# CASSINI TOST SEGMENT

# Rev 149 Handoff Package (T77)

# Segment Boundary 2011-171T05:42:00 – 2011-173T07:42:00

## 01 November 2010

Deb Chattopadhyay

SMT report and SPASS

Science Highlights

Notes & Liens

Integration Checklist

# SMT report

Data volume summary

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DATA VOLUME SUMMARY --- TRANSFER FRAME OVERHEAD INCLUDED (80 BITS PER 8800-BIT FRAME)
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| | | | 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_149EA_G70METSEQ172_PRIME | 172 20:42 | 173 05:42 | 0 | 3155 | 165 | 3320 | 3319 | 0 | 0 | 215 | 53 | 3587 | 3712 | 125 | 310 | 7% | 0 |
| SP_149EA_C70METNON173_PRIME | 173 05:42 | 173 07:42 | 0 | 0 | 0 | 0 | 3319 | 3319 | 0 | 674 | 12 | 685 | 870 | 184 | 185 | 21% | 0 |

| Request | Riders | Start (SCET) | Start (Epoch) | Duration | End (SCET) | Primary | Secondary | Comments |
|---|---|---|---|---|---|---|---|---|
| Sequence S68, length = 69 days | | 2011-115T16:03:00 | | 068T19:07:00 | 2011-184T11:10:00 | | | |
| Titan Flyby T77 Segment | | 2011-171T05:42:00 | | 002T02:00:00 | 2011-173T07:42:00 | | | |
| SP_149TI_WAYPTTURN171_PRIME | | 2011-171T05:42:00 | | 000T00:40:00 | 2011-171T06:22:00 | NEG_Y to Titan | POS_X to 217.0/-83.7 | |
| NEW WAYPOINT | | 2011-171T06:22:00 | | 001T12:50:00 | 2011-172T19:12:00 | NEG_Y to Titan | POS_X to 217.0/-83.7 | |
| SP_149TI_DEADTIME171_PRIME | | 2011-171T06:22:00 | | 000T00:05:00 | 2011-171T06:27:00 | NEG_Y to Titan | POS_X to 217.0/-83.7 | |
| UVIS_149TI_HDACSTARE001_PRIME | C, I, R, V | 2011-171T06:27:00 | GMB_E149_TITAN_T77-000T12:1 | 000T03:05:01 | 2011-171T09:32:01 | UVIS_FUV to Titan | POS_X to 217.0/-83.7 | |
| UVIS_149TI_EUVFUV001_PRIME | C, I, R, V | 2011-171T09:32:01 | GMB_E149_TITAN_T77-000T09:1 | 000T06:30:00 | 2011-171T16:02:01 | UVIS_FUV to Titan | POS_X to 217.0/-83.7 | |
| RADAR_149TI_T77INSCAT001_PRIME | M | 2011-171T16:02:01 | GMB_E149_TITAN_T77-000T02:1 | 000T01:18:00 | 2011-171T17:20:01 | NEG_Z to Titan | POS_Y to NTP | |
| RADAR_149TI_T77IHISAR001_PRIME | M | 2011-171T17:20:01 | GMB_E149_TITAN_T77-000T01:1 | 000T00:42:00 | 2011-171T18:02:01 | NEG_Z to Titan | POS_Y to NTP | |
| RADAR_149TI_T77INALT001_PRIME | M | 2011-171T18:02:01 | GMB_E149_TITAN_T77-000T00:1 | 000T00:12:00 | 2011-171T18:14:01 | NEG_Z to Titan | NEG_X to Titan_SC_RAM | |
| Begin Dual Playback Science | | 2011-171T18:14:01 | GMB_E149_TITAN_T77-000T00:1 | 000T00:00:01 | 2011-171T18:14:02 | | | |
| RADAR_149TI_T77INOSAR001_PRIME | M | 2011-171T18:14:01 | GMB_E149_TITAN_T77-000T00:1 | 000T00:36:00 | 2011-171T18:50:01 | NEG_Z to Titan | NEG_X to Titan_SC_RAM | |
| 149TI (t) T77 TITAN Outbou... | | 2011-171T18:32:01 | | 000T00:00:01 | 2011-171T18:32:02 | | | |
| End Dual Playback Science | | 2011-171T18:50:01 | GMB_E149_TITAN_T77+000T00:1 | 000T00:00:01 | 2011-171T18:50:02 | | | |
| RADAR_149TI_T77OUTALT001_PRIME | M | 2011-171T18:50:01 | GMB_E149_TITAN_T77+000T00:1 | 000T00:12:00 | 2011-171T19:02:01 | NEG_Z to Titan | NEG_X to Titan_SC_RAM | |
| RADAR_149TI_T77OHISAR001_PRIME | M | 2011-171T19:02:01 | GMB_E149_TITAN_T77+000T00:1 | 000T00:42:00 | 2011-171T19:44:01 | NEG_Z to Titan | NEG_Y to NTP | |
| RADAR_149TI_T77OUTSCT001_PRIME | M | 2011-171T19:44:01 | GMB_E149_TITAN_T77+000T01:1 | 000T01:18:00 | 2011-171T21:02:01 | NEG_Z to Titan | NEG_Y to NTP | |
| CIRS_149TI_FIRNADMAP002_PRIME | I, V | 2011-171T21:02:01 | GMB_E149_TITAN_T77+000T02:1 | 000T02:30:00 | 2011-171T23:32:01 | CIRS_FP1 to Titan | NEG_X to North_Pole_Dir | |
| CIRS_149TI_MIRLMBMAP002_PRIME | I, U, V | 2011-171T23:32:01 | GMB_E149_TITAN_T77+000T05:1 | 000T04:00:00 | 2011-172T03:32:01 | CIRS_FPB to Titan | PIC | |
| VIMS_149TI_GLOBMAP001_PRIME | C, I | 2011-172T03:32:01 | GMB_E149_TITAN_T77+000T09:1 | 000T05:00:00 | 2011-172T08:32:01 | VIMS_IR to Titan | NEG_X to 93.5/-49.9 | |
| CIRS_149TI_MIDIRTMAP002_PRIME | I, V | 2011-172T08:32:01 | GMB_E149_TITAN_T77+000T14:1 | 000T09:44:59 | 2011-172T18:17:00 | CIRS_FPB to Titan | PIC | |
| SP_149NA_DEADTIME172_PRIME | | 2011-172T18:17:00 | GMB_E149_TITAN_T77+000T23 | 000T00:15:00 | 2011-172T18:32:00 | NEG_Y to Titan | POS_X to 217.0/-83.7 | |
| SP_149EA_DLTURN172_PRIME | | 2011-172T18:32:00 | | 000T00:40:00 | 2011-172T19:12:00 | XBAND to Earth (0.0,0.0,-9.5 deg. offs | NEG_Y to Saturn | |
| NEW WAYPOINT | | 2011-172T19:12:00 | | 000T12:30:00 | 2011-173T07:42:00 | XBAND to Earth (0.0,0.0,-9.5 deg. offs | NEG_Y to Saturn | |
| SP_149EA_YBIAS172_PRIME | E | 2011-172T19:12:00 | | 000T01:30:00 | 2011-172T20:42:00 | XBAND to Earth (0.0,0.0,-9.5 deg. offs | NEG_Y to Saturn | |
| SP_149EA_G70METSEQ172_PRIME | C | 2011-172T20:42:00 | | 000T09:00:00 | 2011-173T05:42:00 | XBAND to Earth (0.0,0.0,-9.5 deg. offs | 6_Hr_Rolling | NEG_Y to Saturn (0,0,-9.5), MIMI |
| SP_149EA_C70METNON173_PRIME | C | 2011-173T05:42:00 | | 000T02:00:00 | 2011-173T07:42:00 | XBAND to Earth (0.0,0.0,-9.5 deg. offs | Rolling | NEG_Y to Saturn (0,0,-9.5), MIMI |

DOY 171 :

UVIS - UVIS will obtain an image cube of Titan's atmosphere at EUV and FUV wavelengths by sweeping its slit across the disk. These cubes provide spectral and spatial information on nitrogen emissions, H emission and absorption, absorption by simple hydrocarbons, and the scattering properties of haze aerosols. This is one of many such cubes gathered over the course of the mission to provide latitude and seasonal coverage of Titan's middle atmosphere and stratosphere.

RADAR - Long altimetry over Shangri-La/Xanadu boundary for global shape and Xanadu characterization. SAR of Northern Xanadu (possible stereo with T17 on Ksa impact crater). Inbound and outbound scatterometry/radiometry, HiSAR and altimetry.

CIRS - CIRS is performing hemisphere temperature mapping in the stratosphere to monitor seasonal change, especially of the north polar winter vortex.

DOY 172 :

CIRS - CIRS is performing hemisphere temperature mapping in the stratosphere to monitor seasonal change, especially of the north polar winter vortex.

VIMS - During this flyby, VIMS will stare at Titan during its prime observation in order to continue its mapping of the cloud coverage to detect any seasonal change in the cloud distribution before and after the equinox.

# Dual playbacks

- A Dual Playback for High Value Science (RADAR) has been planned

- Based on DSN requests, SMT results indicate it will fit within this segment

- A SPLAT item has been opened until the DSN negotiations for this time period are complete*
  - *Was unable to add SPLAT item - CIMS will not allow adding a SPLAT entry until the revised ENGR request has been accepted into the sequence delivery

| Flyby | Driving Instrument | BEGHIVAL | ENDHIVAL | P4 Dual Playback | SSR-A empty after first playback? | Anything nonstandard? |
|-------|-------------------|----------|----------|------------------|-----------------------------------|-----------------------|
| T77 | RADAR | T77-18 min | T77+18 min | 674 Mb | Yes | No |

A "standard" dual playback: no carryover coming in, single observation period, first downlink empties SSR, no caboose observation period, second downlink empties SSR

# Notes and Liens

- Pointing:
    - Collaborative prime/rider coordination designs
        - CIRS_149TI_MIDIRTMAP002_PRIME w/ ISS (+14:00 to + 23:44:59)
    - No custom period
    - CIRS heating during waypoints
        - Maximum CIRS delta temperature is 2.90648 and the final CIRS delta temperature is 1.16365 during rolling downlink SP_149EA_G70METSEQ172_PRIME
    - RBOT-friendly secondaries used in all cases except for RADAR and CIRS limb observations. Secondaries are flexible except in the following cases:
        - RADAR_149TI_T77INOSAR001_PRIME : Significant science impact if secondary changed
        - RADAR_149TI_T77IHISAR001_PRIME & RADAR_149TI_T77OHISAR001_PRIME : Secondary preferred (to reduce turn times)
        - All other RADAR observations : Secondary preferred

- Data Volume:
    - No issues. Dual PB for C/A -18:00 to C/A+18:00 for RADAR.

- DSN:
    - No special requests.

- Opmodes:
    - No special op modes.

- Special Activities:
    - None.

**Sequence Liens:**

- Dual PB for C/A -18:00 to C/A+18:00; CIRS heating during rolling downlink SP_149EA_G70METSEQ172_PRIME.

# Segment Checklist p1

| Item | Disposition notes, or X if complete |
|---|---|
| 1. Disposition all requests in CIMS - approve all pending requests, no outstanding revisions/new requests | X |
| 2. No rocking downlinks. No AZSCANS (IGAPIMAGE). No arrayed downlinks. | X |
| 3. Examine SPASS, ensure SP turns correctly designated PRIME or NEW WAYPOINT. Prime RSS observations require the Xband to Earth attitude be a waypoint, use DLTURN with spass type New Waypoint (also for DLTURN before Ybiases) | 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. First turn of segment has been checked using correct final attitude of previous segment. All turns use the slower XM slew rates and include 2 minutes turn margin. Allow extra turn time whenever possible to aid possible RBOT changes. | X |
| 6. YBIAS windows have been included as required, guidelines met per https://cassini.jpl.nasa.gov/sp/xxmdev/ybias_mpforum.pdf | 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 flyby or an asymmetric 10 hour window for Icy Satellite flybys. 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! | n/a |
| 10. PIEs are properly identified via _PIE naming convention. All agreed to PIEs have been integrated. | n/a |
| 11. Prime/rider coordination: secondaries have all been reviewed and agreed to, collaborative observations are so designated, pre-designed in PDT, prime instrument agrees to work with riders for collaborate designs | X |
| 12. Use rolling_sru if required. Follow rolling guidelines per SCO, see the ScoRules wiki page (linked to integration procedure) | n/a |
| 13. The secondary axis for downlinks that contain prime and backup OTMs is the same, and inertially fixed | n/a |
| 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) | n/a |
| 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). MUST have a full length 9 hour station requested for NAV tracking data | n/a |

# Segment Checklist p2

| Item | Disposition notes, or X if complete |
|---|---|
| 16. Moving any downlink pass to a different view period requires coordination with Navigation. Changes to the DSN strawman plan require SPST manager approval. | n/a |
| 17. Multi-revolution turns about the X-axis have an offset greater than or equal to 30 degrees | 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). Waypoint same entering as leaving, and is valid throughout. Avoid skeet shoots in LMBs. If CMT management required, contain within LMB. 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 |
| 19. Pointing is not altered for science during any SCO/MP activity that has pointing requirements (e.g., dust hazards). [Note that science turns are allowed for all but the first minute of an inbound thruster transition during a Titan or icy satellite flyby. No science turns are allowed during any portion of the outbound transition] | 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 (Tour Atlas) | X |
| 23. Dual playback of high value data is performed within this segment and does not affect downstream segments. CIMS entries are correct and SPASS type Note. SSR-A is emptied after the first downlink. Open a SPLAT item (tied to the ENGR request that resets the pointers, ie the DUALPB_CDS request) which says, "During DSN negotiations ensure that SSR-A is emptied before the pointers are reset. This item cannot be closed until the DSN negotiations are complete for both downlink passes, or the dual playback is deleted." | X (SPLAT comment not added, CIMS error as ENGR request has not been dispositioned in a sequence yet) |
| 24. Run the resource checker in CIMS and fix errors found. Remaining notes disposition here or on notes page | SSR parameters for downlink do not match since the removal of P5 from priority playback |
| 25. SMT: note if SSR not empty at end of segment, have approval from following segment. No carryover across sequence boundaries. Aim for empty SSR every 4 days. No negative SSR margin during integration. List discrepancies on notes page. | X |

# Segment Checklist p3

| Item | Disposition notes, or X if complete |
|---|---|
| 26. Examine SMT warnings report, include dispositions here or on notes page of any items | 1. No data policed during part of RADAR warmup (this is ok)<br><br>2. P4 overfilled by <1.0 Mb |
| 27. RSS boresight: one _SP pass, two _PRIME downlink passes, one hour observation block in SNER_3 | n/a |
| 28. Examine "ap_downlink report check" output, include dispositions here or on notes page of any items (see next two items). | 70M usage is 100%; # of seq passes <5 (both ok for TOST) |
| 29. List any DSN stations requested during maintenance periods, AND JUSTIFICATION. **AVOID!!!!!** | n/a |
| 30. Avoid requesting two overlapping stations (except for RSS science) whenever possible – use RSS station for downlink too | n/a |
| 31. Compare RSS requests to DSN requests, make sure they jive (ORT, occ, etc), ORTs are integrated. | n/a |
| 32. Apoapse segments only: List your percent 70M stations requested - avoid >35%. | n/a |
| 33. Apoapse segments only: Follow Integration Guideline & Constaint #15c regarding "two out of three" types of science per RBOT segment. ME OTM's split an RBOT segment. | n/a |
| 34. Periapse segments: >3 hr observations with >60 degree target motion are broken up by a 20 min inertial period (lien if not explicit in SPASS) | X |
| 35. Support images use _XXM or _XXM3 activity type | n/a |
| 36. In CIMS check for "start before", "end before", "start after", "end after" requests - fix if any problems found | X |
| 37. 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 |

# Segment Checklist p4

| Item | Disposition notes, or X if complete |
|---|---|
| 38. If sequence boundary at START of your segment, ensure IVPGAP info correct, NO "start before" MAPS requests | n/a |
| 39. 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 |
| 40. Verify opmodes correct (RSS and RADAR especially), teams going to sleep have agreed? MIMI: not in sleep during RPX? Use table at https://cassini.jpl.nasa.gov/wiki/bin/view/Cassini/XXMOpModes | X |
| 41. If conjunction is in your segment, see Conjunction page on SP Wiki | n/a |
| 42. RAMAVOID: new waypoint, NOT in custom period | n/a |
| 43. If on thrusters, confirm deadbands | n/a |
| 44. Segment products linked to XXM deliveries page, & this package when you are done | X |