



## **CASSINI SOST SEGMENT**

**Rev 165 Handoff Package**

**Segment Boundary 2012-122T10:02:00 – 2012-125T09:47:00**

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SMT report and SPASS

Science Highlights

Notes & Liens

# SMT report

SOST\_165\_E19

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

DOWNLINK PASS NAME	Start doy hh:mm	End doy hh:mm	OBSERVATION PERIOD							DOWNLINK_PASS							
			P4					P5	RECORDED		PLAYBACK						
			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)	MARGN (%)	CAROVN (Mb)
SP_165EA_G34BWGRSS123_PRIME	123 01:31	123 04:31	0	826	65	891	3322	2431	0	78	18	987	274	-713	1	0%	713
SP_165EA_C34BWGRSS123_PRIME	123 08:01	123 11:01	713	397	32	1142	3322	2180	0	796	18	1956	305	-1652	1	0%	1651
SP_165EA_C34BWGRSS423_PRIME	123 14:01	123 17:01	1651	233	30	1914	3322	1408	0	95	18	2027	267	-1760	1	0%	1760
SP_165EA_G70METNON124_PRIME	124 00:47	124 09:47	1760	1282	33	3074	3322	248	0	553	53	3681	3679	-3	1	0%	2
SP_165EA_G34BWGNON125_PRIME	125 00:47	125 09:47	2	478	63	544	3322	2778	0	215	53	812	813	0	1	0%	0

No dual playback.  
No carryover.

Request	Riders	Start (SCET)	Start (Epoch)	Duration	End (SCET)	Primary	Secondary	Comments
Sequence S73, length = 73 days		2012-097T11:47:00		073T11:11:00	2012-170T22:58:00			
Enceladus Flyby E19 Segment		2012-122T10:02:00		002T23:45:00	2012-125T09:47:00			
ISS_1650T_YMIROTA065_PRIME		2012-122T10:02:00		000T09:45:00	2012-122T19:47:00	UVIS_FUV to Rocks	NEG_Z to Earth	
VIMS_1655U_SOLARPORT001_PRIME		2012-122T19:47:00		000T03:00:00	2012-122T22:47:00	VIMS_IR_SOL to Sun	VIMS_IR to N/A	
<b>SP_165EA_DEADTIME122_PRIME</b>		<b>2012-122T22:47:00</b>		<b>000T00:14:29</b>	<b>2012-122T23:01:29</b>	<b>XBAND to Earth</b>	<b>NEG_X to NSP</b>	
ISS_165EN_PLMHPR001_PIE	C, R, U, V	2012-122T23:01:29	GMB_E165_ENCELADUS_E19-000T10:30:00	000T02:30:00	2012-123T01:31:29	ISS_NAC to Enceladus	NEG_X to NSP	SOST PIE
SP_165EA_G34BWGRSS123_PRIME	R	2012-123T01:31:29	GMB_E165_ENCELADUS_E19-000T08:00:00	000T03:00:00	2012-123T04:31:29	XBAND to Earth	NEG_X to NSP	RSS gravity wing PIE; 2ry is NEG_X to NSP
<b>Begin Custom</b>		<b>2012-123T04:31:29</b>	<b>GMB_E165_ENCELADUS_E19-000T05:00:00</b>	<b>000T00:00:01</b>	<b>2012-123T04:31:30</b>	<b>XBAND to Earth</b>	<b>NEG_X to NSP</b>	
ISS_165EN_PLMHPR002_PRIME	C, U, V	2012-123T04:31:29	GMB_E165_ENCELADUS_E19-000T05:00:00	000T01:33:31	2012-123T06:05:00	ISS_NAC to Enceladus	NEG_X to NSP	Pick up at XBAND to Earth, NEG_X to NSP; Hand off at NEG_Y to Enceladus, NEG_X to NSP, SOST PIE
CIRS_165EN_ENCELADUS001_PRIME	M	2012-123T06:05:00	GMB_E165_ENCELADUS_E19-000T03:26:29	000T01:56:29	2012-123T08:01:29	NEG_Y to Enceladus	NEG_X to NSP	Pick up at NEG_Y to Enceladus, NEG_X to NSP; Hand off at XBAND to Earth, NEG_Y to 113.63/-2.61.
SP_165EA_C34BWGRSS123_PRIME	M, R	2012-123T08:01:29	GMB_E165_ENCELADUS_E19-000T01:30:00	000T03:00:00	2012-123T11:01:29	XBAND to Earth	NEG_Y to 113.63/-2.61	Pick up at XBAND to Earth, NEG_Y to 113.63/-2.61; Hand off at XBAND to Earth, NEG_Y to 113.63/-2.61. 2ry NEG_Y to corot (as RA/Dec) for MAPS; No CDA articulation
165EN (t) E19 ENCELADUS In...		2012-123T09:31:29		000T00:00:01	2012-123T09:31:30			
CIRS_165EN_ENCELADUS002_PRIME	I, U	2012-123T11:01:29	GMB_E165_ENCELADUS_E19+000T01:30:00	000T03:00:00	2012-123T14:01:29	NEG_Y to Enceladus (0.0,-20.0,0.0 deg. offset)	NEG_X to NSP	Pick up at XBAND to Earth, NEG_Y to 113.63/-2.61; Hand off at XBAND to Earth, NEG_X to NSP
Periapse R = 3.245 Rs, lat ...		2012-123T12:33:44		000T00:00:01	2012-123T12:33:45			
<b>End Custom</b>		<b>2012-123T14:01:29</b>	<b>GMB_E165_ENCELADUS_E19+000T04:30:00</b>	<b>000T00:00:01</b>	<b>2012-123T14:01:30</b>	<b>XBAND to Earth</b>	<b>NEG_X to NSP</b>	
SP_165EA_C34BWGRSS423_PRIME	R	2012-123T14:01:29	GMB_E165_ENCELADUS_E19+000T04:30:00	000T03:00:00	2012-123T17:01:29	XBAND to Earth	NEG_X to NSP	RSS gravity wing PIE; 2ry is NEG_X to NSP
<b>SP_165EA_DEADTIME123_PRIME</b>		<b>2012-123T17:01:29</b>	<b>GMB_E165_ENCELADUS_E19+000T07:30:00</b>	<b>000T00:13:31</b>	<b>2012-123T17:15:00</b>	<b>XBAND to Earth</b>	<b>NEG_X to NSP</b>	
SP_165DI_WAYPTTURN123_PRIME		2012-123T17:15:00		000T00:34:00	2012-123T17:49:00	ISS_NAC to Dione (0.0,20.0,0.0 deg. offset)	NEG_X to NSP	
<b>NEW WAYPOINT</b>		<b>2012-123T17:49:00</b>		<b>000T06:58:00</b>	<b>2012-124T00:47:00</b>	<b>ISS_NAC to Dione (0.0,20.0,0.0 deg. offset)</b>	<b>NEG_X to NSP</b>	
CIRS_165DI_DIONE001_PIE	I, U, V	2012-123T17:49:00		000T02:13:00	2012-123T20:02:00	NEG_Y to Dione (0.0,20.0,0.0 deg. offset)	NEG_X to NSP	Collaborative Rider(s): ISS
ISS_165DI_REGMAP001_PIE	C, U, V	2012-123T20:02:00		000T04:09:00	2012-124T00:11:00	ISS_NAC to Dione (0.0,20.0,0.0 deg. offset)	NEG_X to NSP	Collaborative Rider(s): UVIS, 2 min. dwells
SP_165EA_DLTURN124_PRIME		2012-124T00:11:00		000T00:29:00	2012-124T00:40:00	XBAND to Earth (0.0,0.0,20.0 deg. offset)	POS_X to NEP	part 1 of 2
SP_165EA_DLTURN424_PRIME		2012-124T00:40:00		000T00:07:00	2012-124T00:47:00	XBAND to Earth	POS_X to NEP	part 2 of 2 (2ry for CAPS as per DLWG)
<b>NEW WAYPOINT</b>		<b>2012-124T00:47:00</b>		<b>001T09:00:00</b>	<b>2012-125T09:47:00</b>	<b>XBAND to Earth</b>	<b>POS_X to NEP</b>	
SP_165EA_G70METNON124_PRIME	C, E, M, R	2012-124T00:47:00		000T09:00:00	2012-124T09:47:00	XBAND to Earth	Rolling	POS_X to NEP or NSP, CAPS
SP_165EA_YGAP124_PRIME	C, E	2012-124T09:47:00		000T01:30:00	2012-124T11:17:00	XBAND to Earth	POS_X to NEP	after DL to avoid RSS gravity bias keepout zone
UVIS_165IC_ALPVIR001_PRIME		2012-124T11:17:00		000T03:00:00	2012-124T14:17:00	UVIS_FUV to 201.298/-11.162	POS_X to NEP	
ISS_1650T_YMIROTB065_PRIME		2012-124T14:17:00		000T09:00:00	2012-124T23:17:00	UVIS_FUV to Rocks	NEG_Z to Earth	RA/Dec approx. 148/+21.8 deg; turns approx. 25 min
SP_165EA_YGAP424_PRIME	E	2012-124T23:17:00		000T01:30:00	2012-125T00:47:00	XBAND to Earth	POS_X to NEP	
SP_165EA_G34BWGNON125_PRIME	C	2012-125T00:47:00		000T09:00:00	2012-125T09:47:00	XBAND to Earth	Rolling/SRU	POS_X to NEP or NSP, CAPS

# Science Highlights

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Overview: RSS flyby at ~74 km with secondary attitude optimized for MAPS at C/A (NEG\_Y to corot, as an RA/Dec). The main goal of this gravity flyby is to understand the interior structure of Enceladus, specifically the nature of a possible mass anomaly located at the southern polar region that may play a role in the onset and sustenance of activity on the moon. Otherwise, ORS Enceladus observations inbound and outbound, as well as ORS Dione after the flyby.

## DOY 122 (of 2012):

This segment starts with an ISS observation of an irregular outer satellite of Saturn for nearly 10 hours to gather data for a light curve. VIMS will then do a 3-hour solar port calibration activity.

## DOY 123:

This is a busy flyby day, which begins with an ISS Enceladus plume observation to understand the large scale morphology of the plume and temporal changes to its structure over weeks (by comparison to the observations on the previous rev). Radio science activities then get underway with a 3-hour gravity observation on the inbound “wing” of the flyby, before handing attitude control back to ISS for more plume imaging and then to CIRS to scan Enceladus in the infrared on the nightside, anti-Saturn hemisphere at equatorial latitudes. CIRS will search for possible hot spots outside of the tiger stripes and to understand the global energy balance of the moon. Spatial resolution of this coverage is best at the end of the observation (12.2 mrad), increasing from 5.0 mrad at start.

Cassini then passes its closest-approach to Enceladus with the high-gain antenna pointed toward Earth for radio science, while the secondary attitude is aligned to enhance fields and particles science.

On the outbound leg, CIRS will observe Enceladus at equatorial latitudes in the daytime to acquire Saturn-facing, leading hemisphere, low phase (<20 degrees) coverage, and then RSS will finish their gravity campaign with a 3-hour outbound “wing”. This busy day concludes with Cassini turning its ORS instruments to Dione, where CIRS and ISS will scan Dione’s equatorial latitudes on the leading hemisphere with a chance to observe the fractured region and do further searches for evidence of outgassing or recent activity.

## DOY 124:

Today Cassini turns to Earth to downlink all of the great flyby data to the 70-meter DSN antenna in Goldstone, CA. Before this icy satellite segment concludes, however, UVIS will take time to do an instrument calibration, and ISS will do another 9-hour observation of one of Saturn’s outer irregular satellites.

## DOY 125:

Cassini will have a final downlink today to playback the rest of the data.

# Y bias windows & data volume

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No YGAP windows overlap downlinks, but after the E19 flyby, the YGAP window has been placed *after* the downlink to avoid the RSS gravity bias “keep out” zone. (see next slide)

SCO has approved.

# Y bias and RSS

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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**

Gravity Science Enhancements. Placing the YGAP window 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.

## Thruster firing/**bias keep-out zone for E19:**

From beginning of inbound GSE until the end of the outbound GSE, with the most critical period being the prime gravity observation (beginning of 1st segment until the end of the third segment).

In SCET: 2012-122T01:02:00 – 2012-124T09:47:00

Critical period: 2012-123T01:31:29 – 2012-123T17:01:29

# Notes

SOST\_165\_E19

- Pointing:
  - E19 C/A pointing is passive, so may not show up in prime commanding for checks. See next page.
  - Valid WPs at all times (even during custom period)
  - No consumable heating expected
  - Ybias window after E19 is *after* DL. See slides 5 & 6.
  - RBOT: ISS\_165DI\_REGMAP001\_PIE violates target motion constraint. SPLAT item opened, designers notified.
  - Earth-pointed DL attitudes used for all WPs (for RSS and RBOT simplicity), except short Dione WP which used a hard-to-find, safe 2ry.
  - Collaborative primes:
    - CIRS\_165DI\_DIONE001\_PIE 2012-123T17:49:00 – 2012-123T20:02:00
    - ISS\_165DI\_REGMAP001\_PIE 2012-123T20:02:00 – 2012-124T00:11:00
    - E19 C/A is RSS primary and MAPS 2ry, but no turns, just Earth-pointed where CIRS will leave S/C for C/A
- Data Volume:
  - No issues. No dual PB. No warnings. Playback occurring during RSS gravity PIEs around/at E19.
- DSN:
  - [Level 3 request](#): Rev 165 E19 Enceladus Gravity Observation: Level 3 request from 2012-122/2200 to 2012-123/1845. Stations: DSS-55, DSS-25, DSS-34
- Resource checker:
  - None that have not been marked ignore.
- Opmodes:
  - No unique opmodes. RSSKRWAF for RSS E19 flyby. CDA agreed to no articulation +/-30 min. around E19 C/A: 2012-123T09:01:29 (GMB\_E165\_ENCELADUS\_E19-000T00:30:00) – 2012-123T10:01:29.
- Hydrazine:
  - N/A (on wheels)
- Special Activities:
  - CDA No-Articulation agreements (during RSS at E19) – secondary optimized for MAPS. See “Opmode” bullet here.

# Liens

SOST\_165\_E19

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## Sequence Liens (should all be SPLAT items):

- List any Liens to be worked in SIP, ie
  - Note (applies to #80 in handoff checklist XLS): RSS E19 C/A PIE is acting as a rider on SP\_165EA\_C34BWGRSS123\_PRIME (at 2012-123T08:01:29) so that we can downlink. This occurs in a custom period where CIRS will leave S/C at proper Earth-pointed attitude and then pick up S/C at that attitude after C/A, so SP (and RSS) will not be doing any turns. This attitude therefore may not (will not?) show up to be checked in the WP pef. [C/A attitude \(XBAND to Earth, NEG\\_Y to 113.6/-2.61\) has been verified as safe according to WP checker](#). Expected heating is on the order of 1.8K for CIRS and 1.3K for VIMS; no consumables. Due to low(ish) altitude, [AACCS may wish to check this attitude](#) (usually use c-kernel, but Ryan Lim said SASF would work... just not sure *whose* SASF is the appropriate one.) Since there is no slewing at C/A and E17 and E18 are at same altitude, perhaps not worth extra concern?