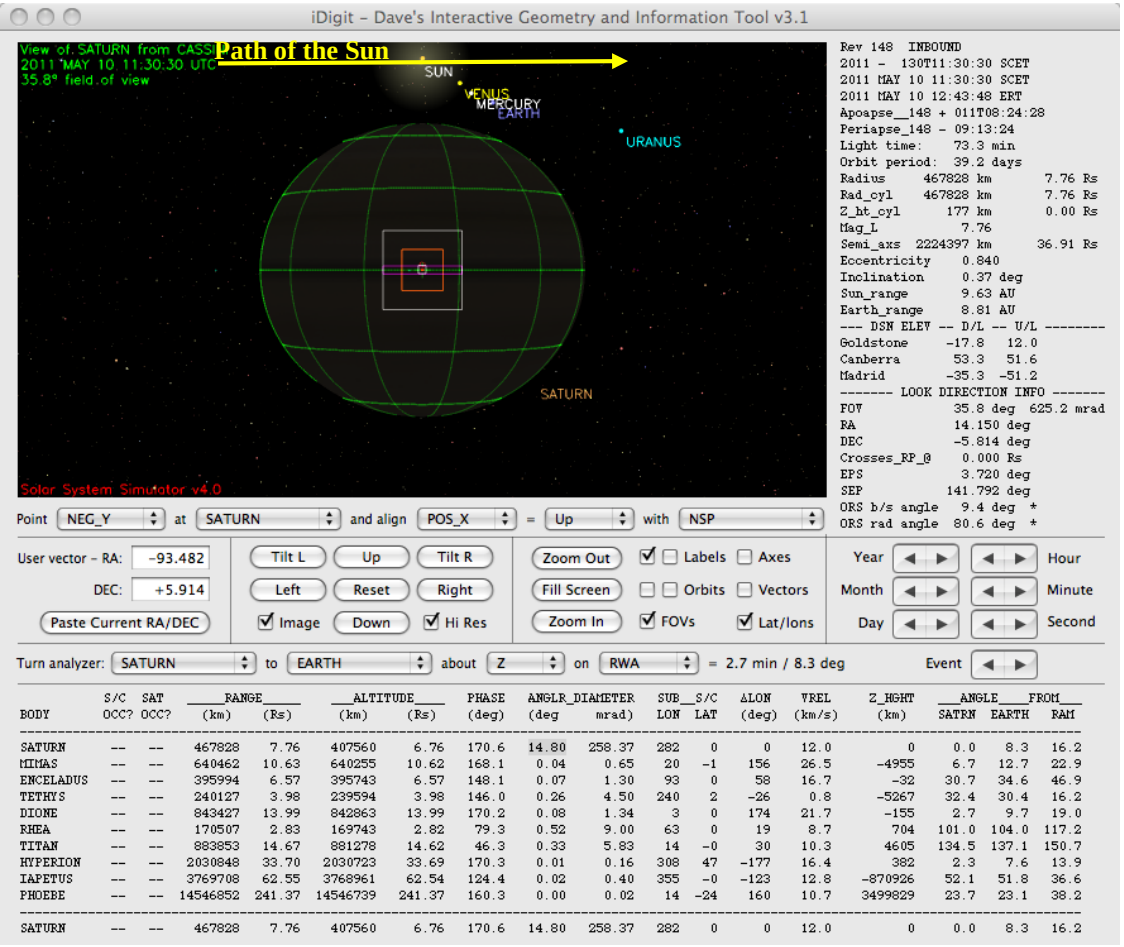
Segment Geometry





	Saturn Range	Phase Angle	Sub-S/C Lat.
Segment Start	8.10	169.6	0
Periapse	5.89	117.9	0
Segment End	24.95	16.8	0

Solar Geometry – ORS Boresight Concerns



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	ΔLON (deg)	VREL (km/s)	Z_HGHT (km)	ANGLE FROM SATRN	ANGLE FROM EARTH	ANGLE FROM RAM
SATURN	--	--	467828	7.76	407560	6.76	170.6	14.80	258.37	282	0	0	12.0	0	0.0	8.3	16.2
MIMAS	--	--	640462	10.63	640255	10.62	168.1	0.04	0.65	20	-1	156	26.5	-4955	6.7	12.7	22.9
ENCELADUS	--	--	395994	6.57	395743	6.57	148.1	0.07	1.30	93	0	58	16.7	-32	30.7	34.6	46.9
TETHYS	--	--	240127	3.98	239594	3.98	146.0	0.26	4.50	240	2	-26	0.8	-5267	32.4	30.4	16.2
DIONE	--	--	843427	13.99	842863	13.99	170.2	0.08	1.34	3	0	174	21.7	-155	2.7	9.7	19.0
RHEA	--	--	170507	2.83	169743	2.82	79.3	0.52	9.00	63	0	19	8.7	704	101.0	104.0	117.2
TITAN	--	--	883853	14.67	881278	14.62	46.3	0.33	5.83	14	-0	30	10.3	4605	134.5	137.1	150.7
HYPERION	--	--	2030848	33.70	2030723	33.69	170.3	0.01	0.16	308	47	-177	16.4	382	2.3	7.6	13.9
IAPETUS	--	--	3769708	62.55	3768961	62.54	124.4	0.02	0.40	355	-0	-123	12.8	-870926	52.1	51.8	36.6
PHOEBE	--	--	14546852	241.37	14546739	241.37	160.3	0.00	0.02	14	-24	160	10.7	3499829	23.7	23.1	38.2
SATURN	--	--	467828	7.76	407560	6.76	170.6	14.80	258.37	282	0	0	12.0	0	0.0	8.3	16.2

- Pointing to NEG_Y to Saturn (center) would lead to a CMT violation.
- < 15º ORS to Sun between ~2011-130T08:43:42 and ~2011-130T13:47:32
- < 12º ORS to Sun between ~2011-130T09:49:46 and ~2011-130T13:01:12
- Minimum NEG_Y to Sun angle is ~9.4˚ at ~2010-130T11:30:00.
- Saturn's diameter ranges from 13.13º to 16.33º (14.78º at the minimum).
- Pointing in the anti-Sun southern hemisphere can help avoid this FR.

Daily Science Highlights

DOY 130: UVIS kicked off the Saturn 148 segment in the middle of the day with a Northern Saturn auroral movie, on which the other ORS instruments rode. CDA performed a ring plane crossing measurement, followed by a VIMS OmiCet stellar-Saturn occultation. ISS led a joint ORS 'PIE' observation of Enceladus plumes. As the spacecraft moved though Periapse, CIRS performed a Saturn limb integration 'PIE' to obtain stratospheric thermal structure by means of limb sounding in the mid-IR. Meanwhile, the MAPS instruments conduct ed measurements of the inner magnetosphere, the equatorial plane and the ring plane crossings.

DOY 131: Outbound from Periapse, Cassini turned its attention to Titan for an ORS cloud-monitoring request. Turning back to Saturn, VIMS conducted a Northern Hemisphere mosaic as CIRS rode along. Meanwhile, the MAPS instruments conducted measurements of the inner magnetosphere, the equatorial plane and the ring plane crossings.

DOY 132: Following another Titan Cloud Monitor, the VIMS instrument led an ORS ring-plane crossing observation near 10 degree phase. The day wrapped up with another look at the Saturn aurora by UVIS and the other ORS instruments. Meanwhile, the MAPS instruments conducted measurements of the inner magnetosphere, the equatorial plane and the ring plane crossings.

Segment Integration Planning

Timeline Gaps and Suggested Observations

Gap	Start (SCET)	Duration	End (SCET)
GAP 1 (VIMS REGMAP or UVIS AURSTARE) WP Turn to SA Center?	2011-130T11:12:00	000T03:48:00	2011-130T15:00:00
GAP 2 (VIMS GLOMAP)	2011-131T10:42:00	000T12:10:00	2011-131T22:52:00
GAP 3 (Rings RPX?)	2011-132T10:42:00	000T12:10:00	2011-132T22:52:00

Initial SMT and Data Volume

Beginning of Integration:

No Initial SMT Report Available

Waypoint Selection

RBOT FRIENDLY WAYPOINTS

PRIMARY : NEG_Y to SATURN

reminder: use an ra/dec average value and keep the same waypoint throughout your segment when possible

OBSERVATION PERIOD	START	END	POS_X	NEG_X	POS_Z	NEG_Z
SP_148NA_OBSERV130_NA	2011-130T10:32:00	2011-130T23:32:00	------	------	------	------
SP_148NA_OBSERV131_NA	2011-131T08:32:00	2011-131T23:32:00	------	37.3/ 83.7	37.3/ 83.7	------
SP_148NA_OBSERV132_NA	2011-132T08:32:00	2011-132T23:32:00	------	37.2/ 83.7	------	37.2/ 83.7

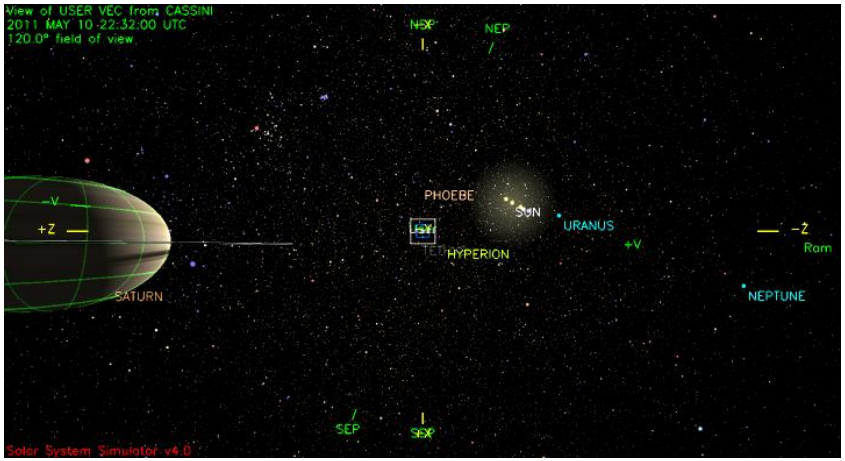
OTHER WAYPOINTS

PRIMARY : NEG_Y to SATURN

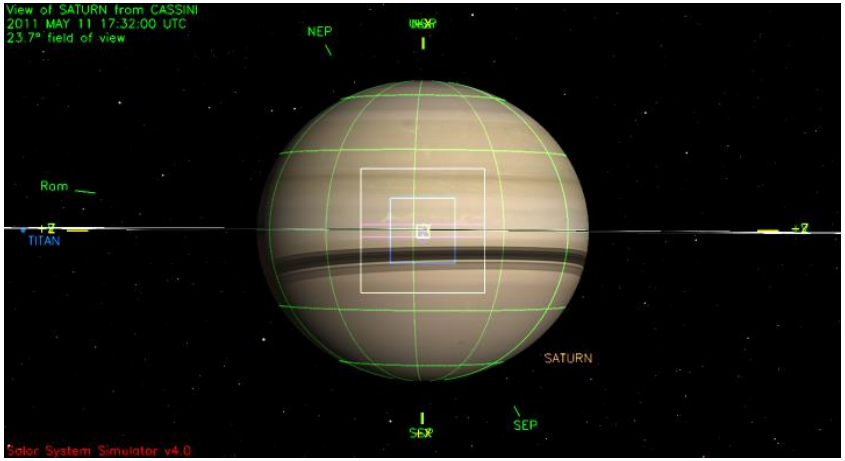
OBSERVATION PERIOD	START	END	POS_X_2_NSP	POS_X_2_NEP	NEG_X_2_NSP	NEG_X_2_NEP	POS_Z_2_NSP	POS_Z_2_NEP	NEG_Z_2_NSP	NEG_Z_2_NEP	NEG_X_2_SUN	NEG_Z_2_EARTH
SP_148NA_OBSERV130_NA	2011-130T10:32:00	2011-130T23:32:00	**BAD**	**BAD**	**BAD**	**BAD**	**BAD**	**BAD**	**BAD**	**BAD**	**BAD**	**BAD**
SP_148NA_OBSERV131_NA	2011-131T08:32:00	2011-131T23:32:00	**BAD**	**BAD**	OK	**BAD**	OK	OK	**BAD**	**BAD**	OK	OK
SP_148NA_OBSERV132_NA	2011-132T08:32:00	2011-132T23:32:00	**BAD**	**BAD**	OK	OK	**BAD**	**BAD**	OK	**BAD**	OK	**BAD**

Waypoints Chosen

Waypoint 1 (2011-130T11:12:00 – 2011-131T09:12:00): ISS_NAC to 34.836/-2.977 (OMICET); NEG_X to NSP

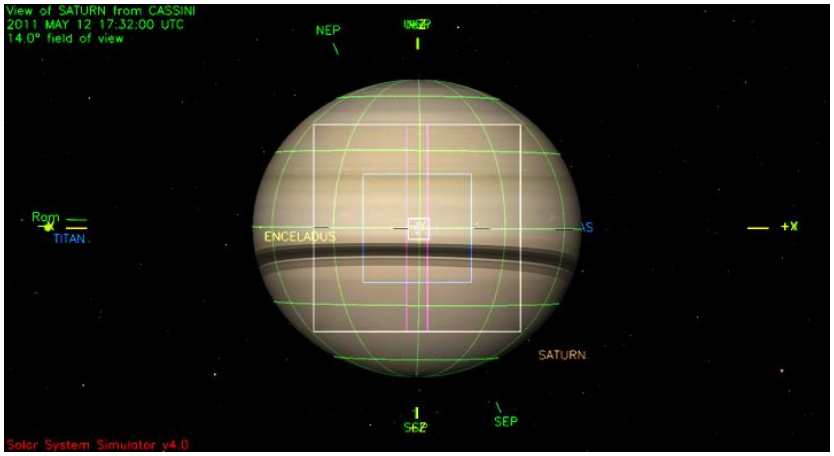


Waypoint 2 (2011-131T09:12:00 – 2011-132T09:12:00): ISS_NAC to Saturn; NEG_X to 37.25/83.7



Waypoints Chosen

Waypoint 3 (2011-132T09:12:00 - 2011-133T10:00:00): ISS_NAC to Saturn; NEG_Z to 37.2/83.7



Notes & Liens

- Pointing:
  - Collaborative prime/rider coordination designs
    - VIMS_148SA_OMICETOCC001_PRIME (2011-130T13:40) with CIRS
  - Any Ybias window issues (approved deviations from guidelines)
    - Y-bias window at 2011-130T23:32 overlaps front of 34M downlink.
  - RBOT friendliness of delivery
    - “RBOT friendly” secondary were used where safe.
- Data Volume:
  - None
- DSN:
  - None
- Opmodes:
  - DFPW the whole segment (other than OTM periods)
- Special Activities:
  - None, but they are all important! ;)

Sequence Liens:

- None