CASSINI T122 SEGMENT

Rev 239 Handoff Package

Segment Boundary 2016-222T22:10:00 – 2016-224T12:25:00

31 DEC2015

Karl Mitchell

SMT report and SPASS

Science Highlights

Notes & Liens

SMT report

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 (%)	CAROVR (Mb)
SP_239EA_G34BWGNON222_PRIME	222 23:13	223 06:10	1510	13	4	1527	3322	1795	0	92	41	1660	260	-1401	10	0%	1400
SP_239EA_C34BWGNON223_PRIME	223 06:10	223 14:24	1400	0	0	1400	3322	1922	0	1599	49	3048	311	-2737	10	0%	2737
SP_239EA_M34BWGNON223_PRIME	223 14:24	223 20:30	2737	0	0	2737	3322	585	0	73	36	2846	231	-2615	10	0%	2615
SP_239EA_C70METNON224_PRIME	224 03:25	224 12:25	2615	668	29	3312	3322	10	0	199	53	3564	3764	199	200	5%	0

SSR PARTITION SIZE SUMMARY - SELECTED SSR CONFIGURATION: DOUBLE

	SSR A/B		
OBSERVATION PERIOD	P4 Size (Frames)	P5 Size (Frames)	P6 Size (Frames)
* INITIAL CONDITION *	188954	10	38863
SP_239NA_OBSERV227_NA	188954	10	38863
SP_239NA_OBSERV223_NA	188954	10	38863

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	222 22:10	222 23:13	0.0	2.0	0.0	0.4	0.0	1.9	3.2	0.0	5.0	0.1	0.0	0.0	4.4	17.1
SP_239EA_G34BWGNON222_PRIME	222 23:13	223 06:10	0.0	13.1	0.0	2.5	0.0	21.2	21.2	0.0	32.7	0.0	0.0	0.0	0.0	90.7
SP_239EA_C34BWGNON223_PRIME	223 06:10	223 14:24	0.0	45.7	0.0	13.0	0.0	48.5	34.6	0.0	1442.7	0.0	0.0	0.0	0.0	1584.5
SP_239EA_M34BWGNON223_PRIME	223 14:24	223 20:30	0.0	11.5	0.0	2.2	0.0	10.9	18.7	0.0	28.8	0.0	0.0	0.0	0.0	72.2
DAILY TOTAL SCIENCE	222 22:10	223 20:30	0.0	72.3	0.0	18.1	0.0	82.4	77.7	0.0	1509.3	0.1	0.0	0.0	4.4	
OBSERVATION_NOR	223 20:30	224 03:25	0.0	13.0	77.6	2.5	350.0	12.3	21.1	0.0	32.5	103.0	50.0	0.0	28.8	690.9
SP_239EA_C70METNON224_PRIME	224 03:25	224 12:25	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	223 20:30	224 12:25	0.0	30.0	164.0	5.7	350.0	28.3	48.7	0.0	75.0	107.9	50.0	0.0	28.8	

	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	102.3	164.0	23.8	350.0	110.7	126.4	0.0	1584.3	108.1	50.0	0.0

Master Timeline

239TI_T122	1698 km

Start Time	End Time	Prime Activity	Obs. Detail	Op Mode	TLM Mode	Comments
2016-222T22:10:00	2016-222T22:25:00	Observation gap	No activity	RSS_K_RWAF	S_N_ER_3	Recent update to segment boundaries introduced a 15-minute gap
2016-222T22:25:00	2016-222T23:05:00	SP Turn to WP	X-band to Earth/RA-Dec:123/-57	RSS_K_RWAF	S_N_ER_3	Recent change of fly-by start time to 22:10:00 means there is now a 15-minute gap between start and SP Turn to WP.
2016-222T23:05:00	C/A-09:17:15	OD Uncertainty Dead Time		RSS_K_RWAF	S_N_ER_3	
C/A-09:17:15	0	SP/RSS Gravity	Warm up RSS during downlink (TN1b)	RSS_K_RWAF	RTE_N_SPB	CDA Collaborative Rider
2016-223T08:30:53		CLOSEST APPROACH	XBAND to EARTH, NEG_X to NSP (Tc2a)			
0	+12:00:00	SP/RSS Gravity	(TN1b)	RSS_K_RWAF	RTE_N_SPB	CDA Collaborative Rider
+12:00:00	C/A+17:59:07	ISS	(TC1a/TN1a)	DFPW Normal	S_N_ER_3	
C/A+17:59:07	2016-224T02:45:00	OD Uncertainty Dead Time		DFPW Normal	S_N_ER_3	
2016-224T02:45:00	2016-224T03:25:00	SP Turn to Earth for downlink	X-band to Earth/RA-Dec:(0.0,0.0,-9.5 deg. offset)	DFPW Normal	S_N_ER_3	RSS requested change to RSS_K_RWAF from 03:19:50 until 03:25:00.
2016-224T03:25:00	2016-224T12:25:00	Canberra 70M	5-hr rolling then MIMI.NEG_Y to Saturn (0,0,-9.5)	RSS_K_RWAF	RTE_N_SPB	RSS GSE on C34 concurrent. KTPY bias, if needed, at very end of downlink (last 1:30 hr, non-rolling). Switching back to DFPW Normal from 12:23:12 to 12:25:00

SPASS for Delivery: **TI239_T122** Records 1-12 (Page **1** of **1**)

Request	Riders	Start (SCET)	Start (Epoch)	Duration	End (SCET)	Observation Attitude: Primary	Observation Attitude: Secondary	Comments
Sequence S95, length = 74 days		2016-178T15:44:00		073T18:52:00	2016-252T10:36:00			
Titan Flyby T122 Segment		2016-222T22:10:00		001T14:15:00	2016-224T12:25:00			
SP_239EA_WAYPTTURN222_PRIME	R	2016-222T22:25:00		000T00:40:00	2016-222T23:05:00	XBAND to Earth	NEG_X to 123.0/-57.0	
NEW WAYPOINT		**2016-222T23:05:00**		**001T04:20:00**	**2016-224T03:25:00**	**XBAND to Earth**	**NEG_X to 123.0/-57.0**	
SP_239EA_DEADTIME222_PRIME	M, R	2016-222T23:05:00		000T00:08:38	2016-222T23:13:38	XBAND to Earth	NEG_X to 123.0/-57.0	Collaborative Rider(s): CDA
SP_239EA_G34BWGNON222_PRIME	M, R	2016-222T23:13:38	GMB_E239_TITAN_T122-000T09:17:15	000T06:56:22	2016-223T06:10:00	XBAND to Earth	NEG_X to 123.0/-57.0	Collaborative Rider(s): CDA, RSS
SP_239EA_C34BWGNON223_PRIME	M, R	2016-223T06:10:00	GMB_E239_TITAN_T122-000T02:20:53	000T08:14:00	2016-223T14:24:00	XBAND to Earth	NEG_X to 123.0/-57.0	Collaborative Rider(s): CDA, RSS
239TI (t) T122 TITAN Outbou...		2016-223T08:30:53		000T00:00:01	2016-223T08:30:54			
SP_239EA_M34BWGNON223_PRIME	M, R	2016-223T14:24:00	GMB_E239_TITAN_T122+000T05:53:07	000T06:06:53	2016-223T20:30:53	XBAND to Earth	NEG_X to 123.0/-57.0	Collaborative Rider(s): CDA, RSS
ISS_239TI_MONITORNA001_PRIME	C, M, U, V	2016-223T20:30:53	GMB_E239_TITAN_T122+000T12:00:00	000T05:59:07	2016-224T02:30:00	ISS_NAC to Titan	NEG_X to 123.0/-57.0	Collaborative Rider(s): CDA. No Preference to secondary pointing
SP_239EA_DEADTIME224_PRIME		2016-224T02:30:00	GMB_E239_TITAN_T122+000T17:59:07	000T00:15:00	2016-224T02:45:00	XBAND to Earth	NEG_X to 123.0/-57.0	
SP_239EA_DLTURN224_PRIME		2016-224T02:45:00		000T00:40:00	2016-224T03:25:00	XBAND to Earth (0.0,0.0,-9.5 deg. offset)	NEG_Y to Saturn	
NEW WAYPOINT		**2016-224T03:25:00**		**000T09:00:00**	**2016-224T12:25:00**	**XBAND to Earth (0.0,0.0,-9.5 deg. offset)**	**NEG_Y to Saturn**	
SP_239EA_C70METNON224_PRIME	C, E, R	2016-224T03:25:00		000T09:00:00	2016-224T12:25:00	XBAND to Earth (0.0,0.0,-9.5 deg. offset)	5_Hr_Rolling	MIMI.NEG_Y to Saturn (0,0,-9.5).SRU.CIRS heating.

High-Priority Observations

Sequence S95/T122: Summary of PIEs and Other High Priority Observations

Discipline	CIMS Request Name	Start Time	End Time	Flexibility in secondary pointing	Comments (e.g., pointing tolerance, uniqueness; relative priority)	Science Traceability Matrix Code(s)	Pointing designer POC
Titan	SP_239EA_G34BWGNON222_P	2016-222T23:13:38	2016-223T06:10:00	Significant Science Impact	RSS Gravity Science; CDA dust occultation experiment (CDA-friendly secondary).	TN1b	Karl.L.Mitchell@jpl.nasa.gov
Titan	SP_239EA_C34BWGNON223_P	2016-223T06:10:00	2016-223T14:24:00	Significant Science Impact	RSS Gravity Science; CDA dust occultation experiment (CDA-friendly secondary).	TN1b	Karl.L.Mitchell@jpl.nasa.gov
Titan	SP_239EA_M34BWGNON223_P	2016-223T14:24:00	2016-223T20:30:53	Significant Science Impact	RSS Gravity Science; CDA dust occultation experiment (CDA-friendly secondary).	TN1b	Karl.L.Mitchell@jpl.nasa.gov

Collaborative riders: CDA_239TI_GRAVITY001_RSS

Science Highlights

DOY 222: RSS will start its last Gravity flyby on HGA, one of a few such critical observations gathered over the course of the mission that contribute data critical for: (1) assessing the presence of a global subsurface ocean by measuring the short-period changes of the gravity field induced by Saturn's tidal field (eccentricity tides); (2) determining the geoid and the presence of large scale gravity anomalies; (3) determine the rheology of the icy crust by correlative analysis with altimetric data. CDA, a collaborative rider, will be using a new "Dust Occultation" technique to observe the interaction of nanodust streams with Titan's atmosphere. Dust particles are used like photons: An obstacle hinders the dust particles from a (more or less) collimated source to reach the observer. T122 is the only and last opportunity to observe a new occultation phenomena first observed during T99 (2014), in which CDA observed a drop out of the impact rate of dust impacts when Saturn vanished behind Titan's atmosphere during the Cassini flyby. The new measurements will constrain the grain parameters like speed, mass and direction they and will provide essential input for the modeling of the interaction of fast nanograin ablation in thin atmospheres.

Science Highlights

DOY 223: **RSS** will continue its last Gravity flyby on HGA, throughout the inbound pass and 12 hours into the outbound, one of a few such critical observations gathered over the course of the mission that contribute data critical for: (1) assessing the presence of a global subsurface ocean by measuring the short-period changes of the gravity field induced by Saturn's tidal field (eccentricity tides); (2) determining the geoid and the presence of large scale gravity anomalies; (3) determine the rheology of the icy crust by correlative analysis with altimetric data. **CDA**, a collaborative rider, will be using a new "Dust Occultation" technique to observe the interaction of nanodust streams with Titan's atmosphere. Dust particles are used like photons: An obstacle hinders the dust particles from a (more or less) collimated source to reach the observer. T122 is the only and last opportunity to observe a new occultation phenomena first observed during T99 (2014), in which CDA observed a drop out of the impact rate of dust impacts when Saturn vanished behind Titan's atmosphere during the Cassini flyby. The new measurements will constrain the grain parameters like speed, mass and direction they and will provide essential input for the modeling of the interaction of fast nanograin ablation in thin atmospheres.

Science Highlights

DOY 223 (cont.) From 12 hours outbound, **ISS** will acquire global-scale imaging of Titan's trailing hemisphere at mid-northern latitudes, providing important constraints for the cloud monitoring campaign. VIMS, CIRS and ISS will ridealong with ISS. **VIMS** will monitor monitoring cloud activity and looking for specular reflections on lakes near the north polar. **UVIS** will obtain spectra of Titan's mid atmosphere and stratosphere, searching in particular for nitrogen emission features in the mid atmosphere and stratosphere. **CIRS** will obtain data to monitor Titan's changing seasons, and giving insights into the stratospheric circulation. And make detailed scans of Titan's atmospheric limb near 50N revealing the vertical structure of temperature and trace gas abundances, such as hydrocarbons and nitriles. These valuable data will be used for comparison with observations of equivalent southern latitudes, which are currently experiencing late Fall (south) instead of spring (north). They will also be compared to views of the north earlier in the mission.

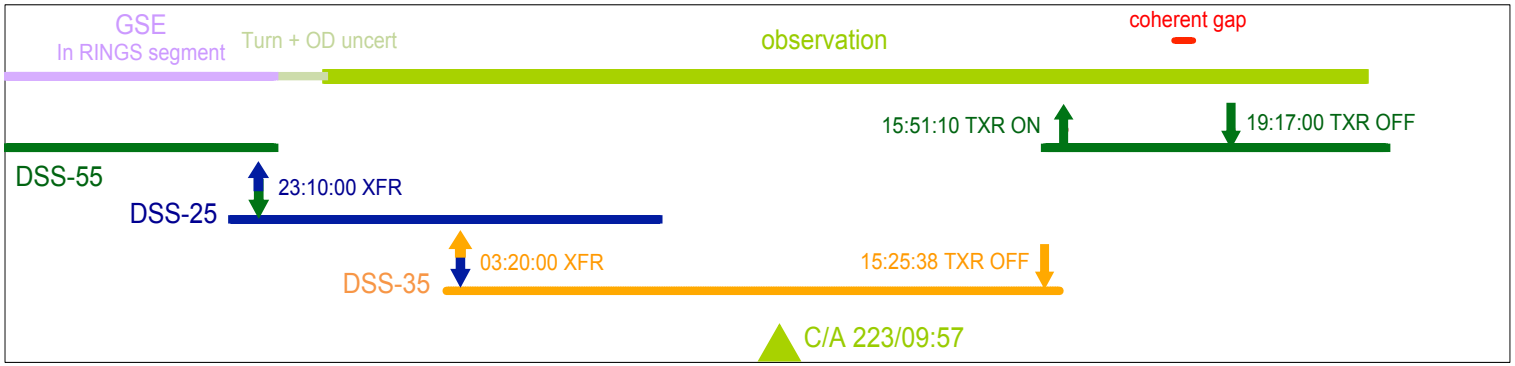
Science Highlights

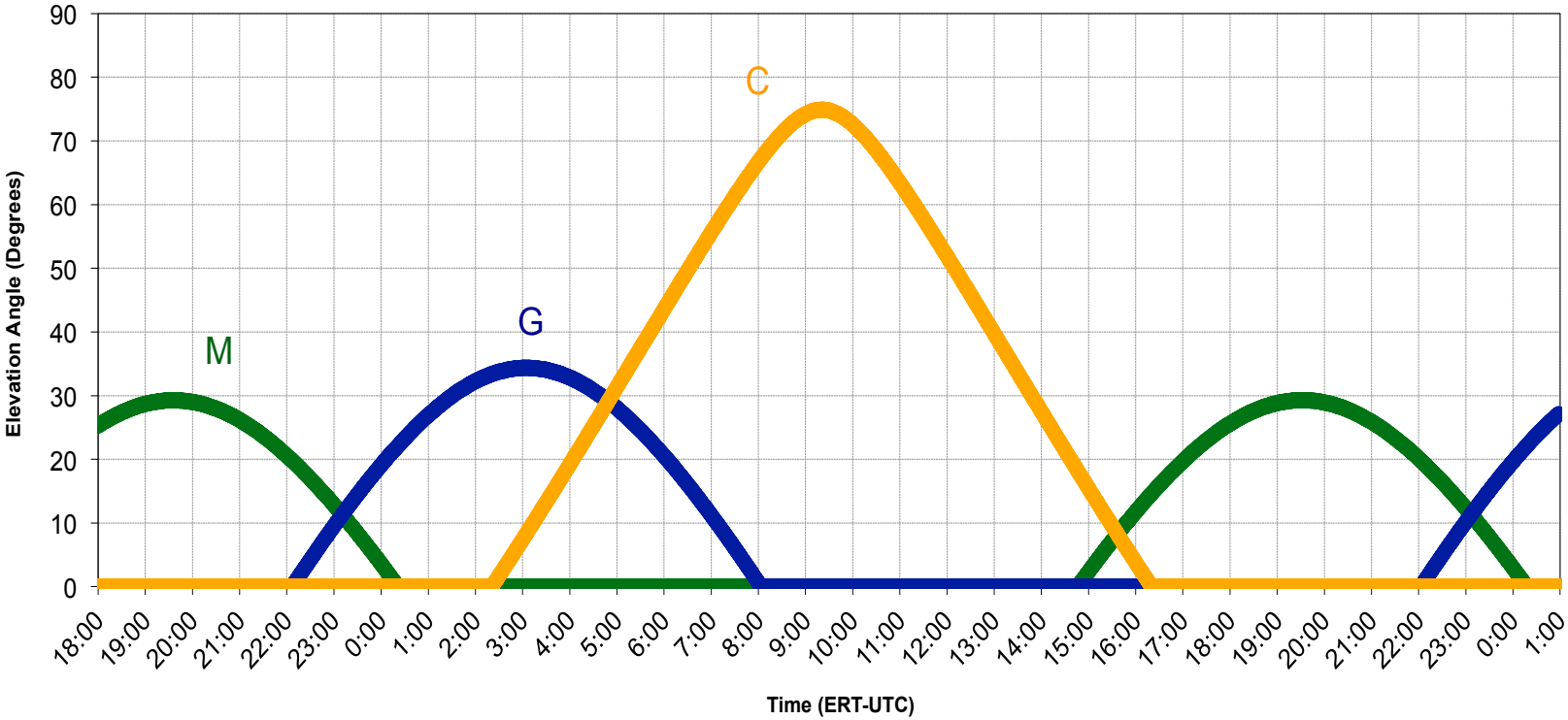
DOY 224: **ISS** will continue to acquire global-scale imaging of Titan's trailing hemisphere at mid-northern latitudes, providing important constraints for the cloud monitoring campaign. VIMS, CIRS and ISS will ridealong with ISS. **VIMS** will monitor monitoring cloud activity and looking for specular reflections on lakes near the north polar. **UVIS** will obtain spectra of Titan's mid atmosphere and stratosphere, searching in particular for nitrogen emission features in the mid atmosphere and stratosphere. **CIRS** will obtain data to monitor Titan's changing seasons, and giving insights into the stratospheric circulation. And make detailed scans of Titan's atmospheric limb near 50N revealing the vertical structure of temperature and trace gas abundances, such as hydrocarbons and nitriles. These valuable data will be used for comparison with observations of equivalent southern latitudes, which are currently experiencing late Fall (south) instead of spring (north). They will also be compared to views of the north earlier in the mission.

RSS Gravity

S95 Rev239 T122 RSS Titan Gravity
2016 222-223 / August 9-10, 2016

OWLT ~1:20
RTLT ~2:40





Y bias windows & data volume

An engineering Y bias window overlaps the last 90 minutes of the DOY 124 Canberra 70m downlink, during the MIMI-fixed secondary period following the 5-hr rolling downlink potion. Due to RSS science (see next slide) TOST is requesting that AACS try to avoid placing a bias in this segment. **SCO has agreed to perform an on-Earth bias if a bias must be placed AND if data volume is tight.** Consequently we are not specifying a plan to cut data volume overflow in the event that this Y bias results in the shortening of the downlink. If SSR overflow occurs, data will be cut from RPWS.

Y bias and RSS

RSS requests no thruster during from the beginning of the inbound GSE 222/21:08:38 (in Rings segment) until the end of the outbound GSE 224/12:25:00, with the critical period being from 222/23:13:38 to 223/20:30:53. If biases are needed during the GSEs, try to place them as early as possible during the inbound GSE or as late as possible during the outbound GSE.

Notes

- Pointing:
  - YGAPs avoided in this segment until near end of final downlink due to RSS science.
- Data Volume:
  - Begins with 1510Mb from previous segment (RINGS_239smt_151208.init).
  - SCO will use on-Earth bias if data volume is tight.
  - Constant low downlink rate used during RSS activities to simplify implementation in the event of DSN changes.
  - SIP leads could implement a telemetry wedding cake if more data volume needed
- DSN:
  - Level 3 requests from 2016-222/1600 to 2016-223/2230. Stations: DSS-55, DSS-25, DSS-35.
- Resource checker:
  - Gap in first 15 minutes of segment (not reported in Resource Checker) due to late change to segment boundary. No adverse consequences.
  - ENGR bias during rolling downlink takes place after 5-hr rolling downlink ends: large data buffer non-problematic.
- Opmodes:
  - RSS warmup begins in previous segment.
- Hydrazine:
  - Flyby on RWA.
- Special Activities:
  - RSS Gravity flyby (SPLAT item)

Liens

Sequence Liens (should all be SPLAT items):

- Request for no biases during RSS gravity experiments (SPLAT item)