CASSINI SOST SEGMENT

Rev 141 Handoff Package

Segment Boundary 2010-331T19:20:00 – 2010-336T01:21:00

1 June 2010

Nancy V: WP, DL strategy
Amanda H: Science timeline
Nora A: Segment clean-up, DV, package

SMT report and SPASS

Science Highlights

Notes & Liens

Integration Checklist

SMT report

https://cassini.jpl.nasa.gov/sp/icy/rev141/SOST_141_E12_100525.rpt (no warnings)

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_141EA_G34HEFOTB332_PRIME	332 10:21	332 19:21	0	1593	63	1657	3309	1652	0	234	53	1944	761	-1184	883	11%	1183
SP_141EA_M70METNON333_PRIME	333 02:36	333 11:36	1183	576	31	1790	3309	1519	0	249	53	2092	2965	873	883	12%	0
SP_141EA_M34BWGRSS334_PRIME	334 03:53	334 06:53	0	679	69	748	3309	2561	0	61	18	826	183	-644	10	0%	644
SP_141EA_C34BWGRSS334_PRIME	334 16:53	334 19:53	644	1760	42	2446	3309	863	0	223	18	2687	217	-2470	10	0%	2470
SP_141EA_M34HEFOTP335_PRIME	335 02:36	335 11:36	2470	494	28	2993	3309	316	0	258	53	3304	558	-2746	10	0%	2746
SP_141EA_C70METOTB335_PRIME	335 16:21	336 01:21	2746	243	20	3009	3309	300	0	131	53	3194	3203	9	10	0%	0

SPASS

https://cassini.jpl.nasa.gov/sp/icy/rev141/SPASS_SOST_141_E12_100601.pdf
https://cassini.jpl.nasa.gov/sp/icy/rev141/SPASS_SOST_141_E12_100601.xls
https://cassini.jpl.nasa.gov/sp/icy/rev141/SPASS_SOST_141_E12_100601.txt

Request	Riders	Start (SCET)	Start (Epoch)	Duration	End (SCET)	Primary	Secondary	Comments
Sequence S65, length = 54 days		2010-328T19:35:00		053T13:07:00	2011-017T08:42:00			
Enceladus Flyby E12 Segment		2010-331T19:20:00		004T06:01:00	2010-336T01:21:00			
ISS_141HY_FLYBY001_PRIME	C, U, V	2010-331T19:20:00		000T15:01:00	2010-332T10:21:00	ISS_NAC to Hyperion	NEG_Z to NEP	
SP_141EA_G34HEFOTB332_PRIME	C, E, N	2010-332T10:21:00		000T09:00:00	2010-332T19:21:00	XBAND to Earth	4_Hr_Rolling	NEG_Y to Saturn (0,0,-9.5)(change to RA/DEC equiv), MIMI
ISS_141HY_FLYBY002_PRIME	C, U, V	2010-332T19:21:00		000T05:05:00	2010-333T00:26:00	ISS_NAC to Hyperion	NEG_X to NEP	
SP_141EA_DLTURN333_PRIME		2010-333T00:26:00		000T00:40:00	2010-333T01:06:00	XBAND to Earth	NEG_X to NEP	
NEW WAYPOINT		**2010-333T01:06:00**		**001T02:46:00**	**2010-334T03:52:00**	**XBAND to Earth**	**NEG_X to NEP**	
SP_141EA_YBIAS333_PRIME	E	2010-333T01:06:00		000T01:30:00	2010-333T02:36:00	XBAND to Earth	NEG_X to NEP	
SP_141EA_M70METNON333_PRIME	C, R	2010-333T02:36:00		000T09:00:00	2010-333T11:36:00	XBAND to Earth	Rolling	NEG_X to NEP or NSP, CAPS
UVIS_141RH_ICYLON001_PRIME	C, V	2010-333T11:36:00		000T10:58:00	2010-333T22:34:00	UVIS_FUV to Rhea	NEG_X to NEP	
CDA_141OT_RINGSHAD001_PIE	R	2010-333T22:34:05		000T03:38:55	2010-334T02:13:00	NEG_Z to Earth (-20.0,-80.0,0.0 deg. offset)	NEG_X to NEP	NEG_X to (24,10) , CDA Art : 125 deg
SP_141SA_WAYPTTURN334_PRIME	R	2010-334T03:13:00		000T00:15:00	2010-334T03:28:00	XBAND to Earth	POS_X to 286.0/-33.0	part 1 of 2
SP_141SA_WAYPTTURN434_PRIME	R	2010-334T03:28:00		000T00:24:00	2010-334T03:52:00	XBAND to Earth	POS_X to NEP	part 2 of 2
NEW WAYPOINT		**2010-334T03:52:00**		**001T21:29:00**	**2010-336T01:21:00**	**XBAND to Earth**	**POS_X to NEP**	
SP_141EN_DEADTIME334_PRIME	**R**	**2010-334T03:52:00**		**000T00:01:59**	**2010-334T03:53:59**	**XBAND to Earth**	**POS_X to NEP**	
SP_141EA_M34BWGRSS334_PRIME	R	2010-334T03:53:59	GMB_E141_ENCELADUS_E12-000T08:00:00	000T03:00:00	2010-334T06:53:59	XBAND to Earth	POS_X to NEP	RSS Gravity PIE
Begin Custom		**2010-334T06:53:59**	**GMB_E141_ENCELADUS_E12-000T05:00:00**	**000T00:00:01**	**2010-334T06:54:00**	**XBAND to Earth**	**POS_X to NEP**	
ISS_141EN_PLMHPHR001_PIE	C, M, U, V	2010-334T06:53:59	GMB_E141_ENCELADUS_E12-000T05:00:00	000T02:30:00	2010-334T09:23:59	ISS_NAC to Enceladus	NEG_X to NSP	Pick up at XBAND to Earth, POS_X to NEP; Hand off at ISS_NAC to Enceladus, NEG_X to NSP. SOST PIE
CIRS_141EN_DRKMAP001_PRIME	M, U	2010-334T09:23:59	GMB_E141_ENCELADUS_E12-000T02:30:00	000T01:00:00	2010-334T10:23:59	CIRS_FP1 to Enceladus	NEG_X to NSP	Pick up at ISS_NAC to Enceladus, NEG_X to NSP; Hand off at XBAND to Earth, ISS_NAC to 285.0/-60.0. Pick up at ISS_NAC to Encel, NEG_X to NSP; hand off at XBAND to Earth, ISS_NAC to 285.0/-60.0
Periapse R = 3.567 Rs, lat ...		2010-334T09:32:59		000T00:00:01	2010-334T09:33:00			
RSS_141EN_GRAVITY002_PIE	C, I, M, U	2010-334T10:23:59	GMB_E141_ENCELADUS_E12-000T01:30:00	000T03:00:00	2010-334T13:23:59	XBAND to Earth	ISS_NAC to 285.0/-60.0	Pick up at XBAND to Earth, ISS_NAC to 285.0/-60.0; Hand off at XBAND to Earth, ISS_NAC to 285.0/-60.0.
141EN (t) E12_ENCELADUS Ou...		2010-334T11:53:59		000T00:00:01	2010-334T11:54:00			
CIRS_141EN_DAYMAP001_PRIME	I, M, U, V	2010-334T13:23:59	GMB_E141_ENCELADUS_E12+000T01:30:00	000T01:00:00	2010-334T14:23:59	CIRS_FP3 to Enceladus	POS_X to NEP	Pick up at XBAND to Earth, ISS_NAC to 285.0/-60.0; Hand off at ISS_NAC to Enceladus, POS_X to NEP. 2x2 mosaic at start for ISS; pick up at WP; hand off at ISS_NAC to Encl, POS_X to NEP
VIMS_141EN_ENCELADUS001_PIE	C, I, M, U	2010-334T14:23:59	GMB_E141_ENCELADUS_E12+000T02:30:00	000T02:30:00	2010-334T16:53:59	ISS_NAC to Enceladus	POS_X to NEP	Pick up at ISS_NAC to Enceladus, POS_X to NEP; Hand off at XBAND to Earth, POS_X to NEP.
End Custom		**2010-334T16:53:59**	**GMB_E141_ENCELADUS_E12+000T05:00:00**	**000T00:00:01**	**2010-334T16:54:00**	**XBAND to Earth**	**POS_X to NEP**	
SP_141EA_C34BWGRSS334_PRIME	M, R	2010-334T16:53:59	GMB_E141_ENCELADUS_E12+000T05:00:00	000T03:00:00	2010-334T19:53:59	XBAND to Earth	POS_X to NEP	RSS Gravity PIE
SP_141EN_DEADTIME434_PRIME		**2010-334T19:53:59**	**GMB_E141_ENCELADUS_E12+000T08:00:00**	**000T00:02:01**	**2010-334T19:56:00**	**XBAND to Earth**	**POS_X to NEP**	
UVIS_141EN_ICYLON001_PRIME	C, I, V	2010-334T19:56:00		000T06:40:00	2010-335T02:36:00	ISS_NAC to Enceladus	POS_X to 115.35/-52.3	
SP_141EA_M34HEFOTP335_PRIME	C, E, N	2010-335T02:36:00		000T09:00:00	2010-335T11:36:00	XBAND to Earth	POS_X to NEP	POS_X to NEP or NSP (changed to RA/DEC equiv), CAPS
ISS_141OT_RHEAL4335_PRIME		2010-335T11:36:00		000T04:45:00	2010-335T16:21:00	ISS_NAC to Rocks	NEG_Z to Earth	
SP_141EA_C70METOTB335_PRIME	N	2010-335T16:21:00		000T09:00:00	2010-336T01:21:00	XBAND to Earth	Rolling	same as OTP pass, CAPS

Nov. 27 - Dec. 2, 2010 (DOY 331-336)

These ~4.5 days encompass the rev 141 SOST segment, which includes a targeted flyby of Enceladus, along with observations of Hyperion, Rhea and other outer satellites.

DOY 331:
The segment begins with a 15-hour Imaging Science Subsystem (ISS) observation of Hyperion with UVIS and CIRS riding along.

DOY 332:
After a 9-hour downlink to send data back to Goldstone, CA, Cassini turns back toward Hyperion for 5 more hours of observing by all Optical Remote Sensing (ORS) instruments (with ISS still in prime control).

DOY 333:
DOY 333 is filled with an 11-hour UVIS observation of Rhea to map ultraviolet albedo as a function of longitude and phase angle. CIRS and VIMS will also collect data. Afterward, CDA will take over pointing control to observe a Ring shadow crossing at a distance of about 7 Saturn radii.

DOY 334:
The Enceladus flyby (E12) begins! This ~48 km flyby is optimized for Radio Science gravity observations. There will be two 3-hour "wing" observations before and after closest-approach (from 5 to 8 hours from C/A on either side), and then 3 more hours centered directly around C/A. Between RSS observations, ISS and CIRS will observe this moon on the inbound leg, and CIRS and VIMS will take data on the outbound leg (with other ORS and MAPS instruments riding along).

DOY 335:
The primary science on this day is a 6+ hours of UVIS mapping the ultraviolet albedo of Enceladus as a function of longitude and phase angle. CIRS, ISS, and VIMS collect more Enceladus data as riders, as well. Then, ISS takes over for almost 5 hours to search around the Rhea L4 Lagrange point for new satellites.

DOY 336:
Cassini downlinks icy satellite data to the large 70-meter DSN antenna in Canberra, Australia.

Y bias and RSS

No Biases during (overlapping) the RSS science observations: Occultation experiments (rings, Saturn atmospheric, Titan, Satellite), Bistatic observations and prime gravity observations.

For gravity observations, the requirement is no biases (thruster firing) in arcs devoted to gravity observations. A gravity arc is defined as the time between the start of the first tracking pass and the end of the last pass, so if there's a gap in between the tracking passes, there should be no biases there as well. Any firing in this arc would destroy the coherence of the trajectory and would lead to an unpredictable result. **TWT/OST to provide exact times of this no_bias arc**

This segment involves RSS gravity observations around Enceladus. Required no_bias arc period is:
2010-334T03:53:59 (GMB_E141_ENCELADUS_E12-000T08:00:00)
to 2010-334T19:53:59 (GMB_E141_ENCELADUS_E12+000T08:00:00).

Desired no_bias arc period actually starts before previous GSE:
2010-333T02:36:00 to 2010-334T19:53:59 (GMB_E141_ENCELADUS_E12+000T08:00:00).

Gravity Science Enhancements. Placing the Y-Bias during the first 90 minutes of the downlink is OK for inbound GSEs. Impact to outbound GSEs should be looked at on a case-by-case basis (contact Aseel), and the ones following a prime gravity observation would likely be more impacted by a Y-Bias than the ones following an occultation.

GSE in this segment:
RSS_141EN_KADOWN001_RSS: 2010-333T02:36:00 - 2010-333T11:36:00
Current y-bias window, which is ok with RSS: 2010-333T01:06:00 - 2010-333T02:36:00

Notes and Liens

- Pointing:
  - RSS at C/A does not care about secondary, but current secondary is designed for concurrent ORS drag across Enceladus.
  - Collaborative primes:
    ISS_141HY_FLYBY001_PRIME at 2010-331T19:20:00
    ISS_141HY_FLYBY002_PRIME at 2010-332T19:21:00
    CIRS_141EN_DAYMAP001_PRIME at 2010-334T13:23:59 (C/A + 1:30)
  - No periods without valid WP. If full custom period is removed WP may cause some CIRS heating.
  - Custom handoffs and turn times have been validated
  - There should be no CDA articulation during RSS segments (RSS_141EN_GRAVITY001_PIE: 2010-334T03:53:59 - 2010-334T06:53:59. RSS_141EN_GRAVITY002_PIE: 2010-334T10:23:59 - 2010-334T13:23:59. RSS_141EN_GRAVITY003_PIE: 2010-334T16:53:59 - 2010-334T19:53:59). Articulation is OK during the RSS warm-up. *Note that we are also playing back science data during RSS gravity PIEs 1 and 3, so they are riders on SP downlink requests. (They are still PIEs!)
  - RBOT friendly WPs and secondaries used, except friendly secondaries were not used for the Enceladus ORS observations embedded on DOY 334 to allow for science preferred secondary or safe, shorter turns from the waypoint. Because they are interspersed with RSS earth-pointed observations, the RBOT secondary was probably not much better than matching the waypoint secondary.
  - Two-part turn for WP at 334, 03:52 to avoid 180-deg singularity issue with KPT. Secondary change needed for following DL attitude (CAPS and OTP/OTB matching).

Notes and Liens

- Data Volume:
  - RSS flyby = no dual PB. No negative SSR margin or carryover to next segment.
- DSN:
  - One RSS Level 3 DSN request in S65:
    E12 Rev 141 Enceladus Gravity
    Level 3 requested from 2010-334/0010 till 2010-334/2145
    Stations: DSS-34, DSS-55, DSS-26
  - RSS pass SP_141NA_G34B26RSS334_SP (level 3 pass!) overlaps start of DSS-26 weekly maintenance by 4.2 hours. No alternative here (DSS-25 is down). Push back! (this is Enceladus C/A)
- Opmodes:
  - Opmode during E12 should be RSSK (as indicated in the Thermal request). RSSK-RWAF is valid until 05/31/14 and does not impact other instruments. We should switch to RSSK 2hr5min before the start of the first segment (5 mins for Ka-TWTA maintenance, 2 hrs for warm-up).

Segment Checklist p1

1. Disposition all requests in CIMS - approve all pending requests, no outstanding revisions/new requests	x
2. Version the SPASS in CIMS, use label INTEG_FIN, in description put date and your name	x
3. Examine SPASS, ensure SP turns correctly designated PRIME or NEW WAYPOINT. Review Ybias presentation. Prime RSS observations require the Xband to Earth attitude be a waypoint, use DLTURN with spass type New Waypoint	x
4. Waypoints and downlinks are violation free (per CTV). NOTE ON ISSUES PAGE if periods of no valid waypoint	x
5. SP turns have been checked and are violation free- use ctv_batch or PDT. Fix any issues found. All turns use the slower XM slew rates and include 2 minutes turn margin. First turn of segment has been checked using correct final attitude of previous segment	x
6. YBIAS windows have been included as required, guidelines for integration met per latest Ybias package	x
7. There are no more than 3 waypoint changes in a 24 hour period (DLTURN waypoints for YBIAS do not count)	x
8. The minimum prime instrument request duration outside ±5 hours from a targeted satellite flyby is 30 minutes	x
9. Custom handoffs are limited to ±3 hours around a targeted Titan or Icy Satellite flyby. Custom periods 1) designated properly with SPASS notes 2) requests have “pick up at” and “hand off at” information filled in correctly 3) turn times and handoff attitudes have been verified – early PDT work recommended!	X (10 hr custom window is XXM guideline)
10. PIEs are properly identified via _PIE naming convention. All agreed to PIEs have been integrated.	X (watch for PIE in comments field for 2 RSS gravity PIEs riding on DLs)
11. Prime/rider coordination: secondaries have all been reviewed and agreed to, collaborative observations are so designated, pre-designed in PDT	x
12. Use rolling_sru if required per CTV checks	x
13. The secondary axis for downlinks that contain prime and backup OTMs is the same, and inertially fixed	x
14. Downlinks that contain OTPs only roll for the first 4 hours of the downlink pass max. OTB: Full rolling OK, unless SRU issues, then 4_Hr_Rolling max (NO split rolls)	x
15. There is one downlink pass block per OTM prime or backup window (one wedding cake for a split pass). Exception - if first split downlink pass is ≤4 hours can use 2 cakes, put playback_gap in 2nd pass, put OTP/OTB in name of BOTH passes (for CDA)	x
16. Downlinks (attitude/rolling) match XMDLWG plan. Negotiated changes should be reported back to the WG	x

Segment Checklist p2

17. Multi-revolution turns about the X-axis have an offset greater than or equal to 30 degrees about Z	N/A
18. Live moveable blocks (LMBs) include the appropriate time margin specified as a DEADTIME request in CIMS at the beginning and end of the moveable block. TLM modes in separate OBSMOV request (n/a for RSS)	N/A
19. Live moveable blocks use an LMB epoch and use the appropriate epoch naming conventions. Live Update Blocks use a LUB epoch (RSS only)	N/A
20. All stellar occultation observations include an additional +/-20 minutes of time (40 minutes total) when they occur within -1 day to +2 days of Saturn periapse	N/A
21. All Ground and Live Moveable blocks associated with non-targeted geometric events (e.g., solar and earth occultations) include an additional +/-20 minutes of time margin (40 minutes total) to account for reference trajectory changes.	N/A
22. Check your GMB, LMB, LUB, Occ times against current reference trajectory	x
23. Dual playback of high value science data is performed via multiple playbacks within this segment. CIMS entries are correct. Dual playback does not affect downstream segments	N/A
24. Run the resource checker in CIMS and fix errors found. Remaining notes disposition here (1-6) OBSERV does not match obs period naming convention (7) Gap from 334T02:13 – 03:13 (dur =01:00) (8) Turn away from downlink does not have name WAYPTTURN at 332, 19:21 (9-14) Requests incorrectly referencing GMB	(1-6) Ignore (7) Ok. Gap was planned (8) Ok. Using DL attitude as WP (9-14) Ok. SP requests are GMB boundary requests. (CRC incorrectly flags these?) RSS thermal needs to be tied to RSS primes in GMB. CAPS uses GMB timing to ensure no gaps in data.
25. Run SMT, if SSR not empty at end of segment include in notes. Aim for empty SSR every 4 days minimum.	(see notes page)
26. Examine SMT warnings report, include dispositions here of any items	none
27. RSS boresight: one _SP pass, two _PRIME downlink passes, one hour observation block in SNER_3	N/A

Segment Checklist p3

Item	Disposition notes, or X if complete
28. Examine “ap_downlink report check” output, include dispositions here of any items (see next two items).	RSS C/A DL overlaps weekly maintenance 4.2 hours. (See RSS notes earlier in package.)
29. List any DSN stations requested during maintenance periods, AND JUSTIFICATION. **AVOID!!!!!**	See notes on RSS earlier in package
30. Avoid requesting two overlapping stations (except for RSS science) whenever possible – use RSS station for downlink too – or have RSS move ORT	x
31. Compare RSS requests to DSN requests, make sure they jive (ORT, occ, etc), ORTs are integrated.	x
32. List your percent 70M stations requested - avoid >35%	2/6 = 33%
33. Examine “ap_downlink report nav” output, MP should ensure NAV OK with gaps in 2way	x
34. In CIMS check for “start before”, “end before”, “start after”, “end after” requests - fix if any problems found	x
35. Verify OPNAVs are in SNER5 and are support_image class, sanity check rest of tlm modes (RADAR 15 min in 5A/activity in 5A or 8, etc)	x
36. If sequence boundary at START of your segment, ensure IVPGAP info correct, NO “start before” MAPS requests	N/A
37. If sequence boundary at END of your segment (ie in the next segment), ensure 6 “SEQ” upload DSN passes - will probably ripple into preceding segment(s), make sure to notify them. Last pass has Ybias window in front, no bonus science. NO “end after” MAPS requests	N/A
38. Verify opmodes correct (RSS and RADAR especially), teams going to sleep have agreed? Use table at https://cassini.jpl.nasa.gov/wiki/bin/view/Cassini/XXMOpModes	x
39. If conjunction is in your segment, see Conjunction page on SP Wiki	N/A
40. RAMAVOID: new waypoint, NOT in custom period	N/A
41. If on thrusters, confirm deadbands	N/A
42. Segment products & this package linked to XXM deliveries page	x