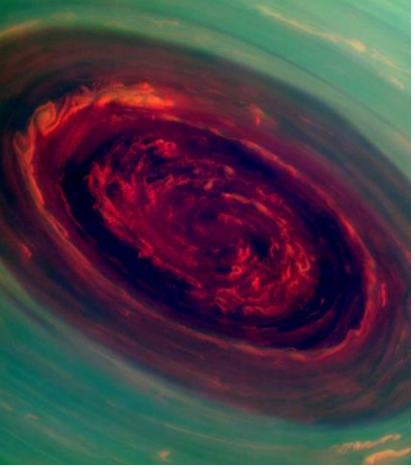
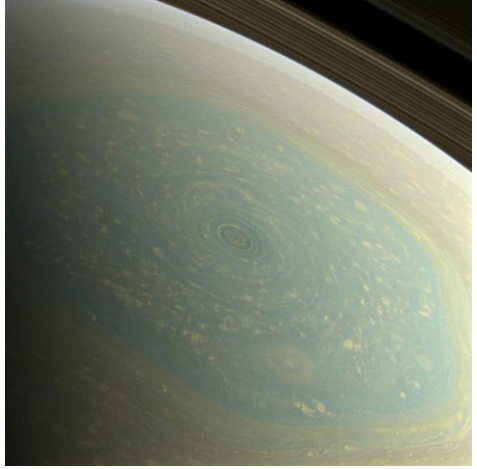
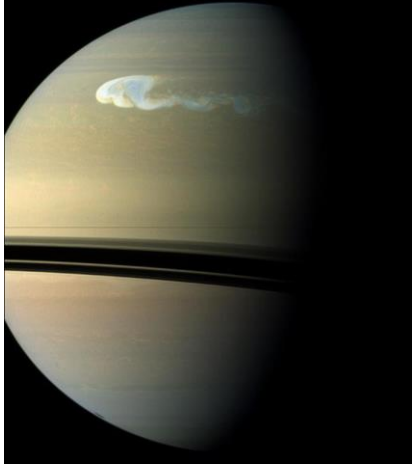


Science Planning & Sequence Team
CASSINI

SATURN TARGET WORKING TEAM

Rev 283_284 Segment Legacy Package

Segment Boundary: July 14, 2017 – July 22, 2017
2017-195T00:59 – 2017-203T14:51 (SCET)

Integration Began 10/03/2016
Segment Delivered to S101 Sequence 01/19/2017
Lead Integrator was Kyle Cloutier

Legacy Package Assembled by Kyle Cloutier

Table of Contents

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

Segment Overview and Final Products

Segment Summary

- This segment covered roughly 1.5 revs. Rev 284 periapse science focused on the Radio Science Subsystem's **last science observations of the mission.** This was among the **best opportunities** during the Cassini Mission to conduct radio occultations of Saturn's ring system and to run a gravity experiment to characterize Saturn's gravitational field with unprecedented detail.

- Observations on either side of periapse included a series of UVIS stellar occultations.

- 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 2)

	Request	Riders	Start (SCET)	Start (Epoch)	Duration	End	Primary	Secondary	Comments
	SATURN_283_284 Segment		2017-195T00:59:00		008T13:52:00	2017-203T14:51:00			
	SP_283SA_WAYPTTURN195_PRIME		2017-195T00:59:00		000T00:40:00	2017-195T01:39:00	ISS_NAC to Saturn	NEG_X to NSP	
	NEW WAYPOINT		**2017-195T01:39:00**		**001T04:42:00**	**2017-196T06:21:00**	**ISS_NAC to Saturn**	**NEG_X to NSP**	
	UVIS_283ST_GAMORI002_PIE		2017-195T01:54:00		000T01:14:00	2017-195T03:08:00	UVIS_FUV to 81.283/6.35 (0.258,0.0,0.0 deg. offset)	NEG_X to NSP	PIE
1a	VIMS_283SA_SHEMMAP001_PRIME	C	2017-195T03:08:00		000T02:02:00	2017-195T05:10:00	ISS_NAC to Saturn	NEG_X to NSP	
	UVIS_283ST_EPSORI001_PIE		2017-195T05:10:00		000T01:11:00	2017-195T06:21:00	UVIS_FUV to 84.054/-1.202 (0.258,0.0,0.0 deg. offset)	NEG_X to NSP	
1b	VIMS_283SA_SHEMMAP002_PRIME	C	2017-195T06:21:00		000T02:09:00	2017-195T08:30:00	ISS_NAC to Saturn	NEG_X to NSP	
	UVIS_283ST_ZETAORI001_PIE		2017-195T08:30:00		000T01:10:00	2017-195T09:40:00	UVIS_FUV to 85.19/-1.943 (0.258,0.0,0.0 deg. offset)	NEG_X to NSP	
Gap	ISS_283EN_PLUME001_PIE	C, U, V	2017-195T09:40:00		000T06:25:00	2017-195T16:05:00	ISS_NAC to Enceladus	NEG_X to NSP	SOST PIE
1c	VIMS_283SA_FULLDISK001_PRIME	C	2017-195T16:05:00		000T05:33:00	2017-195T21:38:00	ISS_NAC to Saturn	NEG_X to NSP	
	UVIS_283ST_EPSORI002_PIE		2017-195T21:38:00		000T01:14:00	2017-195T22:52:00	UVIS_FUV to 84.054/-1.202 (0.258,0.0,0.0 deg. offset)	NEG_X to NSP	
1d	VIMS_283SA_FULLDISK002_PRIME	C	2017-195T22:52:00		000T01:56:00	2017-196T00:48:00	ISS_NAC to Saturn	NEG_X to NSP	
	UVIS_283ST_ZETAORI002_PIE		2017-196T00:48:00		000T01:14:00	2017-196T02:02:00	UVIS_FUV to 85.19/-1.943 (0.258,0.0,0.0 deg. offset)	NEG_X to NSP	
1e	VIMS_283SA_FULLDISK003_PRIME	C	2017-196T02:02:00		000T03:39:00	2017-196T05:41:00	ISS_NAC to Saturn	NEG_X to NSP	
	SP_283EA_DLTURN196_PRIME		2017-196T05:41:00		000T00:40:00	2017-196T06:21:00	XBAND to Earth	NEG_X to NSP	
	NEW WAYPOINT		**2017-196T06:21:00**		**000T09:40:00**	**2017-196T16:01:00**	**XBAND to Earth**	**NEG_X to NSP**	
	SP_283EA_C34BWGOTP196_PRIME	C, N	2017-196T06:21:00		000T09:00:00	2017-196T15:21:00	XBAND to Earth	4_Hr_Rolling	OTP.
	SP_283SA_WAYPTTURN196_PRIME		2017-196T15:21:00		000T00:40:00	2017-196T16:01:00	ISS_NAC to Saturn	POS_Z to NSP	
Gap 2	**NEW WAYPOINT**		**2017-196T16:01:00**		**000T12:35:00**	**2017-197T04:36:00**	**ISS_NAC to Saturn**	**POS_Z to NSP**	
	CIRS_283SA_MIRMAP001_PRIME	U, V	2017-196T16:01:00		000T11:55:00	2017-197T03:56:00	CIRS_FP3 to Saturn	POS_Z to NSP	Storm Alley 40 degrees south
	Apoapse Per = 6.5 d, inc =...		2017-197T02:21:26		000T00:00:01	2017-197T02:21:27			
	SP_283EA_DLTURN197_PRIME		2017-197T03:56:00		000T00:40:00	2017-197T04:36:00	XBAND to Earth	NEG_X to NSP	
	NEW WAYPOINT		**2017-197T04:36:00**		**000T11:10:00**	**2017-197T15:46:00**	**XBAND to Earth**	**NEG_X to NSP**	
	ENGR_283SC_KPTYBIAS197_PRIME		2017-197T04:36:00		000T01:30:00	2017-197T06:06:00	NEG_Z to DELTA_H (0.0,0.0,-13.002 deg. offset)	NEG_X to Sun	
	SP_283EA_C34BWGNON197_PRIME	R	2017-197T06:06:00		000T09:00:00	2017-197T15:06:00	XBAND to Earth	Rolling	
	SP_284SA_WAYPTTURN197_PRIME		2017-197T15:06:00		000T00:40:00	2017-197T15:46:00	ISS_NAC to Saturn	NEG_X to NSP	
Gap 3	**NEW WAYPOINT**		**2017-197T15:46:00**		**000T14:20:00**	**2017-198T06:06:00**	**ISS_NAC to Saturn**	**NEG_X to NSP**	
	ISS_284SA_LIMBINT001_PRIME	U, V	2017-197T15:46:00		000T04:40:00	2017-197T20:26:00	ISS_NAC to Saturn	NEG_X to NSP	
	MAG_284SU_LFCALROLL001_PRIME	U	2017-197T20:26:00		000T09:00:00	2017-198T05:26:00	NEG_X to Earth (0.0,0.0,-30.0 deg. offset)	Rolling	
	SP_284EA_DLTURN198_PRIME		2017-198T05:26:00		000T00:40:00	2017-198T06:06:00	XBAND to Earth	NEG_X to NSP	
	NEW WAYPOINT		**2017-198T06:06:00**		**000T09:40:00**	**2017-198T15:46:00**	**XBAND to Earth**	**NEG_X to NSP**	
	SP_284EA_C34UNQOTB198_PRIME	C, E, N	2017-198T06:06:00		000T09:00:00	2017-198T15:06:00	XBAND to Earth	Rolling	OTB. Same secondary as OTP.
	SP_284SA_WAYPTTURN198_PRIME		2017-198T15:06:00		000T00:40:00	2017-198T15:46:00	ISS_NAC to Saturn	NEG_X to Sun	
	NEW WAYPOINT		**2017-198T15:46:00**		**000T19:52:00**	**2017-199T11:38:00**	**ISS_NAC to Saturn**	**NEG_X to Sun**	
4a	ISS_284SA_LIMBINT002_PRIME	U, V	2017-198T15:46:00		000T02:24:00	2017-198T18:10:00	ISS_NAC to Saturn	NEG_X to Sun	
Gap	UVIS_284ST_BETCMA001_PIE		2017-198T18:10:00		000T01:12:00	2017-198T19:22:00	UVIS_FUV to 95.675/-17.956 (0.258,0.0,0.0 deg. offset)	NEG_X to Sun	
4b	CIRS_284SA_COMPSIT001_PRIME	I, U, V	2017-198T19:22:00		000T11:36:00	2017-199T06:58:00	CIRS_FP1 to Saturn	NEG_X to Sun	58N left limb ring rain. We lost the last ring-rain observation due to reaction wheels.
	UVIS_284SA_AURDSTARE001_PRIME	C, I, V	2017-199T06:58:00		000T02:00:00	2017-199T08:58:00	VIMS_IR to Saturn	NEG_X to NSP	Collaborative Rider(s): VIMS
	UVIS_284SA_AURDSLEW001_PRIME	C, V	2017-199T08:58:00		000T02:00:00	2017-199T10:58:00	UVIS_FUV to Saturn	NEG_X to NSP	Collaborative Rider(s): VIMS

Final Sequenced SPASS (2 of 2)

Rev 284 Jumpstart

Gap

	Request	Riders	Start (SCET)	Start (Epoch)	Duration	End	Primary	Secondary	Comments
	SP_284EA_DLTURN199_PRIME		2017-199T10:58:00		000T00:40:00	2017-199T11:38:00	XBAND to Earth	NEG_Y to 127.0/-37.0	
	NEW WAYPOINT		2017-199T11:38:00		002T04:02:00	2017-201T15:40:00	XBAND to Earth	NEG_Y to 127.0/-37.0	
	ENGR_284SC_KPTYBIAS199_PRIME		2017-199T11:38:00		000T01:30:00	2017-199T13:08:00	POS_Z to DELTA_H (0.0,0.0,-18.001 deg. offset)	NEG_X to Sun	
	SP_284EA_C70METNON199_PRIME	C	2017-199T13:08:00		000T03:50:00	2017-199T16:58:00	XBAND to Earth	Rolling/SRU	SRU.
	SP_284EA_M34HEFNON199_PRIME	R	2017-199T16:58:00		000T02:55:00	2017-199T19:53:00	XBAND to Earth	Rolling/SRU	MAG Range 1 - Roll Requested. SRU.
	SP_284EA_M34BWGRSS199_PRIME	M, R	2017-199T19:53:00		000T04:20:00	2017-200T00:13:00	XBAND to Earth	Rolling/SRU	Collaborative Rider(s): MAG. RSS Gravity
	SP_284EA_G34BWGRSS200_PRIME	C, M, R	2017-200T00:13:00		000T03:45:00	2017-200T03:58:00	XBAND to Earth	Rolling/SRU	Collaborative Rider(s): MAG. RSS Gravity
	SP_284EA_C70METRSS400_PRIME	C, M, R	2017-200T03:58:00		000T03:06:00	2017-200T07:04:00	XBAND to Earth	Rolling/SRU	Collaborative Rider(s): MAG. RSS Gravity. SRU.
	RSS_284RI_PERIOCC001_PRIME	M, R	2017-200T07:04:00		000T02:07:00	2017-200T09:11:00	XBAND to Earth	Rolling	Collaborative Rider(s): MAG. Rolling initiated by previous SP request.
	Periapse R = 1.044 Rs, lat ...		2017-200T07:54:49		000T00:00:01	2017-200T07:54:50			
	SP_284EA_C70METRSS200_PRIME	M, R	2017-200T09:11:00		000T02:25:00	2017-200T11:36:00	XBAND to Earth	Rolling/SRU	Collaborative Rider(s): MAG. RSS Gravity. SRU.
	RSS_284RI_CRDOCC001_PRIME	R	2017-200T11:36:00		000T09:07:00	2017-200T20:43:00	XBAND to Earth	NEG_Y to 127.0/-37.0	
	VIMS_284SA_SHEMMAP001_PRIME	C, U	2017-200T20:43:00		000T07:47:00	2017-201T04:30:00	ISS_NAC to Saturn	NEG_X to NSP	
	ENGR_284SC_KPTYBIAS201_PRIME		2017-201T04:30:00		000T01:30:00	2017-201T06:00:00	NEG_Z to DELTA_H (0.0,0.0,10.997 deg. offset)	NEG_X to Sun	
	SP_284EA_C34BWGNON201_PRIME	C	2017-201T06:00:00		000T09:00:00	2017-201T15:00:00	XBAND to Earth	Rolling	
	SP_284SA_WAYPTTURN201_PRIME		2017-201T15:00:00		000T00:40:00	2017-201T15:40:00	ISS_NAC to Saturn	NEG_X to NSP	
	NEW WAYPOINT		2017-201T15:40:00		001T12:41:00	2017-203T04:21:00	ISS_NAC to Saturn	NEG_X to NSP	
	ISS_284TI_M150R2HZ201_PRIME	V	2017-201T15:40:00	E284_M150R2HZ201 +000T00:00:00	000T01:30:00	2017-201T17:10:00	ISS_NAC to Titan	NEG_X to NSP	No Preference to secondary pointing
	UVIS_284ST_EPSORI001_PIE		2017-201T17:36:00		000T01:10:00	2017-201T18:46:00	UVIS_FUV to 84.054/-1.202 (0.258,0.0,0.0 deg. offset)	NEG_X to NSP	
5a	UVIS_284SA_AURNSLEW001_PRIME	C, V	2017-201T18:46:00		000T01:25:00	2017-201T20:11:00	UVIS_FUV to Saturn	NEG_X to NSP	Collaborative Rider(s): VIMS
5a	UVIS_284SA_AURNSTARE001_PRIME	C, I, V	2017-201T20:11:00		000T01:25:00	2017-201T21:36:00	ISS_NAC to Saturn	NEG_X to NSP	Collaborative Rider(s): VIMS
5b	UVIS_284ST_ZETAORI001_PIE		2017-201T21:36:00		000T01:10:00	2017-201T22:46:00	UVIS_FUV to 85.19/-1.943 (0.258,0.0,0.0 deg. offset)	NEG_X to NSP	
5b	CIRS_284SA_FIRMAP001_PRIME	V	2017-201T22:46:00		000T10:11:00	2017-202T08:57:00	CIRS_FP1 to Saturn	NEG_X to NSP	
	UVIS_284ST_EPSORI002_PIE		2017-202T08:57:00		000T01:12:00	2017-202T10:09:00	UVIS_FUV to 84.054/-1.202 (0.258,0.0,0.0 deg. offset)	NEG_X to NSP	
5c	VIMS_284SA_NHEMMAP001_PRIME	C	2017-202T10:09:00		000T01:17:00	2017-202T11:26:00	ISS_NAC to Saturn	NEG_X to NSP	
5c	UVIS_284ST_ZETAORI002_PIE		2017-202T11:26:00		000T01:10:00	2017-202T12:36:00	UVIS_FUV to 85.19/-1.943 (0.258,0.0,0.0 deg. offset)	NEG_X to NSP	
	ISS_284TI_M150R2HZ202_PRIME	V	2017-202T12:36:00	E284_M150R2HZ202 +000T00:00:00	000T01:30:00	2017-202T14:06:00	ISS_NAC to Titan	NEG_X to NSP	No Preference to secondary pointing
5d	VIMS_284SA_FULLDISK001_PRIME	C	2017-202T14:06:00		000T07:09:00	2017-202T21:15:00	ISS_NAC to Saturn	NEG_X to NSP	
	UVIS_284ST_KAPORI001_PIE		2017-202T21:15:00		000T01:10:00	2017-202T22:25:00	UVIS_FUV to 86.939/-9.67 (0.258,0.0,0.0 deg. offset)	NEG_X to NSP	PIE in apoapse. Must point within 15 deg of Saturn Center.
5e	ISS_284SA_LIMBINT003_PRIME	U, V	2017-202T22:25:00		000T02:00:00	2017-203T00:25:00	ISS_NAC to Saturn	NEG_X to NSP	
5e	VIMS_284SA_NHEMMAP002_PRIME	C, I	2017-203T00:25:00		000T03:16:00	2017-203T03:41:00	ISS_NAC to Saturn	NEG_X to NSP	
	SP_284EA_DLTURN203_PRIME		2017-203T03:41:00		000T00:40:00	2017-203T04:21:00	XBAND to Earth	NEG_Y to 127.0/-37.0	
	NEW WAYPOINT		2017-203T04:21:00		002T13:20:00	2017-205T17:41:00	XBAND to Earth	NEG_Y to 127.0/-37.0	
	SP_284EA_YGAP203_PRIME		2017-203T04:21:00		000T01:30:00	2017-203T05:51:00	XBAND to Earth	NEG_Y to 127.0/-37.0	
	SP_284EA_C70METNON203_PRIME	C	2017-203T05:51:00		000T09:00:00	2017-203T14:51:00	XBAND to Earth	Rolling	
	Apoapse Per = 6.5 d, inc =...		2017-203T13:27:05		000T00:00:01	2017-203T13:27:06			

Final Sequenced SMT and Data Volume (1 of 2)

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

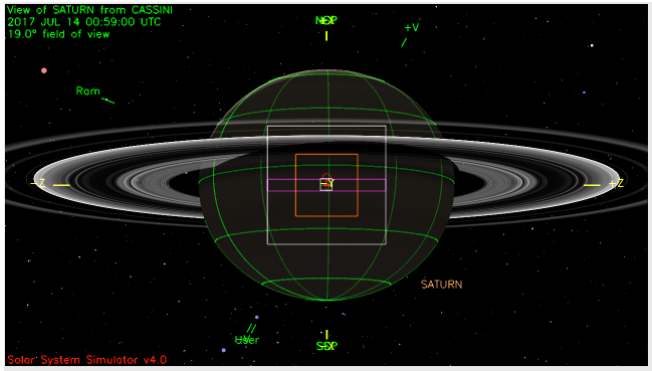
			OBSERVATION_PERIOD							DOWNLINK_PASS							
			P4						P5	RECORDED		PLAYBACK					
DOWNLINK PASS NAME	Start doy hh:mm	End doy hh:mm	START (Mb)	SCI (Mb)	HK+E (Mb)	TOTAL (Mb)	CPACTY (Mb)	MRGN (Mb)	OPNAV (Mb)	SCI (Mb)	ENGR (Mb)	TOTAL (Mb)	CPACTY (Mb)	MARGN (Mb)	NET_MARGN (Mb)	(%)	CAROVR (Mb)
SP_283EA_C34BWGOTP196_PRIME	196 06:21	196 15:21	0	2615	124	2740	3322	583	0	164	53	2957	753	-2204	0	0%	2204
SP_283EA_C34BWGNON197_PRIME	197 06:06	197 15:06	2204	305	62	2571	3322	751	0	106	53	2730	898	-1832	0	0%	1832
SP_284EA_C34UNQOTB198_PRIME	198 06:06	198 15:06	1832	677	63	2572	3322	750	0	156	53	2781	855	-1927	0	0%	1926
SP_284EA_C70METNON199_PRIME	199 13:08	199 16:58	1926	1001	93	3021	3322	301	0	70	23	3114	1279	-1835	37	0%	1834
SP_284EA_M34HEFNON199_PRIME	199 16:58	199 19:53	1834	0	0	1834	3322	1488	0	32	17	1884	207	-1678	37	0%	1677
SP_284EA_M34BWGRSS199_PRIME	199 19:53	200 00:13	1677	0	0	1677	3322	1645	0	73	26	1775	301	-1475	37	0%	1475
SP_284EA_G34BWGRSS200_PRIME	200 00:13	200 03:58	1475	0	0	1475	3322	1848	0	312	22	1809	269	-1540	37	0%	1540
SP_284EA_C70METRSS400_PRIME	200 03:58	200 07:04	1540	0	0	1540	3322	1782	0	358	18	1916	969	-948	37	0%	948
SP_284EA_C70METRSS200_PRIME	200 09:11	200 11:36	948	318	9	1274	3322	2048	0	223	14	1511	1024	-488	37	0%	487
SP_284EA_C34BWGNON201_PRIME	201 06:00	201 15:00	487	840	78	1405	3322	1917	0	175	53	1633	888	-746	37	0%	746
SP_284EA_C70METNON203_PRIME	203 05:51	203 14:51	746	2375	164	3285	3322	37	0	410	53	3748	3848	99	241	1%	0

Final Sequenced SMT and Data Volume (2 of 2)

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	195 00:59	196 06:21	0.0	55.4	202.7	10.6	650.0	52.2	89.9	0.0	96.2	663.7	771.0	0.0	122.7	2714.4
SP_283EA_C34BWGOTP196_PRIME	196 06:21	196 15:21	0.0	17.0	64.5	3.2	0.0	16.0	27.5	0.0	29.5	4.9	0.0	0.0	0.0	162.7
DAILY TOTAL SCIENCE	195 00:59	196 15:21	0.0	72.4	267.2	13.8	650.0	68.2	117.4	0.0	125.7	668.7	771.0	0.0	122.7	
OBSERVATION_NOR	196 15:21	197 06:06	0.0	27.8	85.8	5.3	0.0	26.2	45.1	0.0	48.3	43.2	20.0	0.0	61.6	363.4
SP_283EA_C34BWGNON197_PRIME	197 06:06	197 15:06	0.0	14.1	0.0	13.3	0.0	16.0	27.5	0.0	29.5	4.9	0.0	0.0	0.0	105.3
DAILY TOTAL SCIENCE	196 15:21	197 15:06	0.0	41.9	85.8	18.6	0.0	42.2	72.7	0.0	77.8	48.1	20.0	0.0	61.6	
OBSERVATION_NOR	197 15:06	198 06:06	0.0	14.1	0.0	5.4	400.0	74.7	45.9	0.0	49.1	21.8	60.0	0.0	62.7	733.8
SP_284EA_C34UNQOTB198_PRIME	198 06:06	198 15:06	0.0	8.5	64.5	3.2	0.0	16.0	27.5	0.0	29.5	4.9	0.0	0.0	0.0	154.2
DAILY TOTAL SCIENCE	197 15:06	198 15:06	0.0	22.6	64.5	8.6	400.0	90.7	73.4	0.0	78.6	26.8	60.0	0.0	62.7	
OBSERVATION_NOR	198 15:06	199 13:08	0.0	21.9	112.3	7.9	256.0	39.2	67.4	0.0	72.2	218.1	197.0	0.0	92.1	1084.0
SP_284EA_C70METNON199_PRIME	199 13:08	199 16:58	0.0	7.2	27.9	1.4	0.0	6.8	11.7	0.0	12.6	2.1	0.0	0.0	0.0	69.7
SP_284EA_M34HEFNON199_PRIME	199 16:58	199 19:53	0.0	5.5	0.0	1.1	0.0	5.2	8.9	0.0	9.6	1.6	0.0	0.0	0.0	31.8
SP_284EA_M34BWGRSS199_PRIME	199 19:53	200 00:13	0.0	8.2	0.0	2.0	0.0	29.0	16.2	0.0	14.2	2.4	0.0	0.0	0.0	71.9
SP_284EA_G34BWGRSS200_PRIME	200 00:13	200 03:58	0.0	7.1	29.7	1.7	0.0	26.7	16.2	0.0	225.9	2.1	0.0	0.0	0.0	309.3
SP_284EA_C70METRSS400_PRIME	200 03:58	200 07:04	0.0	17.7	33.5	2.2	0.0	22.1	13.7	0.0	264.1	1.7	0.0	0.0	0.0	355.0
DAILY TOTAL SCIENCE	198 15:06	200 07:04	0.0	67.6	203.4	16.2	256.0	129.0	134.2	0.0	598.5	227.9	197.0	0.0	92.1	
OBSERVATION_NOR	200 07:04	200 09:11	0.0	31.9	0.0	10.1	0.0	15.1	13.1	0.0	244.8	0.0	0.0	0.0	8.8	323.9
SP_284EA_C70METRSS200_PRIME	200 09:11	200 11:36	0.0	8.7	0.0	0.9	0.0	17.2	10.4	0.0	181.9	1.3	0.0	0.0	0.0	220.5
DAILY TOTAL SCIENCE	200 07:04	200 11:36	0.0	40.7	0.0	10.9	0.0	32.2	23.6	0.0	426.7	1.3	0.0	0.0	8.8	
OBSERVATION_NOR	200 11:36	201 06:00	0.0	34.7	56.0	6.6	0.0	69.8	57.7	0.0	233.1	14.1	360.0	0.0	76.9	909.0
SP_284EA_C34BWGNON201_PRIME	201 06:00	201 15:00	0.0	17.0	64.5	3.2	0.0	32.0	22.7	0.0	29.5	4.9	0.0	0.0	0.0	173.8
DAILY TOTAL SCIENCE	200 11:36	201 15:00	0.0	51.7	120.6	9.9	0.0	101.8	80.4	0.0	262.6	19.0	360.0	0.0	76.9	
OBSERVATION_NOR	201 15:00	203 05:51	0.0	73.3	251.3	14.0	392.0	138.2	97.9	0.0	127.3	610.6	649.0	0.0	162.4	2515.9
SP_284EA_C70METNON203_PRIME	203 05:51	203 14:51	0.0	17.0	86.4	3.2	0.0	32.0	22.7	0.0	239.8	4.9	0.0	0.0	0.0	406.0
DAILY TOTAL SCIENCE	201 15:00	203 14:51	0.0	90.3	337.7	17.2	392.0	170.2	120.6	0.0	367.0	615.5	649.0	0.0	162.4	

Segment Geometry (1 of 2)



Rev 283 OUTBOUND
2017 - 195T00:59:00 SCET
2017 JUL 14 00:59:00 SCET
2017 JUL 14 02:15:14 ERT
Apoapse_283 + 004T09:45:27
Periapse_283 + 001T04:10:45
Light time: 76.2 min
Orbit period: 6.5 days

Radius	907469 km	15.06 Rs
Rad_cyl	897744 km	14.90 Rs
Z_ht_cyl	-132495 km	-2.20 Rs
Mag_L	15.39	
Semi_axs	669167 km	11.10 Rs
Eccentricity	0.906	
Inclination	61.89 deg	
Sun_range	10.07 AU	
Earth_range	9.17 AU	

--- DSN ELEV -- D/L -- U/L --------

Goldstone	13.8	-13.4
Canberra	-24.7	-32.5
Madrid	6.6	24.5

-------- LOOK DIRECTION INFO --------

FOV	19.0 deg	331.6 mrad
RA	80.641 deg	
DEC	3.462 deg	
Crosses_RP_@	0.000 Rs	
EPS	2.833 deg	
SEP	150.702 deg	
ORS b/s angle	19.1 deg	
ORS rad angle	71.6 deg	*

Point NEG_Y at SATURN and align POS_X = Up with NSP

User vector - RA: +116.196 DEC: -42.405 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

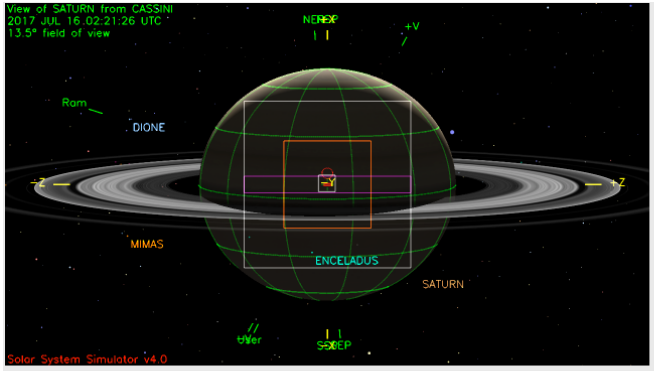
Turn analyzer: SATURN to EARTH about Z on RWA = 4.0 min / 18.5 deg Event

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	--	--	907469	15.06	847322	14.06	160.9	7.62	132.92	301	-8	0	5.2	0	0.0	18.5	128.9
MIMAS	--	--	916903	15.21	916706	15.21	160.9	0.03	0.45	82	-7	87	9.8	2454	11.5	20.1	118.0
ENCELADUS	--	--	1143119	18.97	1142862	18.96	159.5	0.03	0.45	9	-7	173	14.1	15	2.2	20.1	128.2
TETHYS	--	--	913126	15.15	912595	15.14	150.5	0.07	1.18	281	-8	-82	16.2	3668	18.6	27.2	145.5
DIONE	--	--	817998	13.57	817437	13.56	154.9	0.08	1.38	91	-9	64	5.5	-152	24.5	27.3	105.2
RHEA	--	--	1126909	18.70	1126145	18.69	142.6	0.08	1.36	311	-7	-100	13.6	2471	27.4	34.8	153.4
TITAN	--	--	1495290	24.81	1492715	24.77	120.1	0.20	3.44	320	-5	-90	10.8	-4011	52.6	57.0	163.5
HYPERION	--	--	2209411	36.66	2209282	36.66	152.4	0.01	0.15	325	50	-162	9.5	21812	11.4	25.9	140.3
IAPETUS	--	--	4312659	71.56	4311912	71.55	151.4	0.02	0.35	8	1	138	4.8	964080	33.4	31.2	95.7
PHOEBE	--	--	13253391	219.91	13253279	219.91	97.5	0.00	0.02	307	-15	-101	4.1	-344705	75.2	79.2	151.2
SATURN	--	--	907469	15.06	847322	14.06	160.9	7.62	132.92	301	-8	0	5.2	0	0.0	18.5	128.9

Segment Start: 2017-195T00:59

	Saturn Range	Phase Angle	Sub-S/C Lat.
Segment Start	15.06	160.9	-8
Apoapse	21.16	146.9	6
Periapse	1.05	33.2	-6
Apoapse	21.16	146.9	6
Segment End	21.16	146.6	7

Apoapse: 2017-197T02:21:26



Rev 283 OUTBOUND
2017 - 197T02:21:26 SCET
2017 JUL 16 02:21:26 SCET
2017 JUL 16 03:37:49 ERT
Apoapse_283 + 006T11:07:53
Periapse_283 + 003T05:33:11
Light time: 76.4 min
Orbit period: 6.5 days

Radius	1275471 km	21.16 Rs
Rad_cyl	1267790 km	21.04 Rs
Z_ht_cyl	139767 km	2.32 Rs
Mag_L	21.42	
Semi_axs	669123 km	11.10 Rs
Eccentricity	0.906	
Inclination	61.91 deg	
Sun_range	10.07 AU	
Earth_range	9.19 AU	

--- DSN ELEV -- D/L -- U/L --------

Goldstone	26.0	3.5
Canberra	-12.1	-30.4
Madrid	-8.6	15.4

-------- LOOK DIRECTION INFO --------

FOV	13.5 deg	236.1 mrad
RA	89.691 deg	
DEC	-10.555 deg	
Crosses_RP_@	0.000 Rs	
EPS	3.013 deg	
SEP	148.629 deg	
ORS b/s angle	33.0 deg	
ORS rad angle	57.0 deg	*

Point NEG_Y at SATURN and align POS_X = Up with NSP

User vector - RA: +116.196 DEC: -42.405 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 = 5.4 min / 33.4 deg Event

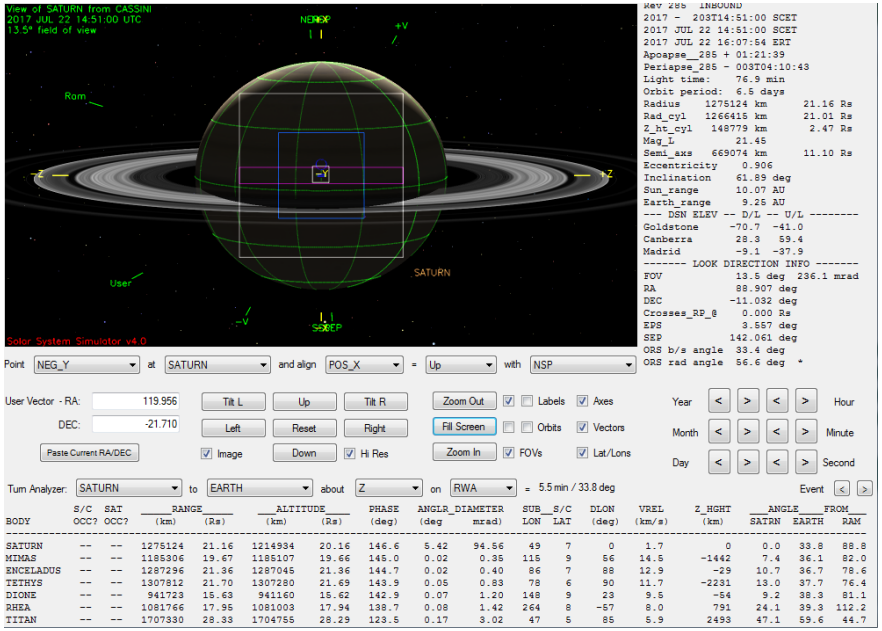
BODY	S/C OCC?	SAT OCC?	RANGE (km)	RANGE (Rs)	ALTITUDE (km)	ALTITUDE (Rs)	PHASE (deg)	ANGLR_DIAMETER (deg)	ANGLR_DIAMETER mrad)	SUB_S/C LON	SUB_S/C LAT	ALON (deg)	VREL (km/s)	Z_HGHT (km)	ANGLE FROM SATRN	ANGLE FROM EARTH	ANGLE FROM RAM
SATURN	--	--	1275471	21.16	1215271	20.16	146.9	5.42	94.54	161	6	0	1.7	0	0.0	33.4	90.0
MIMAS	--	--	1116989	18.53	1116785	18.53	145.4	0.02	0.37	147	9	27	14.0	-3271	4.3	35.3	86.3
ENCELADUS	--	--	1040175	17.26	1039918	17.25	145.5	0.03	0.49	183	8	1	12.0	-15	1.5	34.9	90.1
TETHYS	--	--	1385381	22.99	1384848	22.98	146.2	0.04	0.78	298	6	-106	11.6	799	11.8	33.0	101.1
DIONE	--	--	1635941	27.14	1635377	27.14	147.8	0.04	0.69	15	5	162	10.9	-61	4.4	32.9	85.6
RHEA	--	--	1491155	24.74	1490392	24.73	141.3	0.06	1.03	59	6	104	9.0	-1817	20.1	40.6	70.7
TITAN	--	--	2250925	37.35	2248350	37.31	143.2	0.13	2.29	330	3	-131	6.3	3000	23.9	35.0	111.9
HYPERION	--	--	2667199	44.26	2667075	44.25	149.3	0.01	0.12	82	35	165	6.3	25778	8.7	31.8	81.4
IAPETUS	--	--	4559325	75.65	4558578	75.64	143.6	0.02	0.33	11	6	137	4.3	932753	35.9	39.2	54.6
PHOEBE	--	--	13122821	217.74	13122710	217.74	97.1	0.00	0.02	63	-13	-92	3.0	-481940	81.9	79.4	162.4
SATURN	--	--	1275471	21.16	1215271	20.16	146.9	5.42	94.54	161	6	0	1.7	0	0.0	33.4	90.0

Segment Geometry (2 of 2)

Rev 284 Periapse: 2017-200T07:54:49
(not pictured)

Apoapse: 2017-203T13:27:05
(not pictured)

Segment End: 2017-203T14:51



	Saturn Range	Phase Angle	Sub-S/C Lat.
Segment Start	15.06	160.9	-8
Apoapse	21.16	146.9	6
Periapse	1.05	33.2	-6
Apoapse	21.16	146.9	6
Segment End	21.16	146.6	7

Solar Geometry – ORS Boresight Concerns

No ORS Boresight Solar Constraints on Science Pointing Noted.

Periapse Quicklooks

Rev 284

SP_284EA_M34BWGRSS199_PRIME	M, R
SP_284EA_G34BWGRSS200_PRIME	C, M, R
SP_284EA_C70METRSS400_PRIME	C, M, R
RSS_284RI_PERIOCC001_PRIME	M, R
Periapse R = 1.044 Rs, lat ...	
SP_284EA_C70METRSS200_PRIME	M, R
RSS_284RI_CRDOCC001_PRIME	R
VIMS_284SA_SHEMMAP001_PRIME	C, U

Radio Science Subsystem's **last science observations of the mission.** RSS took advantage of **one of the best opportunities, and in this case the last** during the Cassini Mission, to conduct radio occultations of Saturn's ring system and to run a gravity experiment to characterize Saturn's gravitational field with unprecedented detail.

RSS determined Saturn's gravity by very precisely tracking the orbit of Cassini relative to the Earth as the spacecraft plunges at about 30 km/s into the deepest recesses of the planet's gravity field, just skimming the atmosphere. RSS searched for deviations of gravity from spherical symmetry. While passing close to the planet, Cassini also felt the gravitational pull from the rings (the B-ring in particular), whose mass can therefore be determined very accurately, aiding in determining the age of the ring system.

Almost immediately after the S/C crossed the ring plane, RSS captured a near-periapse occultation observing the rings from a distance < ~1 Saturnian radius staring. These never-before-attempted occultations were short in duration (< 30 min) but covered the full ring system. As the spacecraft came out of periapse, RSS took advantage of an Earth occultation track geometry that systematically sweeps across the ring system, a set of distant RSS occultation chords was designed to collectively capture spread in both Earth relative and inertial ring longitudes.

As Cassini flew through periapse the spacecraft rolled to benefit the Magnetometer instrument. MAG collected unique measurements which together will 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 will lead to a better understanding of auroral processes (in conjunction with other instruments).

Science on the day of periapse finished with a nighttime map of Saturn's southern hemisphere by VIMS, with CIRS and UVIS riding.

Daily Science Highlights (1 of 4)

DOY 195 (14 July 2017): Saturn_283_284 was an ~8.5 day segment, covering a full orbit around Saturn. The first day's science alternates between UVIS stellar occultation observations and VIMS mapping of Saturn. UVIS observed the occultations of multiple stars in the constellation Orion. These observations were designed as an ensemble to capture a picture of temperature and some chemical maps of the thermosphere of Saturn. This region of Saturn's atmosphere is higher than CIRS and RSS are able to probe and was the last accessible region of Saturn's atmosphere that is open to initial exploration. A 'picture' of the thermosphere requires measuring temperature and chemical constituents (CH_4, C_2H_2, C_2H_4, C_2H_6, C_6H_6) sampled in both latitude and altitude. Multiple occultations, i.e. a dense sampling in latitude, is needed to create the full picture, which we can then use, with the principles of atmospheric chemistry and dynamics, to learn about the meridional circulation, eddy transports in 2 dimensions, and the roles of heating from auroral or other processes in the high atmosphere. What makes Saturn's thermosphere as hot as it is, especially at low latitudes, is still an open question remaining from Voyager discoveries.

UVIS observed Gamma Orionis (commonly known as Bellatrix in the constellation Orion) as it is occulted by Saturn's atmosphere, then Epsilon Orionis (commonly known as Alnilam), then Zeta Orionis (commonly known as Alnitak). As Cassini moved along its orbit around Saturn, UVIS caught an Epsilon Orionis occultation again. In between all of the particularly timed occultations, VIMS created a global map of the planet, piece by piece over a period of 11hr, including 4 2x3 mosaics covering the southern hemisphere from just north of the equator to off the south polar limb and a series of mosaics of the full disk of Saturn.

DOY 196 (15 July 2017): UVIS again observed an occultation of Zeta Orionis by Saturn's atmosphere. VIMS took one more mapping observation as part of the full disk map. Then, after a downlink of data to Earth, CIRS performed a temperature mapping observation in the mid-IR (MIRMAP), sitting at one latitude on the Central Meridian Longitude as Saturn rotates for 12hr. This obtained upper troposphere and tropopause temperatures at all longitudes at this specific latitude. CIRS uses this data to look for waves.

DOY 197 (16 July 2017): CIRS finished its MIRMAP. After another downlink to Earth, ISS took the lead to observe Saturn's lit limb, working with VIMS and UVIS to study the composition of the high atmosphere. The spacecraft then rolled for 9hr in support of a routine calibration of the Magnetometer instrument.

DOY 198 (17 July 2017): The spacecraft completed its roll and Magnetometer calibration. ISS performed another lit limb observation to study the composition of the high atmosphere with UVIS and VIMS. UVIS observed the occultation of the star Beta Canis Majoris, commonly known as Mirzam in the constellation Canis Major, by Saturn's atmosphere. Just as on DOY 195, this occultation was one of many used to study temperature and some chemical maps of the thermosphere of Saturn. CIRS, with ISS, UVIS and VIMS riding, studies the composition of Saturn's atmosphere as it rotated.

Daily Science Highlights (2 of 4)

DOY 199 (18 July 2017): CIRS completed its composition observation. UVIS and VIMS collaborated, with CIRS and ISS riding, to observe the illuminated northern auroral oval, first staring for 2hr, then with repeated slews for 2hr. Cassini then turned its high-gain antenna to Earth and, after a downlink of previously collected data, focused its attention on the Radio Science Subsystem's **last science observations of the mission**. Multiple DSN and ESA antennae were monitoring Cassini's signal. Beginning 12hr before periapse, the Radio Science Subsystem took advantage of **one of the best opportunities, and in this case the last** of the Cassini Mission, to conduct radio occultations of Saturn's ring system and to run a gravity experiment to characterize Saturn's gravitational field with unprecedented detail.

Radio Science began it's 24hr gravity experiment, **the 6th and last during the Grand Finale,** starting 12hr before periapse to determine Saturn's gravity field and infer constraints on its internal structure, helping to answer some of the key questions about what is inside Saturn, how the planet is layered, what it's temperature profile is, and how deep the winds are. RSS determined Saturn's gravity by very precisely tracking the orbit of Cassini relative to the Earth as the spacecraft plunged at about 30 km/s into the deepest recesses of the planet's gravity field, just skimming the atmosphere. RSS searched for deviations of gravity from spherical symmetry. According to the theory of rotating fluid bodies, these deviations reveal how density varies with depth and the depth to which the strong winds extend. While passing close to the planet, Cassini also felt the gravitational pull from the rings (the B-ring in particular), whose mass can therefore be determined very accurately, which also significantly constrains the age of the ring system.

The orbit of Cassini was inferred from radio tracking by the antennae of the DSN and the ESA network, which provided measurements of the spacecraft radial velocity as accurate as 0.01 mm/s after 60 s of averaging. This was about three billion times smaller than the spacecraft velocity. Cassini was tracked continuously for 24 hours around the pericenter during six of the 22 Grand Finale orbits. The favorable orbital geometry and the proximity to the planet allowed Cassini to measure gravity accelerations as small as 0.1 mGal (or 10 million times smaller than the acceleration of gravity on the Earth).

Daily Science Highlights (3 of 4)

DOY 200 (19 July 2017): As the gravity experiment continued and Cassini passed through periapse, RSS conducted radio occultations of Saturn's ring system **(again, the last RSS occultations of the mission)**. Almost immediately after the S/C crossed the ring plane, RSS captured a near-periapse occultation observing the rings from a distance < ~1 Saturnian radiius, staring. These never-before-attempted occultations were short in duration (< 30 min) but covered the full ring system. High resolution observations of both the scattered and direct signals were expected because of the smaller HGA footprint and the smaller Fresnel scale of diffraction.

As the spacecraft came out of periapse, RSS took advantage of an Earth occultation track geometry that systematically sweeps across the ring system. A set of distant RSS occultation chords was designed to collectively capture the spread in both Earth relative and inertial ring longitudes. The first allows exceptional characterization of the virtual azimuthal ring asymmetry due to gravitational wakes, known to permeate the A and B rings. The second allows characterization of true azimuthal ring asymmetry driven by ring dynamics, in particular, sharp edges and resonant interaction with the satellites and with Saturn's interior structure.

Uniquely, the campaign captured the rings when they were close to their maximum opening angle (B~26-27˚) as seen from the Earth, possible only close to the 2017 epoch of the proximal orbits. The large B-angle allowed maximum possible penetration of the radio signals of optically thick features of the B Ring and its 4 regions of distinct morphology, where most of the ring mass resides. The same is true for regions of optical depth enhancements within the many density and bending waves known to populate the A Ring and the some in the B Ring, allowing reliable profiling not only of wave frequencies but also of wave amplitudes, crucial for characterization of wave damping and hence ring viscosity, as well as standard inference of rings surface mass density, particularly of the massive B-Ring. The deep penetration was also crucial for reliable profiling of confined and optically thick ringlets across the ring system, in particular the plateau regions of the C Ring where puzzling behavior had been reported. The use of three coherent radio frequencies during these observation also helps constrain the physical properties of the rings' structures. The collective RSS Proximal occultations "campaign" was unprecedented in the Cassini Mission, with the unique Proximal orbit geometry enabling one of the best opportunities during the Cassini Mission to conduct radio occultations of Saturn's ring system.

As Cassini flew through periapse the spacecraft rolled to benefit the Magnetometer instrument. MAG collected unique measurements which together will 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 will lead to a better understanding of auroral processes (in conjunction with other instruments).

Science on the day of periapse finished with a nighttime map of Saturn's southern hemisphere by VIMS, with CIRS and UVIS riding.

Daily Science Highlights (4 of 4)

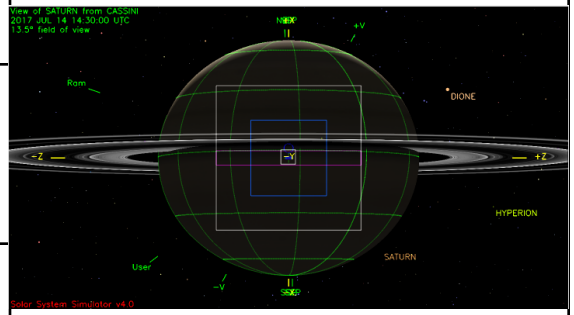
DOY 201 (20 July 2017): ISS preformed haze observations of Titan's atmosphere as part of the Titan Monitoring Campaign (phase 143.9 and range 1.9 Mkm) with VIMS riding. Then, continuing the occultation ensemble begun on DOY 195, UVIS began observing occultations of multiple stars in the constellation Orion. Specifically, UVIS observed Epsilon Orionis (commonly known as Alnilam in the constellation Orion) as it is occulted by Saturn's atmosphere, and Zeta Orionis (commonly known as Alnitak).In between these specifically timed occultations, UVIS and VIMS collaborated, with CIRS and ISS riding, to observe the dark southern auroral oval, first with repeated slews for ~1.5hr, then staring for ~1.5hr.

DOY 202 (21 July 2017): CIRS created a far IR map with the spatial resolution of about two degrees of latitude and longitude of Saturn's Southern Hemisphere to determine upper troposphere and tropopause temperature. UVIS again observed Epsilon Orionis, Zeta Orionis, then Kappa Orionis (commonly known as Saiph) as they were occulted by Saturn's atmosphere. In between all of the particularly timed occultations, VIMS created mosaics covering the northern hemisphere from just north of the north pole to the equator and maps Saturn with 3 3*4 mosaics of the full disk. ISS performed another haze observation of Titan's atmosphere as part of the Titan Monitoring Campaign (phase 134.8 and range 1.9Mkm).

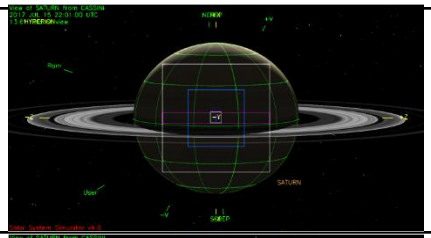
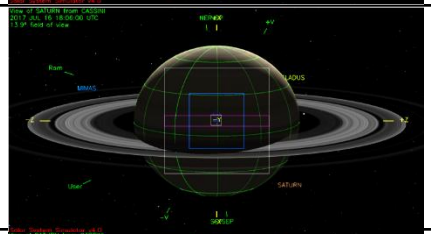
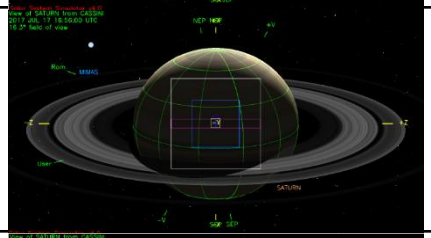
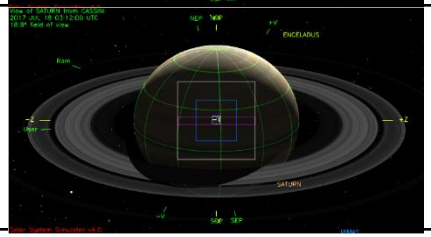
DOY 203 (22 July 2017): VIMS took another mosaic covering the northern hemisphere from just north of the north pole to the equator. The segment ended with a downlink of all data to Earth via the 70m antenna in Canberra, Australia. During this downlink, the Cassini spacecraft was at apoapse.

Segment Integration Planning

Timeline Gaps and Suggested Observations

Gap	Start	End	Duration	Phase angle (range)	Rs range	Sub-S/C Lat.	Snapshot (mid-gap)
1a	2017-195T03:08:00	2017-195T05:10:00	000T02:02:00	160.1 to 159.4	15.6 to 16.1	-7 to -7	
	Suggested observations: VIMS movie						
1b	2017-195T06:21:00	2017-195T08:30:00	000T02:09:00	158.9 to 158.2	16.4 to 16.9	-6 to -5	195T14:30 
	Suggested observations: VIMS movie						
1c	2017-195T16:05:00	2017-195T21:38:00	000T05:33:00	155.8 to 154.2	18.4 to 19.2	-3 to -1	
	Suggested observations: VIMS movie						
1d	2017-195T22:52:00	2017-196T00:48:00	000T01:58:00	153.9 to 153.4	19.4 to 19.6	-1 to 0	
	Suggested observations: VIMS movie						
1e	2017-196T02:02:00	2017-196T05:41:00	000T03:39	153.0 to 152.1	19.8 to 20.2	0 to 1	
	Suggested observations: VIMS movie						

Timeline Gaps and Suggested Observations

Gap	Start	End	Duration	Phase angle (range)	Rs range	Sub-S/C Lat.	Snapshot (mid-gap)
2	2017-196T16:01:00 Apo: 197T02:22	2017-197T03:56:00	000T11:55:00	149.5 to 146.5	20.9 to 21.2	4 to 7	
3	2017-197T15:46:00	2017-197T20:26:00	000T04:40:00	143.6 to 142.4	20.8 to 20.4	10 to 11	
4a	2017-198T15:46:00	2017-198T18:10:00	000T02:24:00	136.4 to 135.6	17.8 to 17.4	16 to 17	
4b	2017-198T19:22:00	2017-199T10:58:00	000T15:36:00	135.1 to 127.1	17.1 to 12.8	17 to 25	

Suggested observations: CIRS Map

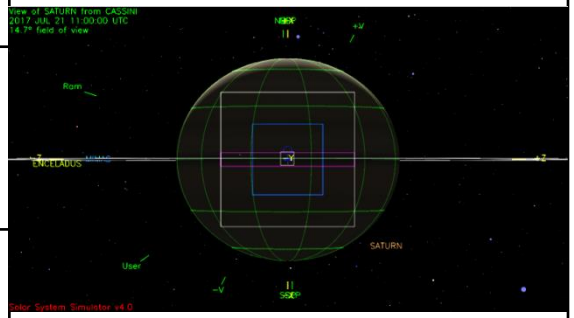
Suggested observations: ISS Limb

Suggested observations: ISS Limb

Suggested observations: CIRS Compsit/UVIS Aur

Peri: 200T07:55

Timeline Gaps and Suggested Observations

Gap	Start	End	Duration	Phase angle (range)	Rs range	Sub-S/C Lat.	Snapshot (mid-gap)
5a	2017-201T18:46:00	2017-201T21:36:00	000T02:15:00	158.2 to 157.3	16.7 to 17.3	-6 to -4	
	Suggested observations: VIMS Map						
5b	2017-201T22:46:00	2017-202T08:57:00	000T10:11:00	156.9 to 154.0	17.6 to 19.3	-4 to -1	202T11:00 
	Suggested observations: CIRS Map						
5c	2017-202T10:09:00	2017-202T11:26:00	000T01:17:00	153.7 to 153.3	19.4 to 19.6	-1 to 0	
	Suggested observations: VIMS Map						
5d	2017-202T14:06:00	2017-202T21:15:00	000T07:09:00	152.6 to 150.8	19.9 to 20.6	1 to 2	
	Suggested observations: VIMS Global Map						
5e	2017-202T22:30:00	2017-203T03:41:00	000T05:11:00	150.5 to 149.3	20.7 to 20.9	3 to 4	
	Apo: 203T13:27	Suggested observations: ISS Limb/VIMS					

Initial SMT and Data Volume

Beginning of Integration:

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_283EA_C34BWGOTP196_PRIME	196 06:21	196 15:21	0	1962	124	2086	3322	1236	0	199	53	2338	753	-1586	335	5%	1585
SP_283EA_C34BWGNON197_PRIME	197 06:06	197 15:06	1585	176	62	1823	3322	1499	0	122	53	1998	898	-1101	335	5%	1100
SP_284EA_C34BWGOTB198_PRIME	198 06:06	198 15:06	1100	232	63	1396	3322	1926	0	199	53	1648	896	-753	1108	12%	752
SP_284EA_C70METNON199_PRIME	199 13:08	199 16:43	752	733	93	1578	3322	1744	0	203	21	1802	1255	-548	1108	13%	547
SP_284EA_M70METNON199_PRIME	199 16:43	199 19:53	547	0	0	547	3322	2775	0	154	19	720	878	157	1108	15%	0
SP_284EA_M34BWGRSS199_PRIME	199 19:53	200 00:13	0	0	0	0	3322	3322	0	235	26	261	295	34	950	14%	0
SP_284EA_G34BWGRSS200_PRIME	200 00:13	200 07:04	0	0	0	0	3322	3322	0	608	40	648	509	-140	916	15%	139
SP_284EA_C70METRSS200_PRIME	200 09:11	200 11:36	139	507	9	655	3322	2667	0	212	14	881	1024	142	916	16%	0
SP_284EA_C34BWGNON201_PRIME	201 06:00	201 15:00	0	1381	78	1458	3322	1864	0	430	53	1942	888	-1055	773	16%	1054
SP_284EA_C70METNON203_PRIME	203 05:51	203 14:51	1054	1330	164	2549	3322	773	0	216	53	2817	3848	1030	1030	27%	0

Initial SMT and Data Volume

Beginning of Integration:

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	195 00:59	196 06:21	0.0	55.4	92.4	10.6	650.0	52.2	89.9	0.0	138.5	783.9	71.0	0.0	122.7	2066.6
SP_283EA_C34BWGOTP196_PRIME	196 06:21	196 15:21	0.0	17.0	86.4	3.2	0.0	16.0	27.5	0.0	42.4	4.9	0.0	0.0	0.0	197.5
DAILY TOTAL SCIENCE	195 00:59	196 15:21	0.0	72.4	178.8	13.8	650.0	68.2	117.4	0.0	180.9	788.8	71.0	0.0	122.7	
OBSERVATION_NOR	196 15:21	197 06:06	0.0	27.8	0.0	5.3	0.0	26.2	45.1	0.0	69.6	0.0	0.0	0.0	61.6	235.7
SP_283EA_C34BWGNON197_PRIME	197 06:06	197 15:06	0.0	17.0	0.0	13.3	0.0	16.0	27.5	0.0	42.4	4.9	0.0	0.0	0.0	121.2
DAILY TOTAL SCIENCE	196 15:21	197 15:06	0.0	44.8	0.0	18.6	0.0	42.2	72.7	0.0	112.0	4.9	0.0	0.0	61.6	
OBSERVATION_NOR	197 15:06	198 06:06	0.0	28.3	0.0	5.4	0.0	74.7	45.9	0.0	70.7	4.9	0.0	0.0	62.7	292.7
SP_284EA_C34BWGOTB198_PRIME	198 06:06	198 15:06	0.0	17.0	86.4	3.2	0.0	16.0	27.5	0.0	42.4	4.9	0.0	0.0	0.0	197.5
DAILY TOTAL SCIENCE	197 15:06	198 15:06	0.0	45.3	86.4	8.6	0.0	90.7	73.4	0.0	113.2	9.9	0.0	0.0	62.7	
OBSERVATION_NOR	198 15:06	199 13:08	0.0	41.6	0.0	7.9	0.0	39.2	67.4	0.0	435.4	134.8	0.0	0.0	92.1	818.4
SP_284EA_C70METNON199_PRIME	199 13:08	199 16:43	0.0	6.8	27.9	1.3	0.0	6.4	11.0	0.0	145.8	2.0	0.0	0.0	0.0	201.0
SP_284EA_M70METNON199_PRIME	199 16:43	199 19:53	0.0	6.0	0.0	1.1	0.0	5.6	9.7	0.0	128.8	1.7	0.0	0.0	0.0	153.0
SP_284EA_M34BWGRSS199_PRIME	199 19:53	200 00:13	0.0	8.2	0.0	1.6	0.0	28.7	16.2	0.0	176.3	2.4	0.0	0.0	0.0	233.2
SP_284EA_G34BWGRSS200_PRIME	200 00:13	200 07:04	0.0	24.8	63.2	3.2	0.0	48.7	29.9	0.0	428.4	3.8	0.0	0.0	0.0	602.0
DAILY TOTAL SCIENCE	198 15:06	200 07:04	0.0	87.3	91.1	15.2	0.0	128.6	134.2	0.0	1314.6	144.6	0.0	0.0	92.1	
OBSERVATION_NOR	200 07:04	200 09:11	0.0	31.9	0.0	10.1	0.0	15.1	13.1	0.0	432.0	0.0	0.0	0.0	8.8	511.0
SP_284EA_C70METRSS200_PRIME	200 09:11	200 11:36	0.0	8.7	0.0	0.9	0.0	17.2	10.4	0.0	171.6	1.3	0.0	0.0	0.0	210.2
DAILY TOTAL SCIENCE	200 07:04	200 11:36	0.0	40.7	0.0	10.9	0.0	32.2	23.6	0.0	603.7	1.3	0.0	0.0	8.8	
OBSERVATION_NOR	200 11:36	201 06:00	0.0	34.7	56.0	6.6	0.0	69.8	64.3	0.0	748.5	28.2	360.0	0.0	76.9	1445.1
SP_284EA_C34BWGNON201_PRIME	201 06:00	201 15:00	0.0	17.0	86.4	3.2	0.0	32.0	27.5	0.0	255.2	4.9	0.0	0.0	0.0	426.3
DAILY TOTAL SCIENCE	200 11:36	201 15:00	0.0	51.7	142.4	9.9	0.0	101.8	91.8	0.0	1003.8	33.1	360.0	0.0	76.9	
OBSERVATION_NOR	201 15:00	203 05:51	0.0	73.3	43.2	14.0	77.0	138.2	118.9	0.0	183.2	660.5	10.0	0.0	162.4	1480.7
SP_284EA_C70METNON203_PRIME	203 05:51	203 14:51	0.0	17.0	86.4	3.2	0.0	32.0	27.5	0.0	42.4	4.9	0.0	0.0	0.0	213.6
DAILY TOTAL SCIENCE	201 15:00	203 14:51	0.0	90.3	129.6	17.2	77.0	170.2	146.4	0.0	225.7	665.5	10.0	0.0	162.4	

	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	432.4	628.3	94.2	727.0	634.1	659.5	0.0	3553.8	1648.2	441.0	0.0

Waypoint Selection

RBOT – Friendly (Primary is NEG_Y to Saturn Center)

OBSERVATION PERIOD	START	END	POS_X	NEG_X	POS_Z	NEG_Z
SP_283NA_OBSERV195_NA	2017-195T00:59:00	2017-196T06:21:00	------	172.9/ 32.6	172.9/ 32.6	------
SP_283NA_OBSERV196_NA	2017-196T15:21:00	2017-197T06:06:00	------	172.9/ 32.6	172.9/ 32.6	------
SP_284NA_OBSERV197_NA	2017-197T15:06:00	2017-198T06:06:00	------	172.8/ 32.6	172.8/ 32.6	------
SP_284NA_OBSERV198_NA	2017-198T15:06:00	2017-199T13:08:00	------	172.9/ 32.5	172.9/ 32.5	------
SP_284NA_OBSERV200_NA	2017-200T07:43:00	2017-200T08:24:00	------	------	------	------
SP_284NA_OBSERV500_NA	2017-200T13:04:00	2017-201T05:43:00	------	------	------	------
SP_284NA_OBSERV201_NA	2017-201T14:58:00	2017-203T05:51:00	------	171.8/ 32.5	171.8/ 32.5	------
SP_284NA_OBSERV202_NA	2017-202T14:51:00	2017-203T05:51:00	------	171.8/ 32.5	171.8/ 32.5	------

Standard (Primary is NEG_Y to Saturn Center)

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_283NA_OBSERV195_NA	2017-195T00:59:00	2017-196T06:21:00	**BAD**	**BAD**	OK	OK	**BAD**	**BAD**	OK	OK	OK	OK
SP_283NA_OBSERV196_NA	2017-196T15:21:00	2017-197T06:06:00	**BAD**	**BAD**	OK	OK	OK	OK	**BAD**	**BAD**	OK	OK
SP_284NA_OBSERV197_NA	2017-197T15:06:00	2017-198T06:06:00	**BAD**	**BAD**	OK	OK	OK	OK	**BAD**	**BAD**	OK	OK
SP_284NA_OBSERV198_NA	2017-198T15:06:00	2017-199T13:08:00	**BAD**	**BAD**	OK	OK	OK	OK	**BAD**	**BAD**	OK	OK
SP_284NA_OBSERV200_NA	2017-200T07:43:00	2017-200T08:24:00	**BAD**	**BAD**	**BAD**	**BAD**	**BAD**	**BAD**	**BAD**	**BAD**	**BAD**	**BAD**
SP_284NA_OBSERV500_NA	2017-200T13:04:00	2017-201T05:43:00	**BAD**	**BAD**	**BAD**	**BAD**	**BAD**	**BAD**	**BAD**	**BAD**	**BAD**	**BAD**
SP_284NA_OBSERV201_NA	2017-201T14:58:00	2017-203T05:51:00	**BAD**	**BAD**	OK	OK	**BAD**	**BAD**	OK	**BAD**	OK	OK
SP_284NA_OBSERV202_NA	2017-202T14:51:00	2017-203T05:51:00	**BAD**	**BAD**	OK	OK	**BAD**	OK	OK	**BAD**	OK	OK

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_283EA_C34BWGOTP196_PRIME	2017-196T06:21:00	2017-196T15:21:00	OK	OK	OK	OK	OK	OK	OK	OK	OK
SP_283EA_C34BWGNON197_PRIME	2017-197T06:06:00	2017-197T15:06:00	OK	OK	OK	OK	OK	OK	OK	OK	OK
SP_284EA_C34BWGNON198_PRIME	2017-198T06:06:00	2017-198T15:06:00	OK	OK	OK	OK	OK	OK	OK	OK	OK
SP_284EA_C70METNON199_PRIME	2017-199T13:08:00	2017-199T16:43:00	OK	OK	**BAD**	**BAD**	OK	OK	OK	OK	0
SP_284EA_M70METNON199_PRIME	2017-199T16:43:00	2017-199T19:53:00	OK	OK	**BAD**	**BAD**	OK	OK	OK	OK	0
SP_284EA_M34BWGRSS199_PRIME	2017-199T19:53:00	2017-200T00:13:00	OK	OK	**BAD**	**BAD**	OK	OK	OK	OK	0
SP_284EA_G34BWGRSS200_PRIME	2017-200T00:13:00	2017-200T07:43:00	**BAD**	**BAD**	**BAD**	**BAD**	**BAD**	**BAD**	**BAD**	**BAD**	0
SP_284EA_C34BWGRSS200_PRIME	2017-200T08:24:00	2017-200T13:04:00	**BAD**	**BAD**	OK	OK	**BAD**	**BAD**	**BAD**	**BAD**	30
SP_284EA_C34BWGNON201_PRIME	2017-201T05:43:00	2017-201T14:58:00	OK	OK	OK	OK	OK	OK	OK	OK	OK
SP_284EA_C70METNON203_PRIME	2017-203T05:51:00	2017-203T14:51:00	OK	OK	OK	OK	OK	OK	OK	OK	OK

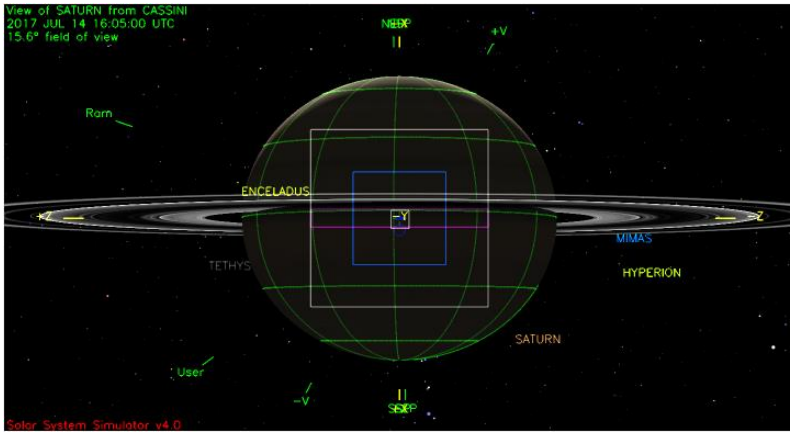
*** NEG_Y to Saturn not safe from 2017-200T17:09 to 200T23:59 (ORS to Sun < 15 deg.).**

- Minimum ORS to SUN angle is appx. 14.2 deg (CIRS Operational FR Zone).

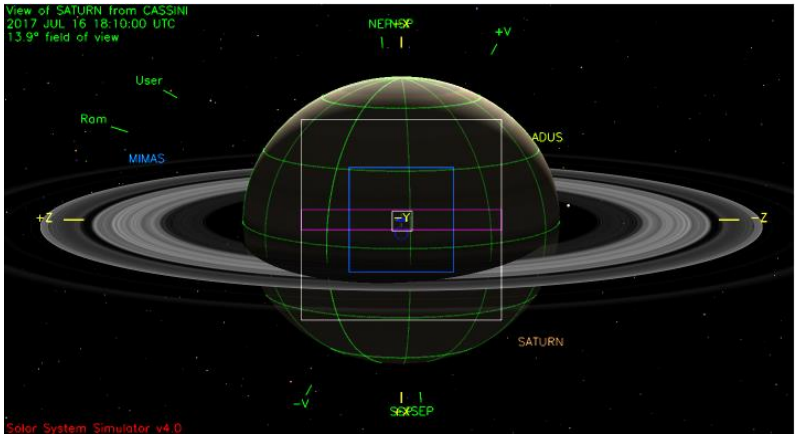
Waypoints during this time are: XBAND to Earth, NEG_Y to 127/-37

Waypoints Chosen (1 of 2)

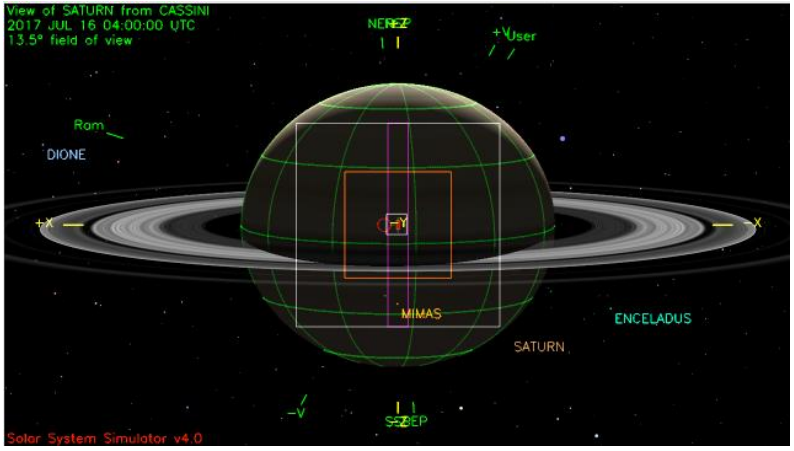
Waypoint 1 (2017-195T01:39 – 196T16:01):
NAC to Saturn, NEG_X to NSP



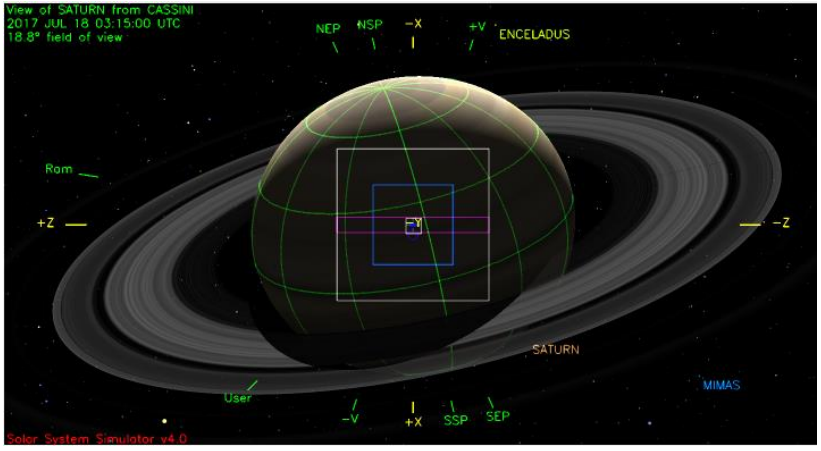
Waypoint 3 (2017-197T15:46 – 198T15:46):
NEG_Y to Saturn, NEG_X to NSP



Waypoint 2 (2017-196T16:01 – 197T15:46):
NEG_Y to Saturn, POS_Z to NSP



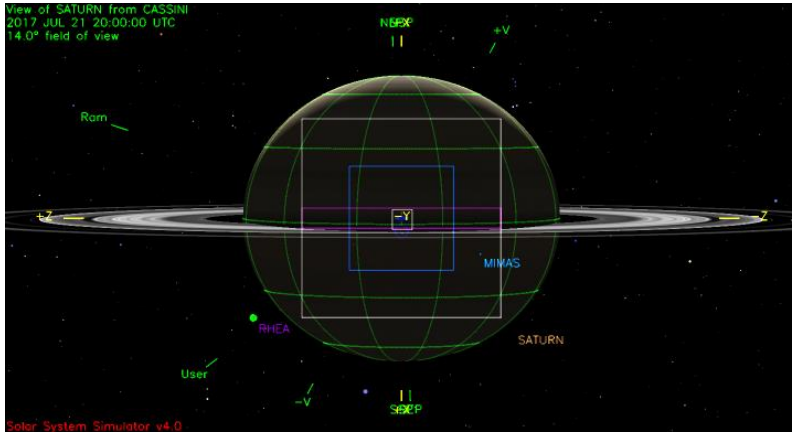
Waypoint 4 (2017-198T15:46 – 199T11:38):
NEG_Y to Saturn, NEG_X to Sun



Waypoints Chosen (2 of 2)

Waypoint 5 (2017-199T11:38 – 201T15:40):
XBAND_Earth, NEG_Y to 127/-37
(for RSS occultations, not pictured)

Waypoint 6 (2017-201T15:40 – 205T17:41):
NEG_Y to Saturn, NEG_X to NSP



Notes 1/3

- Pointing:
  - RBOT friendly waypoints used when compatible with science
  - **Waypoint has excessive heating for Periapse observation period** 2017-199T11:38 – 201T15:40 due to POST design
    - The waypoint attitude is XBAND to Earth / NEG_Y to 127.0/-37.0. All requests except one (VIMS) use this attitude (RSS GRAV/OCC and SP alternate Prime). There are CIRS and VIMS consumable heating for which waivers will be required (see next bullet). This is part of the jumpstart/POST predesign period, which has been verified in PDT.
  - CIRS and VIMS temperature/ boresight violations:
    - CIRS Max Temp = 83.43K (ΔT = 8.83K) @ 200T08:26 SCET
      - CIRS provided approval via email (Rich Achterberg 11/09)
      - **Consumable FR Waiver will be required (See SPLAT item)**
    - VIMS Max Temp = 65.96K (ΔT = 6.3K) @ 200T09:20 SCET
      - VIMS provided approval via email (Ed Audi 11/09)
      - **Consumable FR Waiver will be required (See SPLAT item)**
    - KPT complaints (from Dave Bates):
      - RSS_284SA_GRAVITY001_PIE heating issues

  - **Hand Edits to spturn PDT SASF Required:** MAG rolling during RSS GRAV/OCC experiment
    - Before running spturn, edit tab-delim SPASS to change:
      - SP_284EA_M34BWGRSS199_PRIME → RSS_284EA_M34BWGRSS199_PRIME
      - SP_284EA_G34BWGRSS200_PRIME → RSS_284EA_G34BWGRSS200_PRIME
      - SP_284EA_C70METRSS200_PRIME → RSS_284EA_C70METRSS200_PRIME

      so that these passes are left out of spturn. The SP_284EA_C70METNON199_PRIME request will only include the following M70METNON199_PRIME
    - Following the C70METNON request, **copy** in SP_284EA_M34BWGRSS199_PRIME request from https://cassini.jpl.nasa.gov/tools/index.php?q=file_exchange/view/sip_xxm/s101/integration/sasf/Saturn_284_161101.sasf
      - This request will match the commands within the RSS_284SA_GRAVITY001_PIE request from RSS POST design (https://cassini.jpl.nasa.gov/tools/index.php?q=file_exchange/view/sip_xxm/proximal/sasf/RSS_POST_284_150508.sasf), just renamed (SP_284EA_M34BWGRSS199_PRIME) and with new start time (2017-199T19:53:00) to match M34 SPASS request
      - Note: RSS does not deliver an individual SASF for the PERIOCC

Notes 2/3

- Periapse Jumpstart of Merged PDT & AACS analysis for teams early PDT deliveries during 2017-199T10:58 – 201T15:00 **(See SPLAT item)**

- Data Volume
  - No SMT warnings. SSR cleared by end of segment but constant carryover throughout

- Resource Checker
  - All gaps can be ignored (2)
    - 2017-195T01:39–01:54 between SP_283SA_WAYPTTURN195 & UVIS_283ST_GAMORI002_PIE (dur=15min)
    - 2017-201T17:10–17:36 between ISS_284RI_M150R2HZ201_PRIME & UVIS_284ST_EPSORI001_PIE (dur=26min)

- Hydrazine
  - N/A

- DSN
  - SP_284EA_C70METRSS200_PRIME was upgraded because RSS is requesting both 34M and 70M at this time anyway
  - Level 3 requests: Saturn Gravity and Rings Occultations Experiments: passes on DOY 199-200; Stations: DSS-55, DSS-25 (DOY 199), DSS-43, DSS-35, DSS-55, DSS-63 (DOY 200)
    - SP_284NA_M34BWGRSS199_SP
    - SP_284NA_G34BWGRSS199_SP
    - SP_284NA_C70METRSS200_SP
    - SP_284NA_C34METRSS200_SP
    - SP_284NA_M34BWGRSS200_SP
    - SP_284NA_M70BWGRSS200_SP
  - ap_downlink report check warnings can be ignored
    - ESA codes and precal times (45 min) okay

1. Rev 284 Saturn Gravity and Rings Occultations Experiments:
Level 3 request from 2017-199/1650 to 2017-200/2215
Stations: DSS-55 (DOY 199), DSS-25, DSS-43, DSS-35, DSS-63, DSS-55 (DOY 200)
ESA: DSS-84, DSS-74

Notes 3/3

- Opmodes
  - RSSKRWAF
    - Required for RSS OCCORT on DOY 197
    - Required for RSS_284SA_THERMAL001_RSS and RSS_284SA_GRAVITY001_PIE on DOY 199/200
  - RSS3BRWA**F** required for RSS_284RI_THERMAL001_RSS and RSS Peri/Chord Occs on DOY 200
    - VIMS, ISS, UVIS in 'sleep'
    - Full (not slow) RWA rates allowed for MAG rider

- Special Activities
  - RSS OCCORT from 2017-197T06:06:00 – 2017-197T15:06:00 SCET
    - RSS Operations Readiness Test (ORT), to demonstrate DSN and RSSG preparedness to support the Rev 284 Saturn gravity and rings occultation on 2017/199-200
    - DSS-35 and DSS-25 required to obtain X- and Ka-band downlink data
  - **Last RSS science observations of the mission:** RSS Gravity Science and Ring Occultations
    - RSS_284SA_GRAVITY001_PIE 2017-199T19:54:49 – 2017-200T19:54:49 SCET
    - RSS_284RI_PERIOCC001_PRIME 2017-200T07:04:00 – 2017-200T09:11:00 SCET
    - RSS_284RI_CRDOCC001_PRIME 2017-200T11:36:00 – 2017-200T20:43:00 SCET
    - MAG collaborative on all, including Prime SP requests (M34BWGRSS199, G34BWGRSS200, C70METRSS200)
      - Rolling about XBAND for MAG, rolling initiated by SP (see Hand Edits to spturn)
      - Periapse timing approved by MAG via email (Steve Kellock 11/07)
  - PIEs
    - 11 UVIS stellar occs
    - ISS_283EN_PLUME001_PIE (195T09:40 SCET)
    - RSS_284SA_GRAVITY001_PIE (199T19:54:49 SCET)

Liens

Sequence Liens (should all be SPLAT items):

- Target Motion Violations
  - None

- CIRS heating violation **Consumable FR waiver** required during RSS GRAV/OCC experiments (SPLAT #S101000236)
  - CIRS Max Temp = 83.43K (∆T = 8.83K) @ 200T08:26 SCET
  - CIRS provided approval via email (Rich Achterberg11/09)

- VIMS heating violation **Consumable FR waiver** required during RSS GRAV/OCC experiments (SPLAT #S101000237)
  - VIMS Max Temp = 65.96K (∆T = 6.3K) @ 200T09:20 SCET
  - VIMS provided approval via email (Ed Audi 11/09)

- RSS thruster keep out zone: 2017-199T19:54 – 200T20:43 (SPLAT #S101000238)

- The following science requests from 2017-199T10:58 – 201T15:00 in Saturn_283_284 have been designed in PDT during integration. Teams identified shall deliver these designs as part of the Port 1 delivery; SIP leads to monitor. (SPLAT #S101000239)

  RSS_284SA_GRAVITY001_PIE →(SP_M34BWGRSS199, SP_G34BWGRSS200, RSS_PERIOCC, SP_C70METRSS200)
  RSS_284RI_CRDOCC001_PIE
  VIMS_284SA_SHEMMAP001_PRIME

- SIP Leads to check that the POST science requests from 2017-199T19:53 — 2017-200T20:43 in Saturn 283_284 are the same as what has been approved in integration: https://cassini.jpl.nasa.gov/tools/index.php?q=file_exchange/view/sip_xxm/s101/integration/sasf/Saturn_284_161101.sasf (SPLAT #S101000240)
  - RSS_284SA_GRAVITY001_PIE sasf renamed as SP_M34BWGRSS199_PRIME includes SPASS requests SP_284EA_M34BWGRSS199_PRIME, SP_284EA_G34BWGRSS200_PRIME, RSS_284RI_PERIOCC001_PRIME, SP_284EA_C70METRSS200_PRIME
  - RSS_284RI_CRDOCC001_PIE sasf

RBOT Summary

AACS Evaluation of Saturn 283_284 Jumpstart by David Bates

Dave Bates: The kpt and RBOT runs looked good. RSS_284SA_GRAVITY001_PIE observation has VIMS and CIRS heating issues. Very benign.