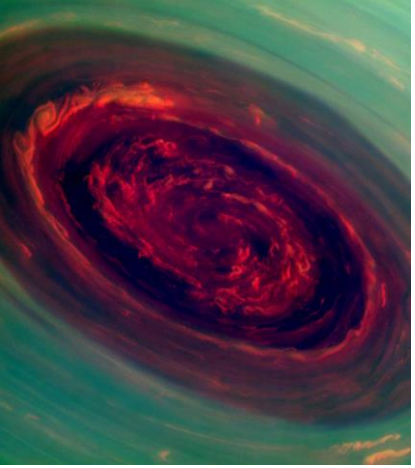

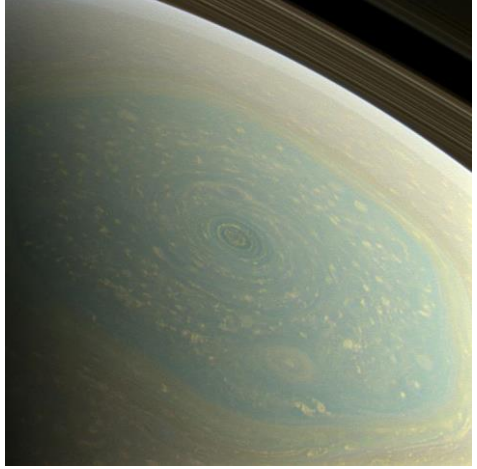
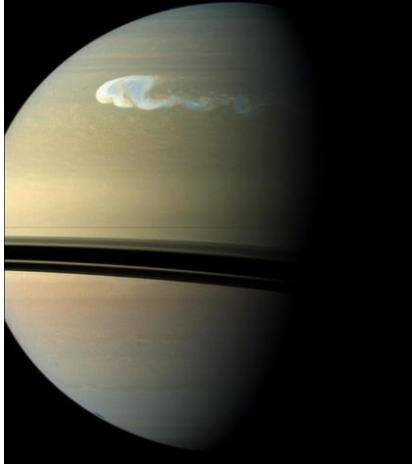

Science Planning & Sequence Team
CASSINI

SATURN TARGET WORKING TEAM

Rev 288 Segment Legacy Package

Segment Boundary: Aug 12, 2017 – Aug 15, 2017
2017-224T12:26:00 – 227T13:41:00 (SCET)

Integration Began 10/24/2016
Segment Delivered to S101 Sequence 01/19/2017
Lead Integrator was Keven Uchida

Legacy Package Assembled by Keven Uchida

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

Segment Overview and Final Products

Segment Summary

- Saturn_288 was a “Grand Finale” proximal periapse segment. Only six segments remained in the Cassini mission, after this segment. The S/C was at a distance of 1.03 R_S at periapse. This segment covered a wide range of phase angles and sub-S/C latitudes.
- Periapse was situated at approximately mid segment. It was encompassed by a “jumpstart” period (see final bullet), within which ISS had a high priority observation (PIE) of the “streaks” in the C Ring plateau. INMS also had a PIE to make the first ever in situ composition measurements of Saturn’s upper atmosphere. Radar rode with INMS, nadir-looking to obtain high spatial resolution observations of Saturn’s 2-cm wavelength thermal emission. See “Periapse Quicklooks”, page 9 and “Science Highlights”, starting page 10.
- A dual playback was incorporated to record (and play back twice) important science and engineering data, from approximately 10 minutes prior to periapse, until 10 minutes after. Data from this segment/dual-playback was an important component in determining whether subsequent S/C trajectory/orbits needed to be modified.
- Data volume was oversubscribed with initial activity placement. Data volume cuts to activities were made by ORS and MAG, without notable issue/contention, to keep the segment to its allocation.
- As noted earlier, this segment contained a “jumpstart” period. Due to the challenging geometry and unique science of this phase of the mission, the timeline for the days around periapse was decided in advance of full segment integration. Detailed pointing analysis, constraint checking, and reaction-wheel bias optimization (RBOT) was performed on the periapse period. No changes were required following this analysis, due to relaxed constraints.

Final Sequenced SPASS (1 of 1)

Rev288 Jumpstart

Gap 1

Request	Riders	Start (SCET)	Start (Epoch)	Duration	End	Primary	Secondary	Comments
SATURN_288 Segment		2017-224T12:26:00		003T01:15:00	2017-227T13:41:00			
SP_288SA_WAYPTTURN224_PRIME		2017-224T12:26:00		000T00:40:00	2017-224T13:06:00	ISS_NAC to Saturn	NEG_X to NSP	
NEW WAYPOINT		2017-224T13:06:00		000T06:20:00	2017-224T19:26:00	ISS_NAC to Saturn	NEG_X to NSP	
VIMS_288SA_NHEMIMAP001_PRIME	C, I, U	2017-224T13:06:00		000T01:00:00	2017-224T14:06:00	ISS_NAC to Saturn	NEG_X to NSP	
UVIS_288SA_AURDSTARE001_PRIME	C, I, V	2017-224T14:06:00		000T01:50:00	2017-224T15:56:00	VIMS_IR to Saturn	NEG_X to NSP	Collaborative Rider(s): VIMS
UVIS_288SA_AURDSLEW001_PRIME	C, V	2017-224T15:56:00		000T01:50:00	2017-224T17:46:00	UVIS_FUV to Saturn	NEG_X to NSP	Collaborative Rider(s): VIMS
ISS_288SA_LIMBINT001_PRIME	C, U, V	2017-224T17:46:00		000T01:00:00	2017-224T18:46:00	ISS_NAC to Saturn	NEG_X to NSP	
SP_288SA_DLTURN224_PRIME		2017-224T18:46:00		000T00:40:00	2017-224T19:26:00	XBAND to Earth (0.0,0.0,-9.5 deg. offset)	NEG_Y to Saturn	
NEW WAYPOINT		2017-224T19:26:00		000T20:25:00	2017-225T15:51:00	XBAND to Earth (0.0,0.0,-9.5 deg. offset)	NEG_Y to Saturn	
MAG_288SU_LFCALROLL001_PRIME	U	2017-224T19:26:00		000T07:00:00	2017-225T02:26:00	NEG_X to Earth (0.0,0.0,-30.0 deg. offset)	Rolling	
SP_288EA_C34BWGNON225_PRIME	C	2017-225T02:26:00		000T12:45:00	2017-225T15:11:00	XBAND to Earth (0.0,0.0,-9.5 deg. offset)	NEG_Y to Saturn	MIMI. XBAND to EARTH (0,0, -9.5), NEG_Y to SA
SP_288SA_WAYPTTURN225_PRIME		2017-225T15:11:00		000T00:40:00	2017-225T15:51:00	ISS_NAC to Saturn	POS_Z to NSP	
NEW WAYPOINT		2017-225T15:51:00		000T14:33:03	2017-226T06:24:03	ISS_NAC to Saturn	POS_Z to NSP	
VIMS_288SA_NPOLEMAP001_PRIME	C, I, U	2017-225T15:51:00		000T04:41:00	2017-225T20:32:00	ISS_NAC to Saturn	POS_Z to NSP	
CIRS_288SA_LIMBINT001_PRIME	U, V	2017-225T20:32:00		000T04:00:00	2017-226T00:32:00	CIRS_FPB to Saturn	PIC	
SP_288SA_DEADTIME226_PRIME		2017-226T00:32:00		000T00:19:54	2017-226T00:51:54	ISS_NAC to Saturn	POS_Z to NSP	Start is absolute, End is epoch
Begin Custom		2017-226T00:51:54	LMB_E288_Peri-000T03:31:00	000T00:00:01	2017-226T00:51:55	ISS_NAC to Saturn	POS_Z to NSP	
ISS_288RI_CPLTSTRKP001_PIE	C, M, U, V	2017-226T00:51:54	LMB_E288_Peri-000T03:31:00	000T02:30:00	2017-226T03:21:54	ISS_NAC to Rings	POS_Z to NSP	Pick up at ISS_NAC to Saturn, POS_Z to NSP; Hand off at NEG_Z to Saturn, POS_X to NSP. Collaborative Rider(s): RADAR
ENGR_288SC_RADRCS226_PRIME	M	2017-226T03:21:54	LMB_E288_Peri-000T01:01:00	000T00:01:00	2017-226T03:22:54	NEG_Z to Saturn	POS_X to NSP	Pick up at NEG_Z to Saturn, POS_X to NSP; Hand off at NEG_Z to Saturn, POS_X to NSP. Deadband=(2,2,20)
INMS_288CO_SATAMOS001_PIE	M, R	2017-226T03:22:54	LMB_E288_Peri-000T01:00:00	000T02:00:00	2017-226T05:22:54	POS_X to COROT	NEG_Z to Saturn	Collaborative Rider(s): RADAR. Pick up at NEG_Z to Saturn, POS_X to NSP; Hand off at NEG_Z to Saturn, POS_Y to Sun. Collaborative Rider(s): RADAR. RADAR secondary
Begin Dual Playback Science		2017-226T04:07:54	LMB_E288_Peri-000T00:15:00	000T00:00:01	2017-226T04:07:55			
Periapse R = 1.026 Rs, lat ...		2017-226T04:22:55		000T00:00:01	2017-226T04:22:56			
End Dual Playback Science		2017-226T04:32:54	LMB_E288_Peri+000T00:10:00	000T00:00:01	2017-226T04:32:55			
SP_288SA_WAYPTTURN426_PRIME	M	2017-226T05:22:54	LMB_E288_Peri+000T01:00:00	000T00:03:00	2017-226T05:25:54	NEG_Z to 353.32/57.49	POS_Y to Sun	Pick up at NEG_Z to Saturn, POS_Y to Sun; Hand off at NEG_Z to 353.32/57.49, POS_Y to Sun. Turn to Quiescent Attitude for RWA Transition.
ENGR_288SC_DFPWBIAS227_PPS	M	2017-226T05:25:54	LMB_E288_Peri+000T01:03:00	000T00:21:09	2017-226T05:47:03	NEG_Z to 353.32/57.49	POS_Y to Sun	Pick up at NEG_Z to 353.32/57.49, POS_Y to Sun; Hand off at NEG_Z to 353.32/57.49, POS_Y to Sun.
SP_288SA_WAYPTTURN226_PRIME	M	2017-226T05:47:03	LMB_E288_Peri+000T01:24:09	000T00:37:00	2017-226T06:24:03	ISS_NAC to Saturn	NEG_Z to NSP	Pick up at NEG_Z to 353.32/57.49, POS_Y to Sun; Hand off at ISS_NAC to Saturn, NEG_Z to NSP.
NEW WAYPOINT		2017-226T06:24:03		000T16:31:57	2017-226T22:56:00	ISS_NAC to Saturn	NEG_Z to NSP	
End Custom		2017-226T06:24:03	LMB_E288_Peri+000T02:01:09	000T00:00:01	2017-226T06:24:04	ISS_NAC to Saturn	NEG_Z to NSP	
SP_288SA_DEADTIME426_PRIME		2017-226T06:24:03	LMB_E288_Peri+000T02:01:09	000T00:19:56	2017-226T06:43:59	ISS_NAC to Saturn	NEG_Z to NSP	Start is epoch, End is absolute
UVIS_288SA_AURSTARE001_PRIME	C, I, V	2017-226T06:44:00		000T15:32:00	2017-226T22:16:00	UVIS_FUV to Saturn	NEG_Z to NSP	Collaborative Rider(s): VIMS
SP_288EA_DLTURN226_PRIME		2017-226T22:16:00		000T00:40:00	2017-226T22:56:00	XBAND to Earth	POS_X to NEP	
NEW WAYPOINT		2017-226T22:56:00		000T15:25:00	2017-227T14:21:00	XBAND to Earth	POS_X to NEP	
SP_288EA_YGAP226_PRIME		2017-226T22:56:00		000T01:30:00	2017-227T00:26:00	XBAND to Earth	POS_X to NEP	
SP_288EA_G70METNON227_PRIME	C	2017-227T00:26:00		000T06:00:00	2017-227T06:26:00	XBAND to Earth	5_Hr_Rolling	SRU. Possible CIRS/VIMS heating depending on secondary used (update in integration)
Pointer Reset in preparatio...		2017-227T06:26:00		000T00:00:01	2017-227T06:26:01			
SP_288EA_C70METNON227_PRIME	C	2017-227T06:26:00		000T07:15:00	2017-227T13:41:00	XBAND to Earth	Rolling/SRU	SRU. Possible CIRS/VIMS heating depending on secondary used (update in integration)

Final Sequenced SMT and Data Volume

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

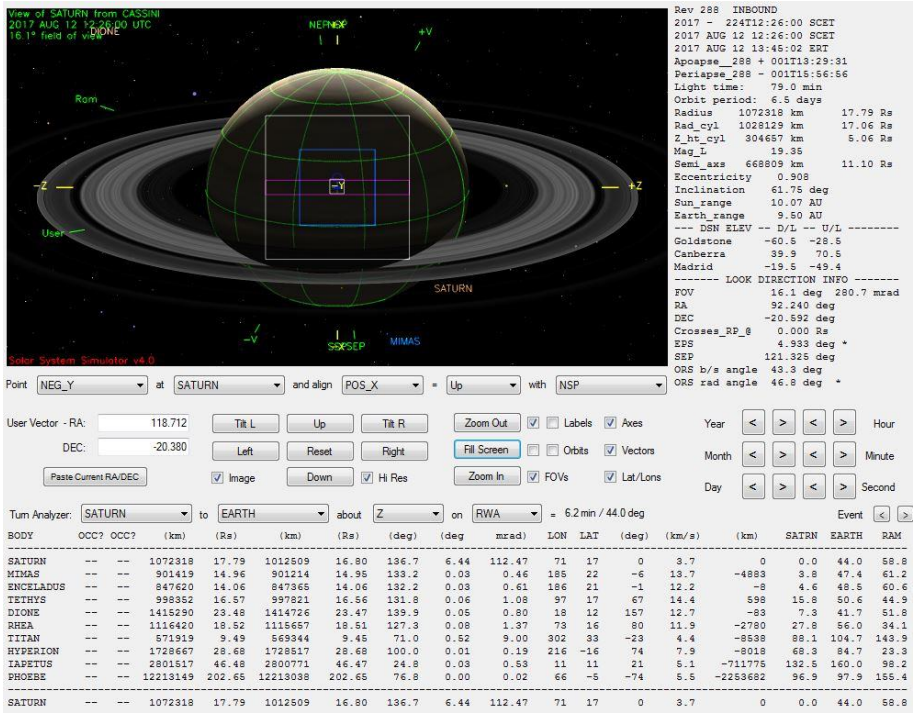
			OBSERVATION_PERIOD							DOWNLINK_PASS							
			P4						P5	RECORDED		PLAYBACK					
DOWNLINK PASS NAME	Start doy hh:mm	End doy hh:mm	START (Mb)	SCI (Mb)	HK+E (Mb)	TOTAL (Mb)	CPACTY (Mb)	MRGN (Mb)	OPNAV (Mb)	SCI (Mb)	ENGR (Mb)	TOTAL (Mb)	CPACTY (Mb)	MARGN (Mb)	NET_MARGN (%)	CAROVR (Mb)
SP_288EA_C34BWGNON225_PRIME	225 02:26	225 15:11	0	590	59	649	3322	2673	0	287	75	1011	1017	5	65	1%	0
SP_288EA_G70METNON227_PRIME	227 00:26	227 06:26	0	3108	155	3263	3322	59	0	138	35	3436	2043	-1394	63	1%	1393
SP_288EA_C70METNON227_PRIME	227 06:26	227 13:41	1393	0	0	1393	3322	1929	0	1283	43	2719	2761	42	63	1%	0

DATA VOLUME REPORT --- TRANSFER FRAME OVERHEAD NOT INCLUDED

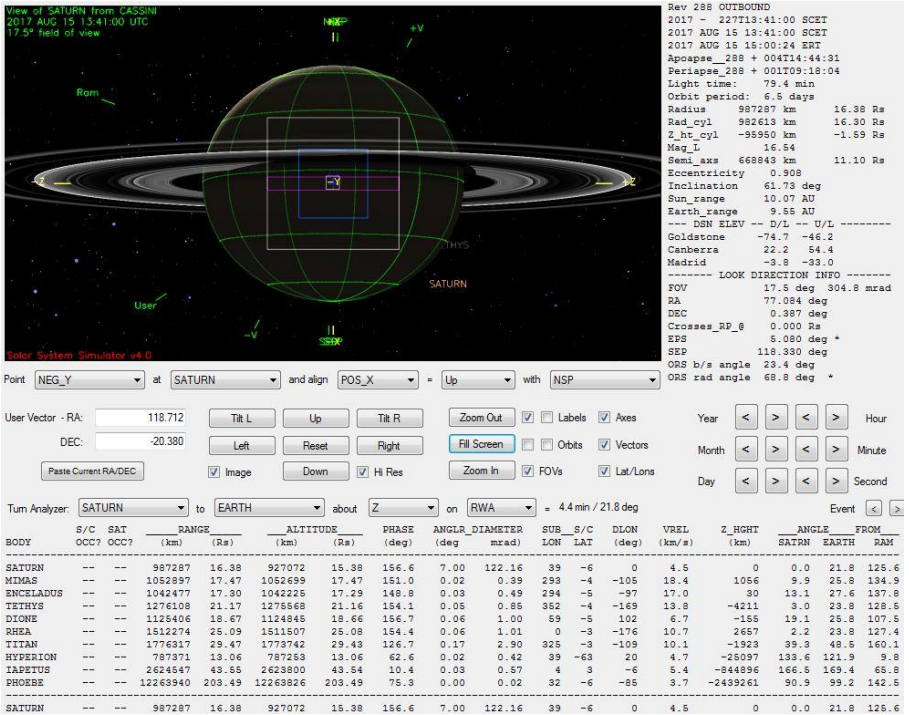
Event	Start doy hh:mm	End doy hh:mm	CAPS (Mb)	CDA (Mb)	CIRS (Mb)	INMS (Mb)	ISS (Mb)	MAG (Mb)	MIMI (Mb)	RADAR (Mb)	RPWS (Mb)	UVIS (Mb)	VIMS (Mb)	PROBE (Mb)	ENGR (Mb)	TOTAL (Mb)
OBSERVATION_NOR	224 12:26	225 02:26	0.0	26.4	40.8	5.0	160.0	81.8	37.8	0.0	45.9	79.9	107.0	0.0	58.5	643.1
SP_288EA_C34BWGNON225_PRIME	225 02:26	225 15:11	0.0	24.1	126.9	4.6	0.0	45.3	34.4	0.0	41.8	7.0	0.0	0.0	0.0	284.1
DAILY TOTAL SCIENCE	224 12:26	225 15:11	0.0	50.5	167.7	9.6	160.0	127.2	72.2	0.0	87.6	86.9	107.0	0.0	58.5	
OBSERVATION_NOR	225 15:11	227 00:26	0.0	103.4	223.0	25.4	203.0	153.5	104.5	36.5	1345.6	476.4	408.0	0.0	153.5	3232.9
SP_288EA_G70METNON227_PRIME	227 00:26	227 06:26	0.0	11.3	54.0	2.2	0.0	21.3	16.2	0.0	28.1	3.3	0.0	0.0	0.0	136.4
SP_288EA_C70METNON227_PRIME	227 06:26	227 13:41	0.0	13.7	67.5	2.6	0.0	25.8	19.6	0.0	1023.6	4.0	0.0	0.0	114.7	1271.5
DAILY TOTAL SCIENCE	225 15:11	227 13:41	0.0	128.4	344.5	30.2	203.0	200.7	140.3	36.5	2397.3	483.7	408.0	0.0	268.2	

Segment Geometry

Start 2017-224T12:26

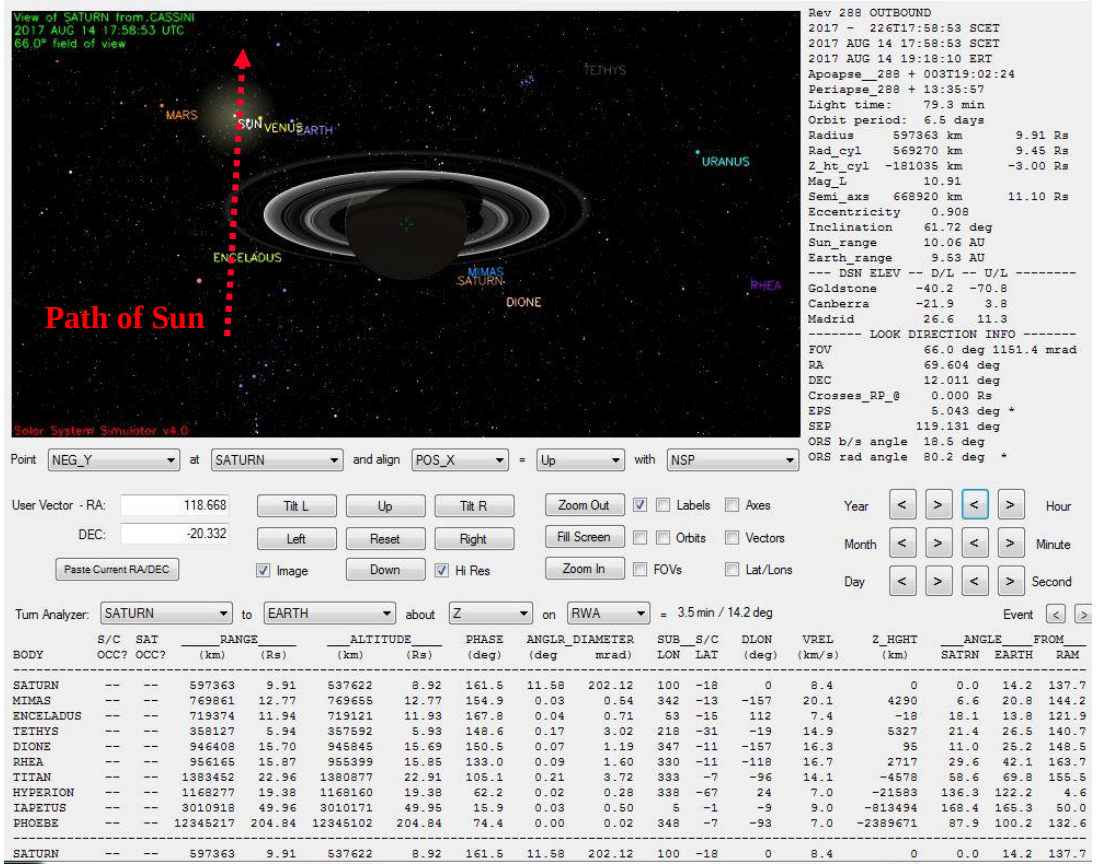


End 2017-227T13:47



	Saturn Range	Phase Angle	Sub-S/C Lat.
Segment Start	17.79	136.7	17
Periapse	1.03	32.2	-5
Segment End	16.38	156.6	-6

Solar Geometry – ORS Boresight Concerns



- No Sun issues/concerns in Gap 1, nor elsewhere.
- Minimum Sun angle to Saturn center is ~18.5 deg at 2017-226T17:59. See figure. That's within ~4 hours of the end of the segment.

Periapse Quicklooks

Rev 288

NEW WAYPOINT	
VIMS 288SA NPOLEMAP001 PRIME	C, I, U
CIRS 288SA LIMBINT001 PRIME	U, V
SP 288SA DEADTIME226 PRIME	
Begin Custom	
ISS 288RI CPLTSTRKP001 PIE	C, M, U, V
ENGR 288SC RADRCS226 PRIME	M
INMS 288CO SATAMOS001 PIE	M, R
Begin Dual Playback Science	
Periapse R = 1.026 Rs, lat ...	
End Dual Playback Science	
SP 288SA WAYPTTURN426 PRIME	M
ENGR 288SC DFPWBIAS227 PPS	M
SP 288SA WAYPTTURN226 PRIME	M
NEW WAYPOINT	

- At the start of this periapsis period VIMS conducted north pole mapping (NPOLEMAP) to study the seasonal effects on winds and cloud structures within the north polar vortex and the hexagon feature that encircles the vortex.
- CIRS then performed a 4 hour long limb integration (LIMBINT) obtaining stratospheric thermal structure by means of limb sounding in the mid-IR, with longitude coverage.
- ISS then observed the "streaks" in the C Ring plateau (CPLTSTRK001_PIE), as part of an ongoing campaign. This was the last of the series, and is at a unique, intermediate phase angle (and lit). It is unknown if the streaks are caused by a vertical structure with shadowing, or by some other effect.
- INMS then took the lead across periapsis (SATMOS001_PIE) -- Starting with this segment (Rev 288) and then continuing with 290, 291 & 292, INMS made the first ever in situ composition measurements of Saturn's upper atmosphere. INMS measured densities of H_2, HD, and He in the neutral exospheres of Saturn and the rings, and perhaps oxygen-bearing species depending on their densities. INMS mapped the other very important ion species, for example H_3^+, in Saturn's topside ionosphere, with 100-km resolution along Cassini's trajectory, and also studies the ring atmosphere-ionosphere.
- Between RPX-10 min to Periapse + 10 min high-value data was marked for "dual playback". Some of the INMS in-situ measurements were obtained within this period. CDA measured dust confined to the ring plane and dust that gets lofted toward the south by the magnetic field post-periapse.
- Rev 288 was Cassini's first encounter with Saturn's atmosphere; the trajectory had been planned based on the most current models that included the shrinking of Saturn's atmosphere that had been observed starting about a year after equinox. It was possible that the atmosphere could shrink more than predicted. If so, then the Rev 288 data at closest approach to Saturn would be critical in making the determination of whether or not to do a pop-down maneuver in late August to lower the final two Saturn in-situ observations opportunities.
- Radar rode along with INMS, nadir-looking to obtain high spatial resolution observations of Saturn's 2-cm wavelength thermal emission in scans through latitude. Previous measurements on Saturn (and Jupiter) of this thermal emission are at spatial resolution > 700 km, and the proximal scans improves this by well over an order of magnitude. This enabled studies of the small-scale structure of Saturn's atmosphere as opposed to regional averages, the spatial variation in ammonia concentration, and yields unique insights into the actual weather occurring in and below Saturn's ammonia clouds.
- Following the INMS/RADAR observation activities across the periapsis, UVIS then performed daytime auroral slew/stare observations. As opposed to most other times in the mission, in this case UVIS was close enough just after periapse to require 2 or 3 slews of the slit to cover the auroral zone. Thus, this was a rare opportunity to spatially resolve multiple auroral arcs, observe discrete spots of emission, and search for satellite footprints.

12 Aug 2017 (DOY 224)
The Saturn_288 Proximal segment began. MAG continued their magnetospheric survey measurements (from the previous segment) in conjunction with the other MAPS instruments: RPWS conducted outer magnetosphere survey observations, INMS examined atmospheric and ionospheric thermal structure, and CDA performed its regular dust surveys.

At approximately mid-day, VIMS mapped the northern hemisphere (NHEMIMAP), for 1 hour, with CIRS, UVIS and ISS riding along. VIMS was looking for changes in winds, cloud structures, and perhaps changes in phosphine content as the rate of upwelling changes with season due principally to potential changes in the upper atmosphere temperature.

UVIS then led with daytime auroral observations comprised of two requests of equal duration (1hr 50m), first an auroral daytime stare and then an auroral slew. The UVIS stare performed fixed pointings, toward the illuminated northern auroral oval, to support VIMS imaged for the entire time. CIRS rode and VIMS rode collaboratively on both. ISS rode on the staring observation.

ISS then imaged along the bright northern limb/crescent of Saturn (LIMBINT) for 1 hr, working with CIRS, VIMS and UVIS to study the composition of the high atmosphere. CIRS obtained information on thermal structure of Saturn's atmosphere.

Following the LIMBINT, MAG conducted a low-field calibration roll (LFCALROLL). The roll was about an axis other than Z for determination of sensor offsets and is performed in low field in a good calibration window which occurs between ~peri-85h to ~peri-12h. UVIS rode on the LFCALROLL performing its Interplanetary Hydrogen Survey (IPHS)

13 Aug 2017 (DOY 225)
Immediately following the MAG LFCAL roll we turned to Canberra for downlink. As during most downlinks, UVIS performed an interplanetary hydrogen survey (IPHSURVEY) and CIRS performed its deep space instrument calibration routine.

All the while, MAG continued with its continuous low-rate magnetospheric survey. RPWS shifted toward the inner magnetosphere survey mode.

Approximately mid-day, VIMS conducted north pole mapping (NPOLEMAP) for approximately 5 hrs, to study the seasonal effects on winds and cloud structures within the north polar vortex and the hexagon feature that encircles the vortex. The north polar views obtained in the Grand Finale achieved measurements of the polar-vortex and hexagon winds at depth (say, near 2 bar) with unprecedented precision. CIRS, ISS, UVIS rode along

Near the end of the day CIRS performed a 4 hour long limb integration (LIMBINT), obtaining stratospheric thermal structure by means of limb sounding in the mid-IR, with longitude coverage. UVIS and VIMS rode along. Being within relatively close proximity of Saturn gave the resolution necessary for a better determination of the vertical and horizontal profiles of airglow, aurora, and hydrocarbons, to test and improve photochemical models of Saturn's high atmosphere.

RPWS conducted its auroral campaign to observe the auroral magnetosphere (e.g. the acceleration region) and SKR source regions.

As each periapse was approached, MAG collected unique measurements which together promise to lead to a better understanding of the departure from axisymmetry for the planetary magnetic field, the resolution of the planetary rotation period, the depth to dynamo region, the size of the central core and the strength of field inside the planet (energy budget). In addition, measurement of field aligned currents leads to a better understanding of auroral processes (in conjunction with other instruments). Each and every periapsis rev provided MAG observations of Saturn's internal magnetic field over a unique orbit track in latitude and longitude.

14 Aug 2017 (DOY 226)

Starting on DOY 226, ISS observed the "streaks" in the C Ring plateau (CPLTSTRK001_PIE), as part of an ongoing campaign. This was the last of the series, and was at a unique, intermediate phase angle (and lit). Whether the streaks are caused by a vertical structure with shadowing or by some other effect is unknown, so it was essential to cover it at a variety of solar angles and illumination and viewing geometries. Prior Revs 260 and 270 covered low phase angles (and lit) and Rev 262 covered high phase angles (unlit). Having this set will go towards that goal. All ORS instruments rode along.

INMS then took the lead across periapsis (SATMOS001_PIE) -- Starting with this segment (Rev 288) and then continuing with 290, 291 & 292, INMS made the first ever in situ composition measurements of Saturn's upper atmosphere. INMS measured densities of H_2, HD, and He in the neutral exospheres of Saturn and the rings, and perhaps oxygen-bearing species depending on their densities. INMS mapped the very important ion species, H_3^+, in Saturn's topside ionosphere with 100-km resolution along Cassini's trajectory. H_2^+ and other species were expected to have lower densities than H_3^+ (Nagy et al., 2009), and are characterized with coarser resolution. INMS also studied the ionosphere of Saturn and the ring atmosphere-ionosphere by measuring neutral densities and composition in the region linking Saturn's atmosphere with the rings (e.g., erosion of the rings through drag and chemical modification of the planetary atmosphere). In this region, INMS measured ions such as O_2^+ created on the surface of the rings and transported along field lines to other locations.

Daily Science Highlights (3/4)

Radar rode along, nadir-looking to obtain high spatial resolution observations of Saturn's 2-cm wavelength thermal emission in scans through latitude. The 2-cm thermal emission measured the variation in ammonia concentration in the atmosphere just below the ammonia cloud base. Previous measurements on Saturn (and Jupiter) of this thermal emission are at spatial resolution > 700 km: the proximal scans will improve this by well over an order of magnitude. This enabled the characterization of small-scale structure of Saturn's atmosphere as opposed to regional averages, and potentially gives unique insights into the weather occurring in and below Saturn's ammonia clouds. Thus, these observations provided a unique opportunity to address an important question about outer planet atmospheres

High-value data between ring plane crossing -10 min to periapse + 10 min were marked for "dual playback". Some of the INMS in-situ measurements were marked for dual playback, and CDA measured dust confined to the ring plane and dust which gets lofted toward the south by the magnetic field.

Rev 288 was Cassini's first encounter with Saturn's atmosphere. The trajectory had been planned based on the most current models from the Saturn Atmospheric Working Group, which included the shrinking of Saturn's atmosphere that was observed starting about a year after equinox. It was possible that the atmosphere would shrink more than predicted. If so, then the Rev 288 data at closest approach to Saturn would provide critical data for making the determination of whether or not to do a pop-down maneuver in late August to lower the final two Saturn in-situ observations opportunities.

At about this time, RPWS was searching for lightning whistlers. These would verify the existence of lightning already suspected from Saturn Electrostatic Discharges (SED). At ring plane crossing, RPWS measured the equatorial dust flux and scale height as a function of radial distance, and obtain high resolution measurements of plasma waves at the magnetic equator.

Following the INMS/RADAR observations across periapsis, UVIS then performed a 15.5 daytime auroral slew/stare observation. In this case, UVIS, VIMS, and ISS took advantage of the unusually close observations to spatially resolve auroral features. During most of the mission UVIS observed the auroral zone during single slews of the long-slit spectrograph. In this case UVIS was close enough just after periapse to require 2 or 3 slews of the slit to cover the auroral zone, providing a rare opportunity to spatially resolve multiple auroral arcs, observe discrete spots of emission, and search for satellite footprints. ISS and VIMS auroral images also benefited from the improved spatial resolution.

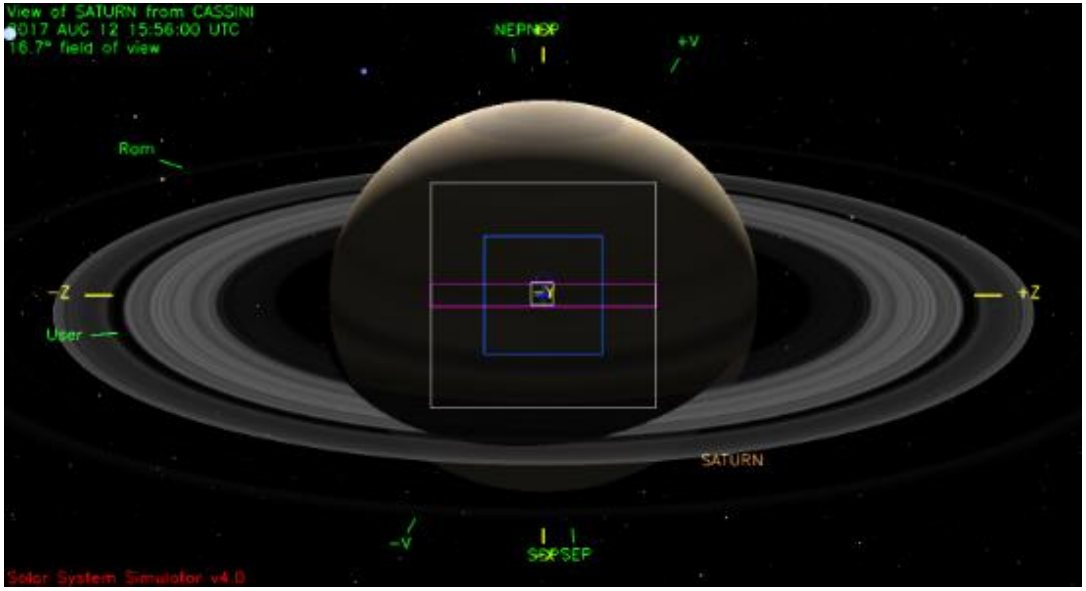
15 Aug 2017 (DOY 227)

DOY 227 started with downlink for 6 hrs to Goldstone 70m, and 7h15 to Canberra 70m. The high priority dual-playback data was received at this time.

Segment Integration Planning

Timeline Gaps and Suggested Observations

Gap	Start	End	Duration	Phase angle (range)	Rs range	Sub-S/C Lat.
1	2017-224T13:06:00	2017-224T18:46:00	000T5:40:00	136.5 – 134.4	16.6 – 15.46	17 – 19
	Suggested Observations: VIMS Map VIMS Auroral DSTARE/DSLEW VIMS MAP		01h00m 03h40m 01h00m			



Initial SMT and Data Volume

Beginning of Integration:

OPNAV TELEMETRY MODE REPORT

OPNAV REQUEST	START TIME	TELEMETRY MODE	OBSERVATION PERIOD

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_288EA_C34BWGNON225_PRIME	225 02:26	225 15:11	0	209	59	268	3322	3054	0	305	75	648	1017	368	-113	-1%	0
SP_288EA_G70METNON227_PRIME	227 00:26	227 06:26	0	3650	155	3805	3322	-481	0	138	35	3495	2043	-1453	704	15%	1452
SP_288EA_C70METNON227_PRIME	227 06:26	227 13:41	1452	0	0	1452	3322	1870	0	562	43	2057	2761	703	704	25%	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	224 12:26	225 02:26	0.0	26.4	0.0	5.0	0.0	67.6	37.8	0.0	66.0	3.8	0.0	0.0	58.5	265.1
SP_288EA_C34BWGNON225_PRIME	225 02:26	225 15:11	0.0	24.1	126.9	4.6	0.0	45.3	34.4	0.0	59.7	7.0	0.0	0.0	0.0	302.0
DAILY TOTAL SCIENCE	224 12:26	225 15:11	0.0	50.5	126.9	9.6	0.0	112.9	72.2	0.0	125.6	10.8	0.0	0.0	58.5	
OBSERVATION_NOR	225 15:11	227 00:26	0.0	103.4	223.0	22.0	453.0	153.5	104.5	290.8	1209.3	518.8	538.0	0.0	153.2	3769.7
SP_288EA_G70METNON227_PRIME	227 00:26	227 06:26	0.0	11.3	54.0	2.2	0.0	21.3	16.2	0.0	28.1	3.3	0.0	0.0	0.0	136.4
SP_288EA_C70METNON227_PRIME	227 06:26	227 13:41	0.0	13.7	67.5	2.6	0.0	25.8	19.6	0.0	255.7	4.0	0.0	0.0	168.3	557.2
DAILY TOTAL SCIENCE	225 15:11	227 13:41	0.0	128.4	344.5	26.8	453.0	200.7	140.3	290.8	1493.1	526.1	538.0	0.0	321.6	

	CAPS (Mb)	CDA (Mb)	CIRS (Mb)	INMS (Mb)	ISS (Mb)	MAG (Mb)	MIMI (Mb)	RADAR (Mb)	RPWS (Mb)	UVIS (Mb)	VIMS (Mb)	PROBE (Mb)
TOTAL RECORDED (OPNAV data not included)	0.0	178.9	471.4	36.4	453.0	313.6	212.5	290.8	1618.8	537.0	538.0	0.0

Waypoint Selection

Good Waypoints

OBS_NAME	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_288NA_OBSERV224_NA	2017-224T12:26:00	2017-225T02:26:00	**BAD**	**BAD**	OK	OK	OK	OK	**BAD**	**BAD**	OK	OK
SP_288NA_OBSERV225_NA	2017-225T15:11:00	2017-227T00:26:00	**BAD**	**BAD**	**BAD**	**BAD**	**BAD**	**BAD**	**BAD**	**BAD**	**BAD**	**BAD**

1 2 3

RBOT Friendly

OBSERVATION PERIOD	START	END	POS_X	NEG_X	POS_Z	NEG_Z
SP_288NA_OBSERV224_NA	2017-224T12:26:00	2017-225T02:26:00	------	------	168.5/ 32.4	------
SP_288NA_OBSERV225_NA	2017-225T15:11:00	2017-227T00:26:00	------	------	------	------

4

Good Downlinks

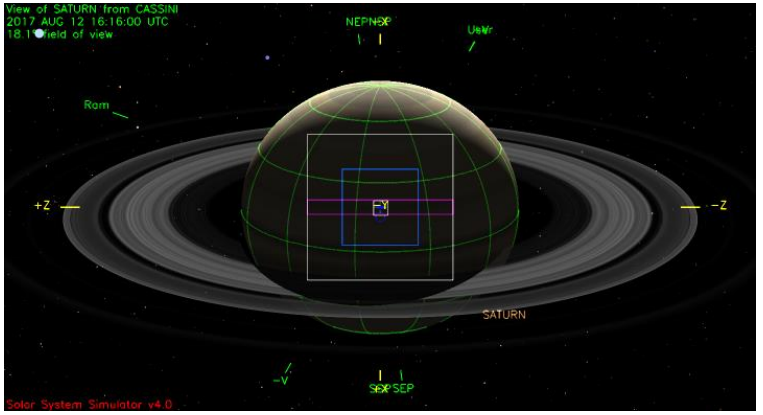
DOWNLINK	START	END	POS_X_2_NSP	POS_X_2_NEP	NEG_X_2_NSP	NEG_X_2_NEP	POS_Y_2_NSP	POS_Y_2_NEP	NEG_Y_2_NSP	NEG_Y_2_NEP	ROLL_FLAG
SP_288EA_C34BWGNON225_PRIME	2017-225T02:26:00	2017-225T15:11:00	OK	OK	**BAD**	**BAD**	OK	OK	**BAD**	**BAD**	11
SP_288EA_G70METNON226_PRIME	2017-227T00:26:00	2017-227T06:26:00	OK	OK	OK	OK	OK	OK	**BAD**	**BAD**	OK
SP_288EA_C70METNON227_PRIME	2017-227T06:26:00	2017-227T13:41:00	OK	OK	OK	OK	OK	OK	**BAD**	**BAD**	OK

SP Turn Times to/from WP for Gap 1

1) 17.5 min
2) 33.2 min
3) 19.6 min
4) 23.2 min

Waypoints Chosen (1/2)

Waypoint 1 (2017-224T13:06:00 – 224T19:26:00): Neg_Y to Saturn, Neg_X to NSP

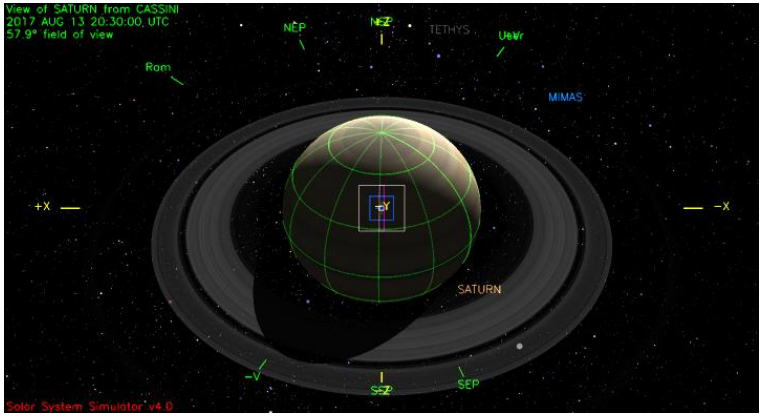


Waypoint 2 (2017-224T19:26:00 – 225T15:51:00): XBAND to Earth (0,0,-9.5), NEG_Y to Saturn

No diagram, since ORS is not Saturn pointed during this period.

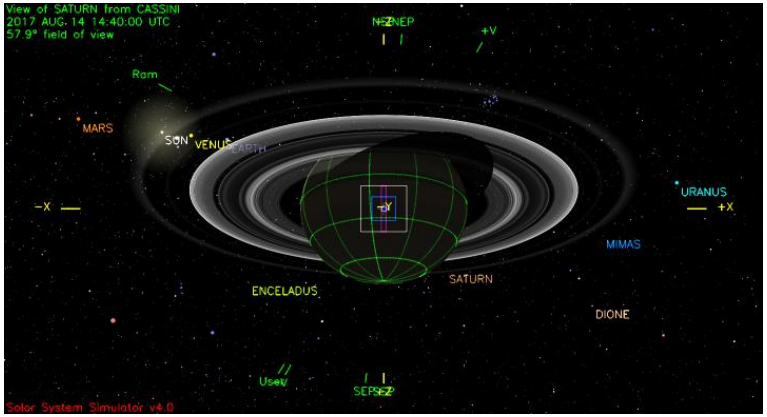
Waypoint 3 (2017-225T15:51:00 – 226T06:24:03): Neg_Y to Saturn, Pos_Z to NSP

Note: This waypoint is valid for the first part of the period – 225T15:51:00 to 226T00:32:00.
There were no valid waypoints for the remainder of the period, so observation we placed in a "custom" period.



Waypoints Chosen (2/2)

Waypoint 4 (2017-226T06:24:03 – 226T22:56:00): Neg_Y to Saturn, Neg_Z to NSP



Notes (1/1)

- Resource checker:
  - Disposition all resource checker items
    - 2017-226T05:22:54 SP_288SA_WAYPTTURN426_PRIME Request Name and Pointing indicate this request should have SPASS type of New Waypoint

      IGNORE – This is not a new waypoint. It is in the custom period.
    - 2017-226T05:22:54 ENGR_288SC_DFPWBIAS227_PPS Prior to the LMB S/C in RADWU, After the LMB S/C in DFPW_normal. Validate OpMode Strategy during Custom Period or LMB

      LMB must execute in order for OPMODE strategy to work.
    - 2017-226T00:51:54 SP_288NA_OBSMOV225_NA Request name does not match SP naming convention. Make sure Request name matches SP naming convention and update if necessary

      Disregard – Naming convention is correct.
    - 2017-227T00:26:00 SP_288EA_G70METNON227_PRIME First_Part value of SSRAP4 does not match default of SSRBP4 Second_Part value of SSRBP4 does not match default of SSRAP4. Validate SSR parameters for Downlink Pass Requests

      OKAY – Dual playback.
    - 2017-227T06:26:00 SP_288EA_C70METNON227_PRIME First_Part value of SSRAP4 does not match default of SSRBP4 Second_Part value of SSRBP4 does not match default of SSRAP4 Validate SSR parameters for Downlink Pass Requests

      OKAY – Dual playback
- Opmodes:
  - NO RWA-slow and/or unique opmodes
  - RCS
    - Transition to RCS Start (RADRCS) 2017-226T03:21:54
    - Return to RWA Start (DFPW_Normal) 2017-226T05:22:54
    - Deadband=(2,2,20)
- Special Activities:
  - ISS_288RI_CPLTSTRKP001_PIE (See Science Highlights)
  - INMS_288CO_SATAMOS001_PIE (See Science Highlights)
  - RADAR_288SA_2CMMAP001 (See Science Highlights)

Liens (1/1)

Sequence Liens (should all be SPLAT items):

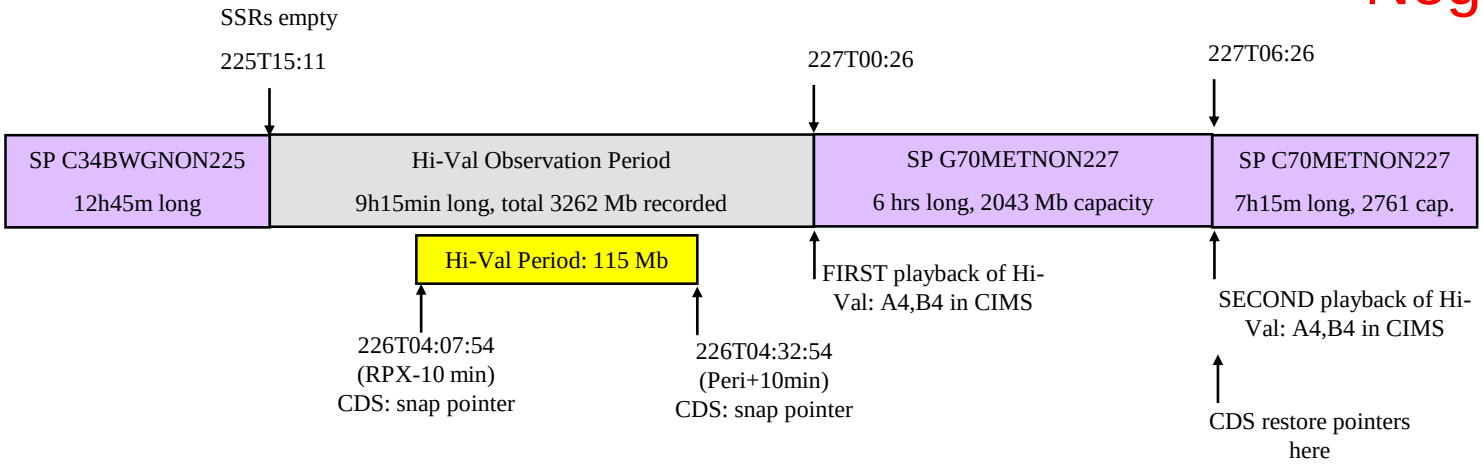
- List any Liens to be worked in SIP
  - **S101000001**; This waypoint turn is in an LMB. If the LMB fails to execute, the S/C will be left in an un-safe attitude and opmode strategy will not work. The LMB is tied to the epoch LMB_E288_Peri. Can be closed following the successful execution of the LMB mini-sequence.
  - **S101000144**: During DSN negotiations ensure that SSR-A is emptied before the pointers are reset. This item cannot be closed until the DSN negotiations are complete for both downlink passes, or the dual playback is deleted.
  - **S101000145**: The following science requests from 2017-225T15:51:00 --- 2017-226T22:16:00 in Saturn 288 have been designed in PDT during integration.
    VIMS_288SA_NPOLEMAP001_PRIME CIRS_288SA_LIMBINT001_PRIME
    ISS_288RI_CPLTSTRKP001_PIE INMS_288CO_SATAMOS001_PIE UVIS_288SA_AURSTARE001_PRIME
    Teams identified shall deliver these designs as part of Port 1 delivery. SIP leads to monitor.
    https://cassini.jpl.nasa.gov/tools/index.php?q=file_exchange/sip_xxm/s101/integration/sasf/Saturn_288_161214.sasf
  - **S101000146**: The following POST science requests from 2017-225T15:51:00 to 2017-226T22:16:00 in Saturn_288 has been designed in PDT during integration:
    INMS_288CO_SATAMOS001_PIE
    SIP leads to check that the POST science designs are the same as what has been approved in integration:
    https://cassini.jpl.nasa.gov/tools/index.php?q=file_exchange/sip_xxm/s101/integration/sasf/Saturn_288_161214.sasf
  - **S101000148:** CIRS consumable FR heating violation (Max heating of Tmax = 91.8 deg, DeltaT = 17.25 deg @ 2017-226T04:53) during INMS_288CO_SATAMOS001_PIE. Consumable FR waiver required. E-mail approval by M. Flasar (12/19/16).
  - **S101000149:** VIMS consumable FR heating violation (Max heating of Tmax = 68.4 deg, DeltaT = 8.71 deg @ 2017-226T05:01) during INMS_288CO_SATAMOS001_PIE. Consumable FR waiver required (SPLAT item). E-mail approval by E. Audi (11/21/16)
  - **S101000150:** PosX to Sun angle < 83 degrees between 2017-226T03:57:25 and 226T04:52:40 during INMS_288CO_STATMOS001_PIE. CMT management required.
  - **S101000205:** Radar activity within the Saturn 288 LMB. OBSMOV block spanning the LMB contains epoch relative telemetry mode changes for radar. Radar will need to update their IEB and trigger as part of the LMB process. Close once IEB/trigger update has been completed.

Dual Playback (Saturn 288)

Flyby	BEGHIVAL	ENDHIVAL	P4 Dual Playback Data Volume	SSR empty before hi-val observation period? (if not verify any carryover on A fits with Hi-Val data)	SSR-A empty after first playback?	PPL set to A4,B4 for first AND second playbacks?	SSRs empty after second playback? (if not does any Hi-Val data carry over?)
PERI	RPX-10min	Peri+10min	115 Mb	Yes	Yes	Yes	Yes

Playbacks contiguous:

Negotiated!



Reminder - ALL instruments' data is played back twice during P4 dual playback periods. In addition to the P4 dual playback, SCO/AACS has asked for P6 playback of RCS period encompassing periapsis

RBOT Summary

AACS Evaluation of Saturn 288 Jumpstart by David Bates (12/14/16)

"The RBOT results look good. Below are the kpt liens" ------ Dave Bates

- 2017-226T03:39:36.100 ISS_288RI_CPLTSTRKP001_PIE$6_7CMD FR37B16-1.2: VIMS Temperature Rise is above 2 deg
- 2017-226T03:57:29.410 INMS_288CO_SATAMOS001_PIE$2_7CMD CMT Violation POS_X_SUN Min Angle: 4.018045e+01 deg at 2017-226T04:47:51.730.
- 2017-226T04:10:58.210 INMS_288CO_SATAMOS001_PIE$2_7CMD FR89B23-1.2: CIRS Temperature Rise is above 5 deg
- 2017-226T04:25:40.210 INMS_288CO_SATAMOS001_PIE$2_7CMD FR89B20-1.2: CIRS Temperature Rise is above 10 deg