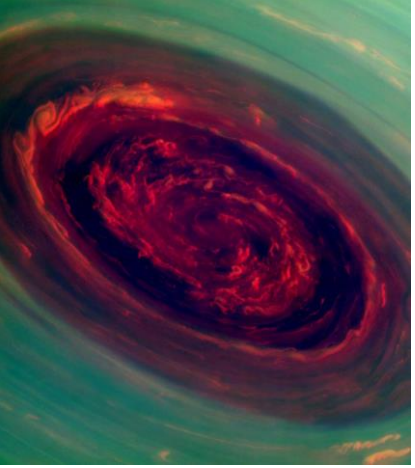
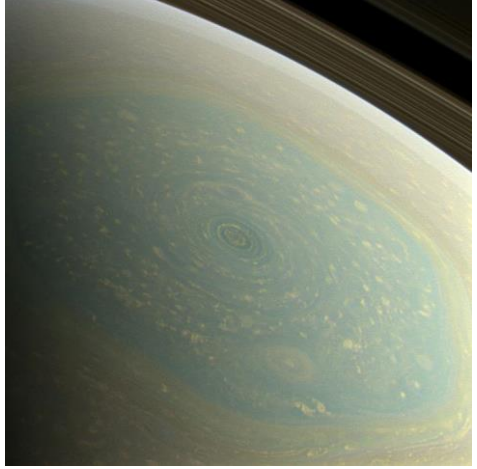
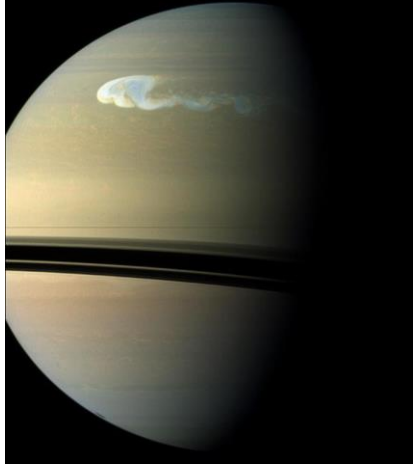


Science Planning & Sequence Team
CASSINI

SATURN TARGET WORKING TEAM

Rev 238 Segment Legacy Package

Segment Boundary: July 20, 2016 – July 24, 2016
2016-202T07:28 – 2016-206T23:27 (SCET)

Integration Began 08/17/2015
Segment Delivered to S95 Sequence 12/31/2015
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

- Rev 238 was an IN-2 periapse segment. Key science included ISS feature tracks, UVIS thermosphere imaging and auroral observations, VIMS mapping of the southern hemisphere, ISS limb integrations, and a VIMS/CIRS stellar occultation. Surrounding periapse, Radio Science occultations of both Saturn's atmosphere and the rings.
- ORS solar viewing constraints impacted science placement, but no CMT constraint management was required during the occulted period since Radio Science was prime at that time.

Final Sequenced SPASS

	Request	Riders	Start (SCET)	Start (Epoch)	Duration	End	Primary	Secondary	Comments
	SATURN_238 Segment		2016-202T07:28:00		004T15:59:00	2016-206T23:27:00			
Gap 1a	SP_238SA_WAYPTTURN202_PRIME		2016-202T07:28:00		000T00:40:00	2016-202T08:08:00	ISS_NAC to Saturn	NEG_Z to NSP	
	NEW WAYPOINT		2016-202T08:08:00		000T19:19:00	2016-203T03:27:00	ISS_NAC to Saturn	NEG_Z to NSP	
Gap 1b	ISS_238SA_FEATMAP001_PRIME	C, U, V	2016-202T08:08:00		000T07:52:00	2016-202T16:00:00	ISS_NAC to Saturn	NEG_Z to NSP	
	UVIS_238MI_LOPHASE001_PIE	C, I, V	2016-202T16:00:00		000T01:30:00	2016-202T17:30:00	UVIS_FUV to Mimas (0.115,0.0,0.0 deg. offset)	NEG_Z to NSP	
	UVIS_238SA_THERMOSPH001_PRIME		2016-202T17:30:00		000T09:17:00	2016-203T02:47:00	ISS_NAC to Saturn	NEG_Z to NSP	
	SP_238EA_DLTURN203_PRIME		2016-203T02:47:00		000T00:40:00	2016-203T03:27:00	XBAND to Earth	NEG_Y to 332.1/16.3	XBAND to Earth, RA/Dec for NEG_Y to Saturn (0,0,-9.5)
	NEW WAYPOINT		2016-203T03:27:00		000T11:10:00	2016-203T14:37:00	XBAND to Earth	NEG_Y to 332.1/16.3	
	ENGR_238SC_KPTYBIAS203_PRIME		2016-203T03:27:00		000T01:30:00	2016-203T04:57:00	NEG_Z to DELTA_H (0.0,0.0,90.0 deg. offset)	NEG_X to Sun	
	SP_238EA_C34BWGNON203_PRIME	C	2016-203T04:57:00		000T07:10:00	2016-203T12:07:00	XBAND to Earth	Rolling	MIMI. RA/Dec for NEG_Y to Saturn (0,0,-9.5).
	SP_238SA_WAYPTTURN203_PRIME		2016-203T13:57:00		000T00:40:00	2016-203T14:37:00	ISS_NAC to Saturn	NEG_Z to NSP	
	NEW WAYPOINT		2016-203T14:37:00		000T14:05:00	2016-204T04:42:00	ISS_NAC to Saturn	NEG_Z to NSP	
Gap 2	ISS_238SA_FEATRAK001_PRIME	C, M, U, V	2016-203T14:37:00		000T13:25:00	2016-204T04:02:00	ISS_NAC to Saturn	NEG_Z to NSP	
	SP_238EA_DLTURN204_PRIME		2016-204T04:02:00		000T00:40:00	2016-204T04:42:00	XBAND to Earth	NEG_X to NSP	
	NEW WAYPOINT		2016-204T04:42:00		000T09:40:00	2016-204T14:22:00	XBAND to Earth	NEG_X to NSP	
	SP_238EA_C70METOTP204_PRIME	C, E, N	2016-204T04:42:00		000T09:00:00	2016-204T13:42:00	XBAND to Earth	4_Hr_Rolling	CAPS.NEG_X to (NSP).OTP.SRU.
	SP_238SA_WAYPTTURN204_PRIME		2016-204T13:42:00		000T00:40:00	2016-204T14:22:00	ISS_NAC to Saturn	NEG_Z to NSP	
Gap 3	NEW WAYPOINT		2016-204T14:22:00		000T14:35:00	2016-205T04:57:00	ISS_NAC to Saturn	NEG_Z to NSP	
	UVIS_238SA_AURSLEW001_PRIME	C, I, V	2016-204T14:22:00		000T13:55:00	2016-205T04:17:00	UVIS_FUV to Saturn	NEG_Z to NSP	Collaborative Rider(s): ISS, VIMS
	Periapse R = 10.716 Rs, lat...		2016-205T03:09:14		000T00:00:01	2016-205T03:09:15			
	SP_238EA_DLTURN205_PRIME		2016-205T04:17:00		000T00:40:00	2016-205T04:57:00	XBAND to Earth	NEG_X to NSP	
	NEW WAYPOINT		2016-205T04:57:00		000T09:40:00	2016-205T14:37:00	XBAND to Earth	NEG_X to NSP	
	SP_238EA_C70METOTB205_PRIME	C, N	2016-205T04:57:00		000T09:00:00	2016-205T13:57:00	XBAND to Earth	NEG_X to NSP	CAPS.same secondary as OTP pass.OTB.SRU.
	SP_238SA_WAYPTTURN205_PRIME		2016-205T13:57:00		000T00:40:00	2016-205T14:37:00	UVIS_SOL_OFF to Sun	NEG_X to NSP	
Gap 4a	NEW WAYPOINT		2016-205T14:37:00		000T09:00:00	2016-205T23:37:00	UVIS_SOL_OFF to Sun	NEG_X to NSP	
	VIMS_238SA_SHEMMAP001_PRIME	R	2016-205T14:37:00		000T08:20:00	2016-205T22:57:00	ISS_NAC to Saturn	NEG_Z to NSP	
	SP_238SA_WAYPTTURN505_PRIME		2016-205T22:57:00		000T00:40:00	2016-205T23:37:00	XBAND to Earth	NEG_Y to 88.793/7.407	
	NEW WAYPOINT		2016-205T23:37:00		001T00:30:00	2016-207T00:07:00	XBAND to Earth	NEG_Y to 88.793/7.407	
	SP_238EA_DEADTIME205_PRIME		2016-205T23:37:00		000T00:20:00	2016-205T23:57:00	XBAND to Earth	NEG_Y to 88.793/7.407	
	RSS_238SA_OCC001_PIE		2016-205T23:57:00	LMB_E238_Saturn_RSS_Occ_Egr-000T04:37:16	000T04:44:00	2016-206T04:41:00	XBAND to Earth	NEG_Y to 88.793/7.407	
	RSS_238RI_OCC001_PIE		2016-206T04:41:00	LMB_E238_Saturn_RSS_Occ_Egr+000T00:06:44	000T03:28:00	2016-206T08:09:00	XBAND to Earth	NEG_Y to 88.793/7.407	
	SP_238EA_DEADTIME206_PRIME		2016-206T08:09:00	LMB_E238_Saturn_RSS_Occ_Egr+000T03:34:44	000T00:19:00	2016-206T08:28:00	XBAND to Earth	NEG_Y to 88.793/7.407	
Gap 4b	ISS_238TI_M90R1CLD206_PRIME		2016-206T08:29:00		000T02:00:00	2016-206T10:29:00	ISS_NAC to Titan	NEG_X to Sun	
	ISS_238SA_LIMBINT001_PRIME		2016-206T10:29:00		000T02:46:00	2016-206T13:15:00	ISS_NAC to Saturn	PIC	
	VIMS_238SA_ALPORIOCC001_PIE	C	2016-206T13:15:00		000T02:02:00	2016-206T15:17:00	VIMS_IR to 88.793/7.407	XBAND to Earth	Collaborative Rider(s): CIRS
	SP_238EA_YGAP206_PRIME		2016-206T15:17:00		000T01:30:00	2016-206T16:47:00	XBAND to Earth	NEG_Y to 88.793/7.407	
	SP_238EA_M34HEFNON206_PRIME		2016-206T16:47:00		000T06:40:00	2016-206T23:27:00	XBAND to Earth	NEG_Y to 88.793/7.407	NEG_Y to 88.793/7.407

Final Sequenced SMT and Data Volume

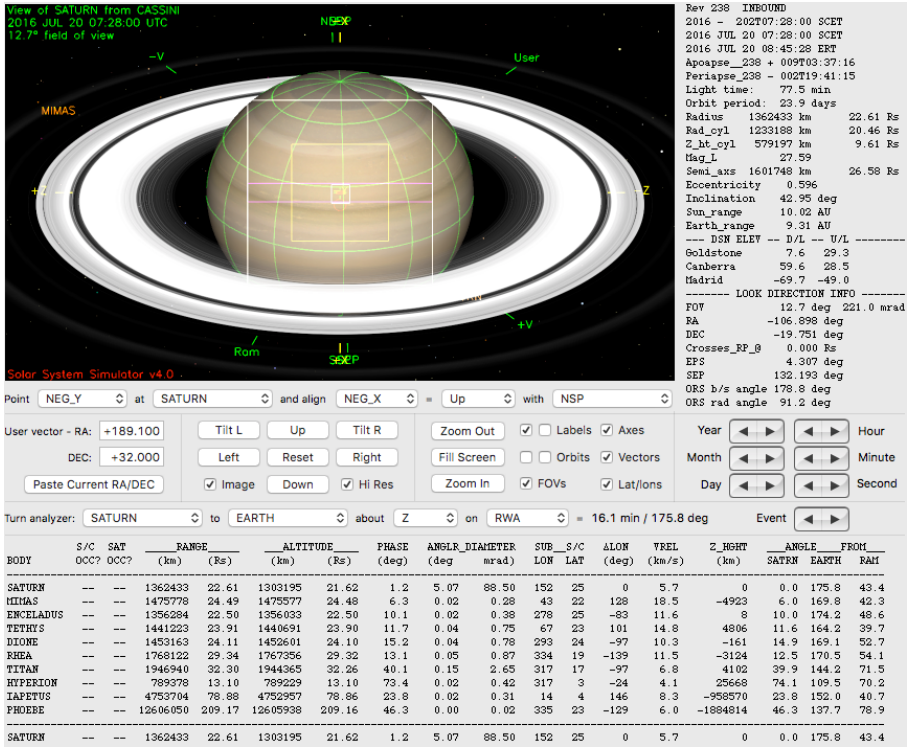
DATA VOLUME SUMMARY --- TRANSFER FRAME OVERHEAD INCLUDED (80 BITS PER 8800-BIT FRAME)

			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_238EA_C34BWGNON203_PRIME	203 04:57	203 12:07	0	1512	91	1603	3322	1719	0	157	42	1801	703	-1099	228	2%	1099
SP_238EA_C70METOTP204_PRIME	204 04:42	204 13:42	1099	1925	70	3094	3322	228	0	199	53	3346	3220	-126	557	4%	126
SP_238EA_C70METOTB205_PRIME	205 04:57	205 13:57	126	1945	64	2135	3322	1187	0	1016	53	3204	3762	557	557	5%	0
SP_238EA_M34HEFNON206_PRIME	206 16:47	206 23:27	0	780	113	893	3322	2429	0	51	39	984	480	-504	0	0%	504

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	202 07:28	203 04:57	0.0	40.5	78.2	7.7	579.4	38.2	65.7	0.0	101.3	275.9	311.0	0.0	89.8	1587.9
SP_238EA_C34BWGNON203_PRIME	203 04:57	203 12:07	0.0	13.5	66.6	2.6	0.0	12.7	21.9	0.0	33.8	3.9	0.0	0.0	0.0	155.1
DAILY TOTAL SCIENCE	202 07:28	203 12:07	0.0	54.0	144.8	10.3	579.4	51.0	87.7	0.0	135.1	279.8	311.0	0.0	89.8	
OBSERVATION_NOR	203 12:07	204 04:42	0.0	37.9	116.4	6.0	499.4	29.5	50.7	0.0	617.9	49.6	500.0	0.0	69.3	1976.7
SP_238EA_C70METOTP204_PRIME	204 04:42	204 13:42	0.0	17.0	86.4	3.2	0.0	16.0	27.5	0.0	42.1	4.9	0.0	0.0	0.0	197.2
DAILY TOTAL SCIENCE	203 12:07	204 13:42	0.0	54.9	202.8	9.2	499.4	45.5	78.3	0.0	660.0	54.6	500.0	0.0	69.3	
OBSERVATION_NOR	204 13:42	205 04:57	0.0	28.8	100.2	5.5	30.0	27.1	46.7	0.0	1236.8	252.1	200.0	0.0	63.7	1990.9
SP_238EA_C70METOTB205_PRIME	205 04:57	205 13:57	0.0	17.0	86.4	3.2	0.0	16.0	27.5	0.0	852.1	4.9	0.0	0.0	0.0	1007.2
DAILY TOTAL SCIENCE	204 13:42	205 13:57	0.0	45.7	186.6	8.7	30.0	43.1	74.2	0.0	2088.9	257.0	200.0	0.0	63.7	
OBSERVATION_NOR	205 13:57	206 16:47	0.0	25.3	29.3	9.7	138.6	23.9	58.0	0.0	87.9	0.0	400.0	0.0	112.1	884.7
SP_238EA_M34HEFNON206_PRIME	206 16:47	206 23:27	0.0	6.3	0.0	2.4	0.0	5.9	14.4	0.0	21.8	0.0	0.0	0.0	0.0	50.9
DAILY TOTAL SCIENCE	205 13:57	206 23:27	0.0	31.6	29.3	12.1	138.6	29.8	72.4	0.0	109.7	0.0	400.0	0.0	112.1	

Segment Geometry (1 of 2)

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Rev 238  INBOUND
2016 - 202T07:28:00 SCET
2016 JUL 20 07:28:00 SCET
2016 JUL 20 08:45:28 ERT
Apoapse__238 + 009T03:37:16
Periapse_238 - 002T19:41:15
Light time:    77.5 min
Orbit period:  23.9 days
Radius     1362433 km      22.61 Rs
Rad_cyl    1233188 km      20.46 Rs
Z_ht_cyl    579197 km       9.61 Rs
Mag_L         27.59
Semi_axs   1601748 km      26.58 Rs
Eccentricity    0.596
Inclination    42.95 deg
Sun_range      10.02 AU
Earth_range     9.31 AU
--- DSN ELEV -- D/L -- U/L --------
Goldstone       7.6   29.3
Canberra       59.6   28.5
Madrid        -69.7  -49.0
------- LOOK DIRECTION INFO -------
FOV            12.7 deg  221.0 mrad
RA           -106.898 deg
DEC           -19.751 deg
Crosses_RP_@    0.000 Rs
EPS             4.307 deg
SEP           132.193 deg
ORS b/s angle 178.8 deg
ORS rad angle  91.2 deg
```

Point NEG_Y at SATURN and align NEG_X = Up with NSP

User vector - RA: +189.100 DEC: +32.000 Paste Current RA/DEC

Tilt L | Up | Tilt R | Left | Reset | Right | Image | Down | Hi Res

Zoom Out | Fill Screen | Zoom In | Labels | Orbits | FOVs | Axes | Vectors | Lat/lons

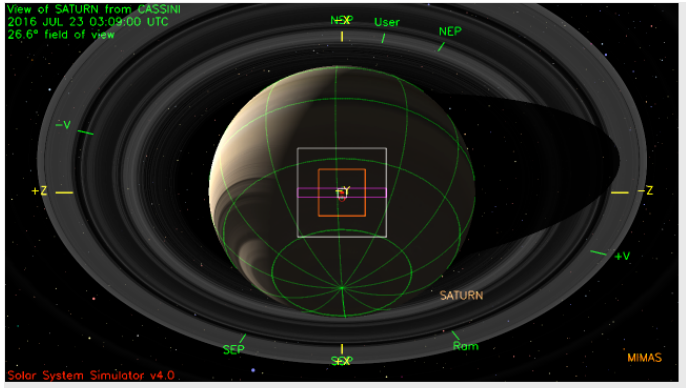
Year / Month / Day / Hour / Minute / Second / Event

Turn analyzer: SATURN to EARTH about Z on RWA = 16.1 min / 175.8 deg

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	--	--	1362433	22.61	1303195	21.62	1.2	5.07	88.50	152	25	0	5.7	0	0.0	175.8	43.4
MIMAS	--	--	1475778	24.49	1475577	24.48	6.3	0.02	0.28	43	22	128	18.5	-4923	6.0	169.8	42.3
ENCELADUS	--	--	1356284	22.50	1356033	22.50	10.1	0.02	0.38	278	25	-83	11.6	8	10.0	174.2	48.6
TETHYS	--	--	1441223	23.91	1440691	23.90	11.7	0.04	0.75	67	23	101	14.8	4806	11.6	164.2	39.7
DIONE	--	--	1453163	24.11	1452601	24.10	15.2	0.04	0.78	293	24	-97	10.3	-161	14.9	169.1	52.7
RHEA	--	--	1768122	29.34	1767356	29.32	13.1	0.05	0.87	334	19	-139	11.5	-3124	12.5	170.5	54.1
TITAN	--	--	1946940	32.30	1944365	32.26	40.1	0.15	2.65	317	17	-97	6.8	4102	39.9	144.2	71.5
HYPERION	--	--	789378	13.10	789229	13.10	73.4	0.02	0.42	317	3	-24	4.1	25668	74.1	109.5	70.2
IAPETUS	--	--	4753704	78.88	4752957	78.86	23.8	0.02	0.31	14	4	146	8.3	-958570	23.8	152.0	40.7
PHOEBE	--	--	12606050	209.17	12605938	209.16	46.3	0.00	0.02	335	23	-129	6.0	-1884814	46.3	137.7	78.9
SATURN	--	--	1362433	22.61	1303195	21.62	1.2	5.07	88.50	152	25	0	5.7	0	0.0	175.8	43.4

Segment Start: 2016-202T07:28

Periapse: 2016-205T03:09:14




```
Rev 238  INBOUND
2016 - 205T03:09:00 SCET
2016 JUL 23 03:09:00 SCET
2016 JUL 23 04:26:51 ERT
Apoapse__238 + 011T23:18:16
Periapse_238 - 00:00:15
Light time:    77.9 min
Orbit period:  23.9 days
Radius     646507 km      10.73 Rs
Rad_cyl    486085 km       8.07 Rs
Z_ht_cyl  -426254 km      -7.07 Rs
Mag_L         18.98
Semi_axs   1601337 km      26.57 Rs
Eccentricity    0.596
Inclination    42.95 deg
Sun_range      10.04 AU
Earth_range     9.36 AU
--- DSN ELEV -- D/L -- U/L --------
Goldstone      34.2   24.3
Canberra       10.2  -17.4
Madrid        -31.8   -3.0
------- LOOK DIRECTION INFO -------
FOV            26.6 deg  464.8 mrad
RA             -1.135 deg
DEC            36.556 deg
Crosses_RP_@    0.000 Rs
EPS             4.487 deg
SEP           129.392 deg
ORS b/s angle  65.5 deg
ORS rad angle 103.1 deg
```

Point NEG_Y at SATURN and align NEG_X = Up with NSP

User vector - RA: +189.100 DEC: +32.000 Paste Current RA/DEC

Tilt L | Up | Tilt R | Left | Reset | Right | Image | Down | Hi Res

Zoom Out | Fill Screen | Zoom In | Labels | Orbits | FOVs | Axes | Vectors | Lat/lons

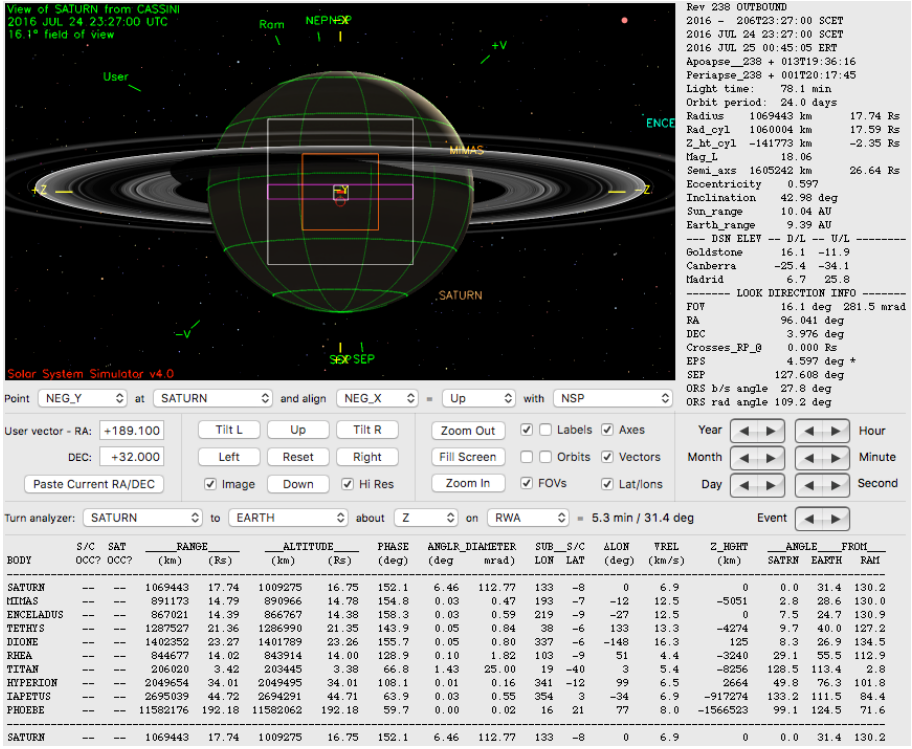
Year / Month / Day / Hour / Minute / Second / Event

Turn analyzer: SATURN to EARTH about Z on RWA = 7.6 min / 62.1 deg

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	--	--	646507	10.73	588758	9.77	114.5	10.70	186.71	177	-41	0	9.7	0	0.0	62.1	90.0
MIMAS	--	--	749179	12.43	748980	12.43	102.1	0.03	0.55	319	-35	-129	20.7	-4912	12.8	74.3	78.2
ENCELADUS	--	--	494118	8.20	493867	8.19	116.2	0.06	1.04	191	-60	-3	3.7	13	18.5	61.6	103.3
TETHYS	--	--	488961	8.11	488431	8.10	132.1	0.13	2.21	127	-59	24	6.3	-4720	25.6	45.9	115.5
DIONE	--	--	443199	7.35	442639	7.34	111.9	0.15	2.54	210	-74	-7	1.8	-174	34.5	67.2	111.6
RHEA	--	--	868727	14.41	867963	14.40	148.5	0.10	1.77	42	-29	96	14.4	2837	37.2	27.3	110.1
TITAN	--	--	1132547	18.79	1129972	18.75	48.2	0.26	4.55	338	-22	-57	7.5	-4811	83.0	131.9	74.6
HYPERION	--	--	1179668	19.57	1179524	19.57	123.0	0.02	0.28	229	-12	26	6.9	15637	107.8	61.4	162.1
IAPETUS	--	--	3743434	62.11	3742688	62.10	53.1	0.02	0.40	360	-7	-126	11.6	-949521	65.8	122.4	28.1
PHOEBE	--	--	11275934	187.10	11275825	187.09	53.3	0.00	0.02	89	19	-26	11.3	-1693210	137.6	130.8	96.2
SATURN	--	--	646507	10.73	588758	9.77	114.5	10.70	186.71	177	-41	0	9.7	0	0.0	62.1	90.0

	Saturn Range	Phase Angle	Sub-S/C Lat.
Segment Start	22.61	1.2	25
Periapse	10.73	114.5	-41
Segment End	17.74	152.1	-8

Segment Geometry (2 of 2)

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Rev 238 OUTBOUND
2016 -  206T23:27:00 SCET
2016 JUL 24 23:27:00 SCET
2016 JUL 25 00:45:05 ERT
Apoapse__238 + 013T19:36:16
Periapse_238 + 001T20:17:45
Light time:    78.1 min
Orbit period:  24.0 days
Radius     1069443 km      17.74 Rs
Rad_cyl    1060004 km      17.59 Rs
Z_bt_cyl   -141773 km      -2.35 Rs
Mag_L          18.06
Semi_axs   1605242 km      26.64 Rs
Eccentricity    0.597
Inclination    42.98 deg
Sun_range      10.04 AU
Earth_range     9.39 AU
--- DSN ELEV -- D/L -- U/L --------
Goldstone      16.1  -11.9
Canberra      -25.4  -34.1
Madrid          6.7   25.8
------- LOOK DIRECTION INFO -------
FOV            16.1 deg  281.5 mrad
RA             96.041 deg
DEC             3.976 deg
Crosses_RP_@    0.000 Rs
EPS             4.597 deg *
SEP           127.608 deg
ORS b/s angle  27.8 deg
ORS rad angle 109.2 deg
```
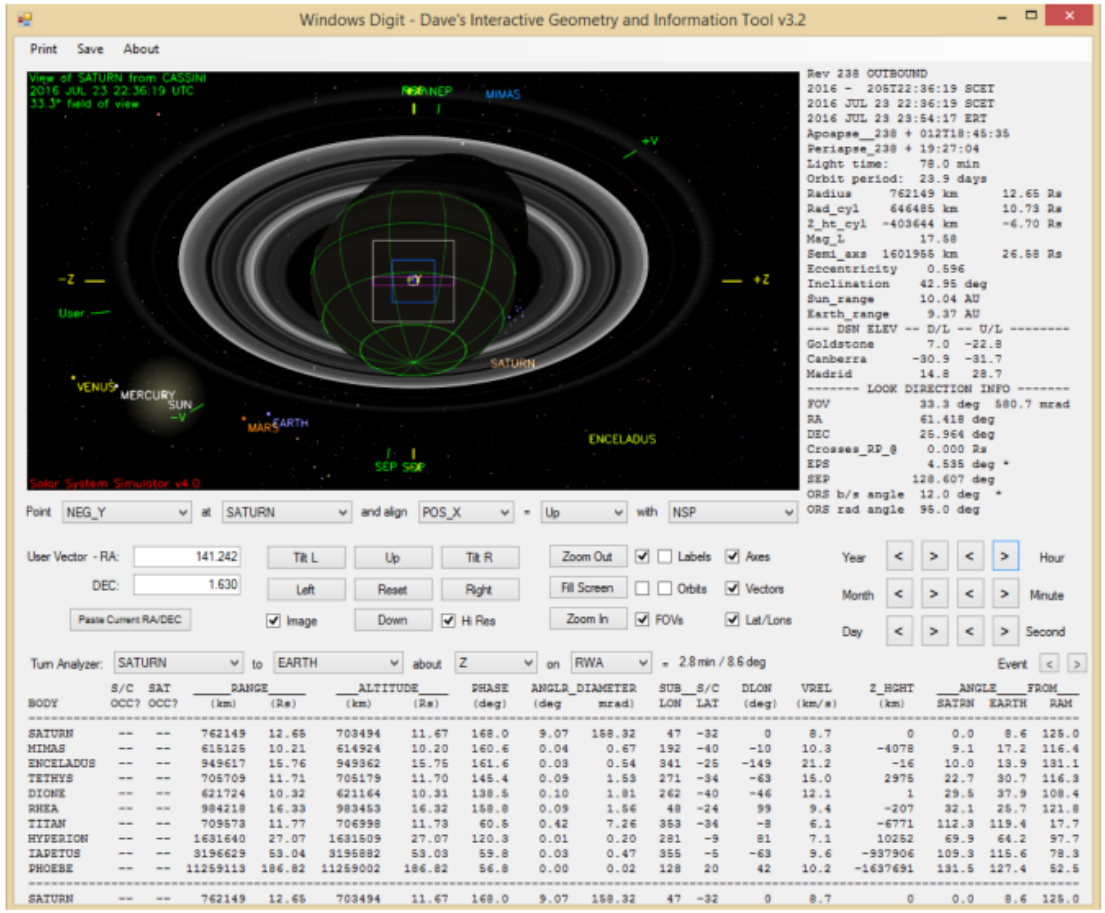

BODY	S/C OCC?	SAT OCC?	RANGE (km)	RANGE (Rs)	ALTITUDE (km)	ALTITUDE (Rs)	PHASE (deg)	ANGLR_DIAMETER (deg	ANGLR_DIAMETER mrad)	SUB_S/C LON	SUB_S/C LAT	ΔLON (deg)	VREL (km/s)	Z_HGHT (km)	ANGLE_FROM SATRN	ANGLE_FROM EARTH	ANGLE_FROM RAH
SATURN	--	--	1069443	17.74	1009275	16.75	152.1	6.46	112.77	133	-8	0	6.9	0	0.0	31.4	130.2
MIMAS	--	--	891173	14.79	890966	14.78	154.8	0.03	0.47	193	-7	-12	12.5	-5051	2.8	28.6	130.0
ENCELADUS	--	--	867021	14.39	866767	14.38	158.3	0.03	0.59	219	-9	-27	12.5	0	7.5	24.7	130.9
TETHYS	--	--	1287527	21.36	1286990	21.35	143.9	0.05	0.84	38	-6	133	13.3	-4274	9.7	40.0	127.2
DIONE	--	--	1402352	23.27	1401789	23.26	155.7	0.05	0.80	337	-6	-148	16.3	125	8.3	26.9	134.5
RHEA	--	--	844677	14.02	843914	14.00	128.9	0.10	1.82	103	-9	51	4.4	-3240	29.1	55.5	112.9
TITAN	--	--	206020	3.42	203445	3.38	66.8	1.43	25.00	19	-40	3	5.4	-8256	128.5	113.4	2.8
HYPERION	--	--	2049654	34.01	2049495	34.01	108.1	0.01	0.16	341	-12	99	6.5	2664	49.8	76.3	101.8
IAPETUS	--	--	2695039	44.72	2694291	44.71	63.9	0.03	0.55	354	3	-34	6.9	-917274	133.2	111.5	84.4
PHOEBE	--	--	11582176	192.18	11582062	192.18	59.7	0.00	0.02	16	21	77	8.0	-1565523	99.1	124.5	71.6
SATURN	--	--	1069443	17.74	1009275	16.75	152.1	6.46	112.77	133	-8	0	6.9	0	0.0	31.4	130.2

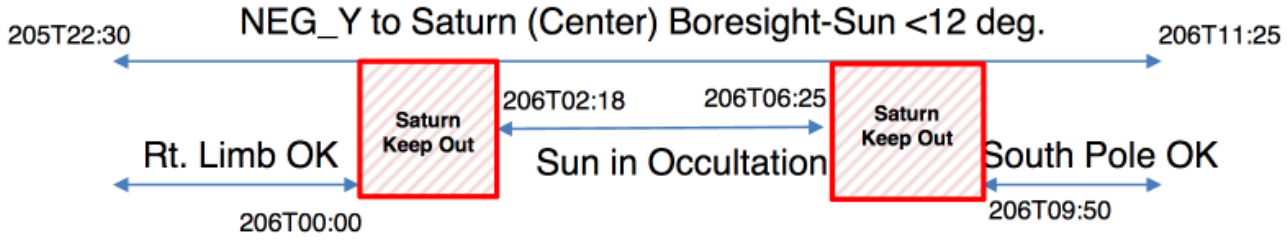
Segment End: 2016-206T23:27

	Saturn Range	Phase Angle	Sub-S/C Lat.
Segment Start	22.61	1.2	25
Periapse	10.73	114.5	-41
Segment End	17.74	152.1	-8

Solar Geometry – ORS Boresight Concerns



- Pointing to NEG_Y to Saturn (center) would lead to a CMT (<12 deg) violation between 2016-205T22:30:00 (Gap 4) and 206T11:25 (Gap 5).
- Minimum NEG_Y to Sun angle is ~1.14° at 2016-206T04:24:00 (in occultation)
- Sun in occultation from 2016-206T02:18 to 06:25
- Until 206T00:00:00, Pointing at the **right limb** brings one out of the 12° cone, but not the 15° cone. ***A waiver will be required.***
- At 206T09:50:00, Pointing at the **south pole** brings one out of the 12° cone, but not the 15° cone. ***A waiver will be required.***



Daily Science Highlights

DOY 202 (20 July 2016): The Saturn_238, a periapse segment, began with a feature track by ISS, imaging specific latitudes/lomgitudes at low, medium, and high emission angles as the planet rotated. VIMS, UVIS, and CIRS rode along. Following this, UVIS targeted Mimas to obtain low phase observations while the ORS instruments rode along. UVIS then performed thermosphere imaging of Saturn for tumble density determination to aid in proximal orbit planning.

DOY 203 (21 July 2016): ISS began a 13h25m feature track observation, again imaging on latitudes at low, medium, and high emission angles as the planet rotated. CIRS, UVIS, and VIMS rode along.

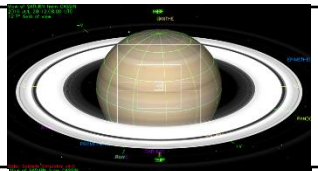
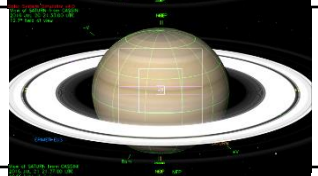
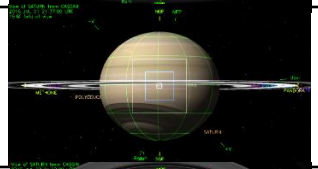
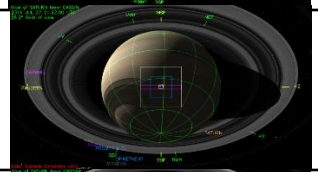
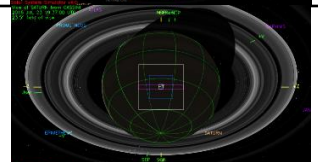
DOY 204 (22 July 2016): UVIS and VIMS collaboratively observed the auroral oval for 14h with ISS riding.

DOY 205 (23 July 2016): Cassini reached periapse at the end of the auroral observation on DOY205. VIMS then proceeded to map the southern hemisphere, from ~30 degrees south latitude to the south pole.

DOY 206 (24 July 2016): Following a downlink of data to the Earth, the spacecraft kept its antenna pointed at the Earth to record the occultation of our planet by Saturn and its rings as seen from Cassini. The Radio Science subsystem and Deep Space Network antennae collected data while signals were exchanged with ground antennae through Saturn's atmosphere and across Saturn's rings on egress. Following this occultation, ISS performed an observation as part of the Titan Monitoring Campaign (phase 63 and range 0.507 Mkm). ISS then spent 2.5h observing the bright limb of Saturn. VIMS and CIRS then proceeded to collaboratively observe the occultation of the star Alpha Ori through Saturn's atmosphere. Saturn_238 ended with a downlink of data via the 34M antenna at the Madrid Complex.

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	2016-202T08:08:00	2016-202T16:00:00	000T07:52:00	1.5 to 7.1	22.47 to 20.89	25 to 21	
	Suggested observations: ISS N. Hemisphere Map						
1b	2016-202T17:30:00	2016-203T02:47:00	000T09:17:00	8.3 to 16.9	20.58 to 17.62	21 to 15	
	Suggested observations: ISS Feature Track, Thermosphere						
2	2016-203T14:37:00	2016-204T04:02:00	000T13:25:00	30.9 to 53.2	16.07 to 13.31	6 to -10	
	Suggested observations: ISS Global Map						
3	2016-204T14:22:00	2016-205T04:17:00	000T13:55:00	77.1 to 118.0	11.62 to 10.73	-25 to -42	
	Suggested observations: VIMS S. Hemisphere Map						
4a	2016-205T14:37:00	2016-206T01:03:00	000T10:26:00	148.4 to 173.2	11.45 to 13.08	-40 to -29	
	Suggested observations: VIMS S. Pole, UVIS Aurstare, VIMS S. Pole, UVIS Aurslew						
4b	2016-206T08:29:00	2016-206T13:15:00	000T04:46:00	172.7 to 165.2	14.55 to 15.55	-21 to -16	
	Suggested observations: Titan Cloud Monitor (can't look at Saturn), CIRS or ISS shimmering Limb						

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)	NET_MARGN (%)	CAROVR (Mb)
SP_238EA_C34BWGNON203_PRIME	203 04:57	203 13:57	0	425	91	515	3322	2807	0	199	53	768	867	98	2368	32%	0
SP_238EA_C34HEFOTP204_PRIME	204 04:42	204 13:42	0	759	62	821	3322	2501	0	199	53	1073	768	-306	2269	35%	305
SP_238EA_C70METOTB205_PRIME	205 04:57	205 13:57	305	683	64	1053	3322	2269	0	526	53	1632	3762	2129	3044	52%	0
SP_238EA_M70METNON206_PRIME	206 16:47	206 23:27	0	822	113	936	3322	2386	0	156	39	1131	2045	914	914	45%	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	202 07:28	203 04:57	0.0	40.5	43.2	7.7	80.0	38.2	65.7	0.0	101.3	23.1	21.0	0.0	89.8	510.6
SP_238EA_C34BWGNON203_PRIME	203 04:57	203 13:57	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	202 07:28	203 13:57	0.0	57.5	129.6	11.0	80.0	54.2	93.3	0.0	143.8	28.0	21.0	0.0	89.8	
OBSERVATION_NOR	203 13:57	204 04:42	0.0	34.4	21.6	5.3	0.0	26.2	45.1	0.0	609.2	0.0	10.0	0.0	61.6	813.6
SP_238EA_C34HEFOTP204_PRIME	204 04:42	204 13:42	0.0	17.0	86.4	3.2	0.0	16.0	27.5	0.0	42.1	4.9	0.0	0.0	0.0	197.2
DAILY TOTAL SCIENCE	203 13:57	204 13:42	0.0	51.4	108.0	8.6	0.0	42.2	72.7	0.0	651.4	4.9	10.0	0.0	61.6	
OBSERVATION_NOR	204 13:42	205 04:57	0.0	28.8	21.6	5.5	0.0	27.1	46.7	0.0	537.6	0.0	10.0	0.0	63.7	741.0
SP_238EA_C70METOTB205_PRIME	205 04:57	205 13:57	0.0	17.0	86.4	3.2	0.0	16.0	27.5	0.0	366.1	4.9	0.0	0.0	0.0	521.2
DAILY TOTAL SCIENCE	204 13:42	205 13:57	0.0	45.7	108.0	8.7	0.0	43.1	74.2	0.0	903.7	4.9	10.0	0.0	63.7	
OBSERVATION_NOR	205 13:57	206 16:47	0.0	50.6	66.6	9.7	0.0	47.7	82.1	0.0	487.6	0.7	70.0	0.0	112.1	927.1
SP_238EA_M70METNON206_PRIME	206 16:47	206 23:27	0.0	12.6	72.0	2.4	0.0	11.9	20.4	0.0	31.4	3.7	0.0	0.0	0.0	154.3
DAILY TOTAL SCIENCE	205 13:57	206 23:27	0.0	63.2	138.6	12.1	0.0	59.6	102.5	0.0	519.0	4.3	70.0	0.0	112.1	

	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	217.8	484.2	40.3	80.0	199.2	342.7	0.0	2217.8	42.2	111.0	0.0

Waypoint Selection

Standard 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_238NA_OBSERV202_NA	2016-202T07:28:00	2016-203T04:57:00	**BAD**	**BAD**	OK	OK	**BAD**	**BAD**	OK	OK	OK	**BAD**
SP_238NA_OBSERV203_NA	2016-203T13:57:00	2016-204T04:42:00	**BAD**	**BAD**	OK	OK	**BAD**	**BAD**	OK	OK	OK	**BAD**
SP_238NA_OBSERV204_NA	2016-204T13:42:00	2016-205T04:57:00	**BAD**	**BAD**	OK	**BAD**	**BAD**	**BAD**	OK	OK	OK	**BAD**
SP_238NA_OBSERV205_NA	2016-205T13:57:00	2016-206T15:37:00	**BAD**	**BAD**	**BAD**	**BAD**	**BAD**	**BAD**	**BAD**	**BAD**	**BAD**	**BAD**
SP_238NA_OBSERV206_NA	2016-206T23:27:00	2016-208T02:27:00	**BAD**	**BAD**	OK	OK	**BAD**	**BAD**	**BAD**	**BAD**	**BAD**	OK

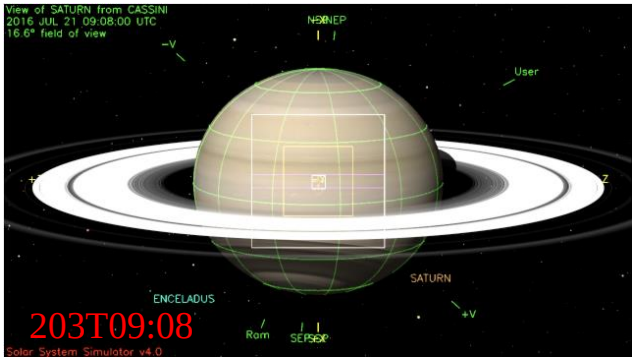
RBOT - Friendly

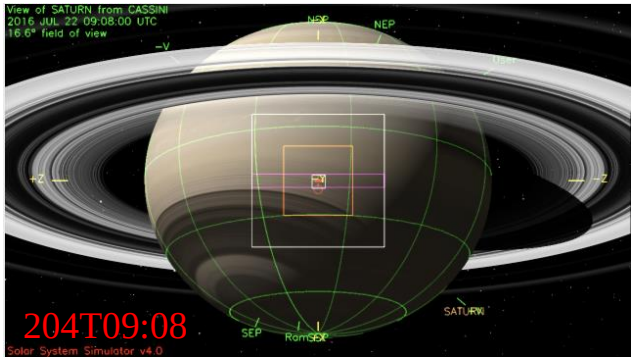
OBSERVATION PERIOD	START	END	POS_X	NEG_X	POS_Z	NEG_Z
SP_238NA_OBSERV202_NA	2016-202T07:28:00	2016-203T04:57:00	191.3/ 52.8	191.3/ 52.8	------	191.3/ 52.8
SP_238NA_OBSERV203_NA	2016-203T13:57:00	2016-204T04:42:00	191.3/ 52.8	191.3/ 52.8	------	191.3/ 52.8
SP_238NA_OBSERV204_NA	2016-204T13:42:00	2016-205T04:57:00	191.3/ 52.8	191.3/ 52.8	------	191.3/ 52.8
SP_238NA_OBSERV205_NA	2016-205T13:57:00	2016-206T15:37:00	------	------	------	------
SP_238NA_OBSERV206_NA	2016-206T23:27:00	2016-208T02:27:00	------	191.2/ 48.8	------	------

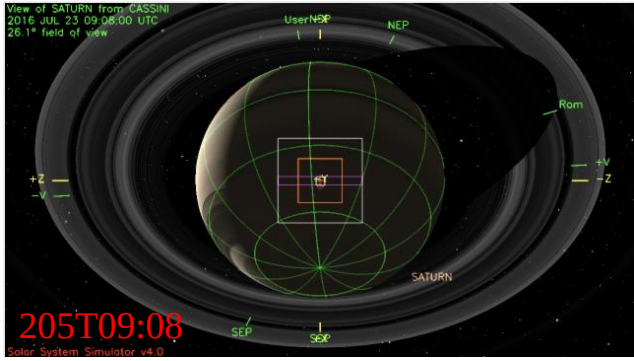
Gap 4 waypoint: NAC to Saturn with an offset to the right limb
Gap 5 waypoint: XBand to Earth, NEG_Y to 88.793/7.407

Waypoints Chosen

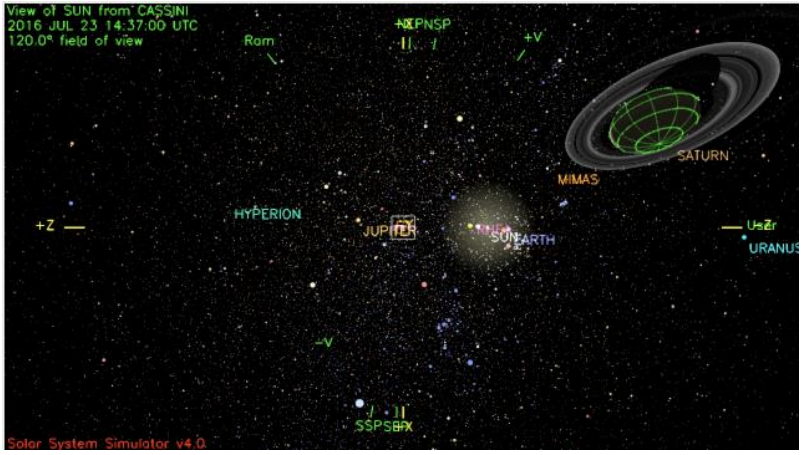
Waypoint 1 (2016-202T09:08 – 205T14:37):
NAC to Saturn, NEG_Z to NSP



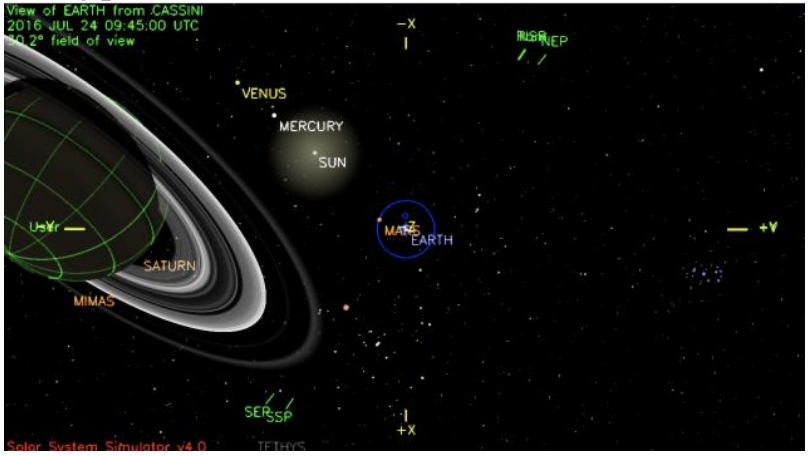




Waypoint 2 (2016-205T14:37 – 205T23:37):
UVIS_SOL_OFF to Sun, NEG_X to NSP



Waypoint 3 (2016-205T23:37 – 207T00:07):
XBAND to Earth, NEG_Y to 88.793/7.407
Waypoint chosen for Radio Science occultations



Notes & Liens

- Data Volume:
  - No SMT warnings. Carrying over 504 Mb to T121 due to loss of DSS-63, forced downgrade.

- DSN:
  - 5 level 3 requests for the RSS Saturn Atmospheric and Rings Occultation Experiments

    Rev 238 Saturn Atmospheric and Rings Occultation Experiments:

    Level 3 request from 2016-205/2100 to 2016-206/1010

    Stations: DSS-55, DSS-14, DSS-25, DSS-43, DSS-35

- Resource checker:
  - 2016-206T08:28:21 ENGR_238SC_DFPW206_PPS Prior to the LMB S/C in RSS3RWAS, After the LMB S/c in DFPW_normal
    - Disposition: Opmode strategy for RSS Occultation LMB is as follows:
      RSSK 2016-205T21:31:50
      RSS3RWAS 2016-205T22:57:00
      DFPW 2016-206T08:28:21
      Opmode change to DFPW is at end of deadtime

- Opmodes:

  RSSK 2016-205T21:31:50
  RSS3RWAS 2016-205T22:57:00

Sequence Liens (should all be SPLAT items):

- None.