

TOST: Handoff Package for 031TI (T20)
[RADAR Option]

Segment Boundary 2006-296T10:56 – 2006-299T18:11
Titan C/A=2006-298T15:51:29, Altitude = 950 km

May 19, 2003

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Why Are There Two 031TI (T20) Deliveries??

- The 031TI (T20) segment is a high priority flyby for both RADAR and VIMS high-resolution surface coverage, as well as for MAPS
- TOST **deferred** choosing between RADAR or VIMS/MAPS (aka “the ORS option”) at closest approach until the results of the first 10 Titan flybys were analyzed; the PSG approved
- This requires implementation of both options during the SOP development of the S25 sequence. The requests for each option are contained in separate CIMS deliveries called “031TI_T20_Option1_ORS” and “031TI_T20_Option2_RADAR”, respectively.
- The differences between the options are confined to the observation period between 297T18:26 and 299T03:07.
 - The observation period starting at 296T10:56, as well as all of the downlink pass blocks, are identical in both options
 - In the DOY 297 observation period there are differences in the SPASS, the PDT designs, the telemetry mode strategy, the OpMode strategy, and the data policing allocations.

Why Are There Two 031TI (T20) Deliveries?? (cont.)

- The exact procedure for implementing both flybys is still an action item on SP, but will probably look something like this:
 - S25 Port 1 = Implement ORS option
 - S25 Port 2 = Implement ORS option
 - S25 Special Port = Remove ORS option observation period for DOY 297; replace with RADAR option observation period for DOY 297; re-merge (i.e., new SMT, SeqGen, KPT runs, SCO analysis, etc.)
- The ORS option is the logical choice to implement first because it has a more complicated set of PDT designs. There are custom handoffs among RADAR, CAPS, and VIMS in the custom period within 0T01:15 of closest approach. It makes sense to spend extra time developing these designs.
 - In the RADAR option, there are no custom handoffs. RADAR is prime from c/a-0T05:30 to c/a+01:46.

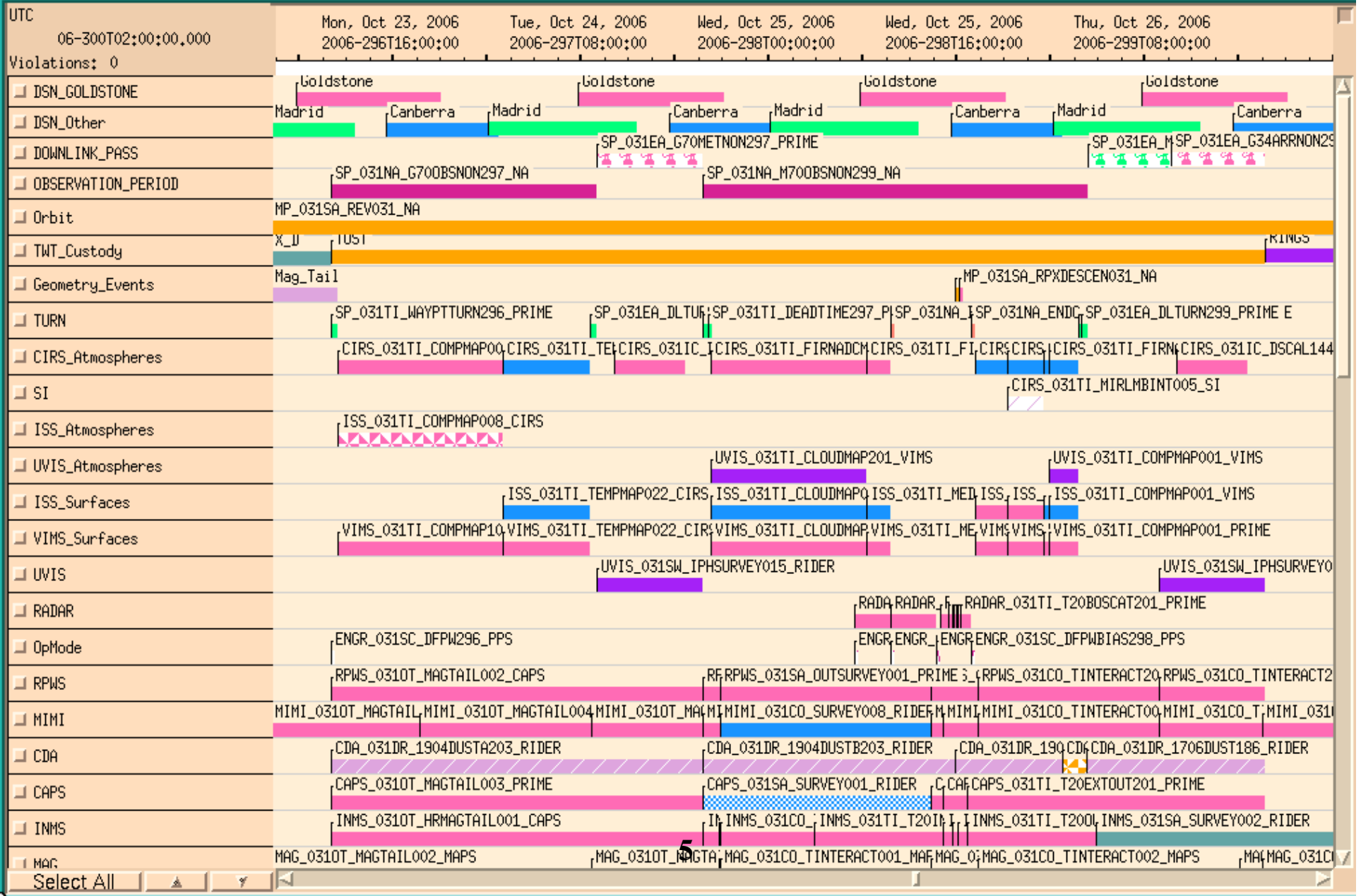
031TI (T20) RADAR Option Timeline

C/A = 2006-298T15:51:29 @ 950 km

Start Time	End Time	Prime Activity	Obs Detail	OpMode	TLM Mode	Comments
296T10:56	296T11:26	SP turn to waypoint	-Y to Titan, -X to Sun	DFPW_NORMAL	S_N_ER_3	
296T11:26	297T01:26	CIRS	Comp Map	DFPW_NORMAL	S_N_ER_3	
297T01:26	297T08:56	CIRS	Temp Map	DFPW_NORMAL	S_N_ER_3	
297T08:56	297T09:26	SP turn to Earth		DFPW_NORMAL	S_N_ER_3	
297T09:26	297T18:26	Gold 70-m		DFPW_NORMAL	RTE_N_SPB	
297T18:26	297T18:56	SP turn to waypoint	-Y to Titan, +X to NTP	DFPW_NORMAL	S_N_ER_3	
297T18:56	297T19:11	OD Deadtime		DFPW_NORMAL	S_N_ER_3	
-20:40	-07:30	VIMS	Cloudmap	DFPW_NORMAL, RADAR_WU	S_N_ER_3, S N ER 5a	RADAR_WU & S_N_ER_5a start at -08:30, S N ER 3 at -08:15
-07:30	-05:30	VIMS	Mosaic	RADAR_WU	S_N_ER_3	
-05:30	-01:37	RADAR	Radiometry	RADAR_RWA	S_N_ER_8	Includes turn from ORS waypoint
-01:37	-01:15	RWA->RCS transition		RADAR_RCS		
-01:15	-00:45	RADAR	scatterometry	RADAR_RCS	S_N_ER_8	
-00:45	+00:45	RADAR	2nd axis -X to RAM for MAPS	RADAR_RCS	S_N_ER_8	2nd axis = +Y to Sun at +00:05 to protect CIRS radiator
+00:45	+01:15	RADAR	scatterometry	RADAR_RCS	S_N_ER_8	
+01:15	+01:23	RADAR	Turn to ORS waypoint	RADAR_RCS	S_N_ER_8	
+01:23	+01:46	RCS->RWA transition		DFPW_NORMAL		
+01:46	+04:30	ISS	1-min. dwells for VIMS	DFPW_NORMAL	S_N_ER_3	
+04:30	+07:30	CIRS	5-min. dwells (for ISS/VIMS?)	DFPW_NORMAL	S_N_ER_3	
+07:30	+08:00	VIMS		DFPW_NORMAL	S_N_ER_3	
+08:00	+10:30	VIMS	Comp Map	DFPW_NORMAL	S_N_ER_3	
299T02:22	299T02:37	OD Deadtime		DFPW_NORMAL	S_N_ER_3	
299T02:37	299T03:07	SP turn to Earth		DFPW_NORMAL	S_N_ER_3	
299T03:07	299T10:11	Mad 70-m Array		DFPW_NORMAL	RTE_N_SPB	
299T10:11	299T18:11	Gold 34-m Array		DFPW_NORMAL	RTE_N_SPB	New DSN capability



031TI (T20) RADAR Option



Select All

031TI (T20) RADAR Option SPASS

Request	Riders	Start(SCET)	Start(Epoch)	Duration	End(SCET)	Primary Pointing	Secondary Pointing	Comments
Sequence S025, length = 33 ...		2006-295T18:28:00		032T22:04:00	2006-328T16:30:00			
TOST rev 31 Segment		2006-296T10:56:00		003T07:15:00	2006-299T18:11:00			
SP_031TI_WAYPTTURN296_PRIME	M	2006-296T10:56:00		000T00:30:00	2006-296T11:26:00	ISS_NAC to Titan	NEG_X to Sun	SP Turn to Waypoint
NEW WAYPOINT		2006-296T11:26:00		001T07:30:00	2006-297T18:56:00	ISS_NAC to Titan	NEG_X to Sun	
CIRS_031TI_COMPMPA008_PRIME	I, M, V	2006-296T11:26:00		000T14:00:00	2006-297T01:26:00	CIRS_FPB to Titan	POS_Z to North_Pole_Dir	
CIRS_031TI_TEMPMPA022_PRIME	I, M, V	2006-297T01:26:00		000T07:30:00	2006-297T08:56:00	CIRS_FPB to Titan	NEG_X to North_Pole_Dir	
SP_031EA_DLTURN297_PRIME	M	2006-297T08:56:00		000T00:30:00	2006-297T09:26:00	XBAND to Earth	NEG_X to NEP	SP Turn to Earth
SP_031EA_G70METNON297_PRIME	C, M	2006-297T09:26:00		000T09:00:00	2006-297T18:26:00	XBAND to Earth	NEG_X to NEP	
SP_031TI_WAYPTTURN297_PRIME	M	2006-297T18:26:00		000T00:30:00	2006-297T18:56:00	ISS_NAC to Titan	POS_X to North_Pole_Dir	SP Turn to Waypoint
NEW WAYPOINT		2006-297T18:56:00		001T23:15:00	2006-299T18:11:00	ISS_NAC to Titan	POS_X to North_Pole_Dir	
SP_031TI_DEADTIME297_PRIME	M	2006-297T18:56:00		000T00:15:00	2006-297T19:11:00	ISS_NAC to Titan	POS_X to North_Pole_Dir	
VIMS_031TI_CLOUDMAP001_PRIME	C, I, M, R, U	2006-297T19:11:29	GMB_E031_Titan20-000T20:40:00	000T13:10:00	2006-298T08:21:29	ISS_NAC to Titan	POS_X to North_Pole_Dir	
VIMS_031TI_MEDRES001_PRIME	C, I, R	2006-298T08:21:29	GMB_E031_Titan20-000T07:30:00	000T02:00:00	2006-298T10:21:29	VIMS_IR to Titan	POS_X to North_Pole_Dir	
Begin Custom Period		2006-298T10:21:29	GMB_E031_Titan20-000T05:30:00	000T00:01:00	2006-298T10:22:29			
RADAR_031TI_T20BINRAD201_PRIME	M	2006-298T10:21:29	GMB_E031_Titan20-000T05:30:00	000T03:53:00	2006-298T14:14:29	NEG_Z to Titan	POS_X to North_Pole_Dir	
ENGR_031SC_RADRCS298_PPS	M	2006-298T14:14:29	GMB_E031_Titan20-000T01:37:00	000T00:21:13	2006-298T14:35:42	NEG_Z to Titan	NEG_Y to North_Pole_Dir	Deadband = (2,2,20)
RADAR_031TI_T20BISCAT201_PRIME	M	2006-298T14:36:29	GMB_E031_Titan20-000T01:15:00	000T00:45:00	2006-298T15:21:29	NEG_Y to Titan	NEG_Y to North_Pole_Dir	
RADAR_031TI_T20BINALT201_PRIME	M	2006-298T15:21:29	GMB_E031_Titan20-000T00:30:00	000T00:15:00	2006-298T15:36:29	NEG_Z to Titan	NEG_X to Titan_SC_RAM	
RADAR_031TI_T20BILSAR201_PRIME	M	2006-298T15:36:29	GMB_E031_Titan20-000T00:15:00	000T00:08:00	2006-298T15:44:29	NEG_Z to Titan	NEG_X to Titan_SC_RAM	
RADAR_031TI_T20BHISAR201_PRIME	M	2006-298T15:44:29	GMB_E031_Titan20-000T00:07:00	000T00:14:00	2006-298T15:58:29	NEG_Z to Titan	NEG_X to Titan_SC_RAM	
RADAR_031TI_T20BOLSAR201_PRIME	M	2006-298T15:58:29	GMB_E031_Titan20+000T00:07:00	000T00:08:00	2006-298T16:06:29	NEG_Z to Titan	NEG_X to Titan_SC_RAM	
RADAR_031TI_T20BONALT201_PRIME	M	2006-298T16:06:29	GMB_E031_Titan20+000T00:15:00	000T00:15:00	2006-298T16:21:29	NEG_Z to Titan	POS_Y to North_Pole_Dir	
RADAR_031TI_T20BOSCAT201_PRIME	M	2006-298T16:21:29	GMB_E031_Titan20+000T00:30:00	000T00:53:00	2006-298T17:14:29	NEG_Z to Titan	POS_Y to North_Pole_Dir	
End Custom Period		2006-298T17:14:29	GMB_E031_Titan20+000T01:23:00	000T00:01:00	2006-298T17:15:29			
ENGR_031SC_DFPWBIAS298_PPS	M	2006-298T17:14:29	GMB_E031_Titan20+000T01:23:00	000T00:22:48	2006-298T17:37:17	ISS_NAC to Titan	POS_X to North_Pole_Dir	
ISS_031TI_HIGHRESNA201_PRIME	C, M, V	2006-298T17:37:29	GMB_E031_Titan20+000T01:46:00	000T02:44:00	2006-298T20:21:29	ISS_NAC to Titan	NEG_X to Sun	
CIRS_031TI_MIRLMBINT004_PRIME	C, I, M, V	2006-298T20:21:29	GMB_E031_Titan20+000T04:30:00	000T03:00:00	2006-298T23:21:29	CIRS_FPB to Titan	PC	
VIMS_031TI_DARKSIDE001_PRIME	C, I, M	2006-298T23:21:29	GMB_E031_Titan20+000T07:30:00	000T00:30:00	2006-298T23:51:29	VIMS_IR to Titan	POS_X to North_Pole_Dir	
VIMS_031TI_COMPMPA001_PRIME	C, I, M, U	2006-298T23:51:29	GMB_E031_Titan20+000T08:00:00	000T02:30:00	2006-299T02:21:29	VIMS_IR to Titan	POS_X to North_Pole_Dir	
SP_031TI_DEADTIME299_PRIME	M	2006-299T02:22:00		000T00:15:00	2006-299T02:37:00	ISS_NAC to Titan	POS_X to North_Pole_Dir	
SP_031EA_DLTURN299_PRIME	M	2006-299T02:37:00		000T00:30:00	2006-299T03:07:00	XBAND to Earth	NEG_X to NEP	SP Turn to Earth
SP_031EA_M70ARRNON299_PRIME	M	2006-299T03:07:00		000T07:04:00	2006-299T10:11:00	XBAND to Earth	Rolling	
SP_031EA_G34ARRNON299_PRIME	C, M	2006-299T10:11:00		000T08:00:00	2006-299T18:11:00	XBAND to Earth	Rolling	

031TI (T20) RADAR Option Telem Modes

- NOTE:** SMT complains about the switch to S_N_ER_3 at 07:36:29 because it is during the RADAR w/u activity. RADAR accepts that they will record only the first 15 minutes of their warm-up. SMT warning should be ignored.

TELEMETRY MODE REPORT

SCET	TELEMETRY MODE	REQUEST
2006-296T10:56:00	S_N_ER_3	SP_031NA_G70OBSNON297_NA
2006-297T09:26:00	RTE_N_SPB_110600	SP_031EA_G70METNON297_PRIME
2006-297T10:11:00	RTE_N_SPB_124425	SP_031EA_G70METNON297_PRIME
2006-297T11:26:00	RTE_N_SPB_142200	SP_031EA_G70METNON297_PRIME
2006-297T16:41:00	RTE_N_SPB_124425	SP_031EA_G70METNON297_PRIME
2006-297T17:56:00	RTE_N_SPB_110600	SP_031EA_G70METNON297_PRIME
2006-297T18:26:00	S_N_ER_3	SP_031NA_M70OBSNON299_NA
2006-298T07:21:29	S_N_ER_5A	SP_031NA_M70OBSNON299_NA
2006-298T07:36:29	S_N_ER_3	SP_031NA_M70OBSNON299_NA
2006-298T10:21:29	S_N_ER_8	SP_031NA_M70OBSNON299_NA
2006-298T17:14:29	S_N_ER_3	SP_031NA_M70OBSNON299_NA
2006-299T03:07:00	RTE_N_SPB_142200	SP_031EA_M70ARRNON299_PRIME
2006-299T10:11:00	RTE_N_SPB_47400	SP_031EA_G34ARRNON299_PRIME



031TI (T20) RADAR Option SMT Results

- Margin at end of segment over handover pass = 201 Mb / (3064 + 1132 Mb) = 5%

DATA VOLUME SUMMARY

DOWNLINK PASS NAME	OBSERVATION_PERIOD										DOWNLINK_PASS						
	Start	End	START	SCI	HK+E	TOTAL	CPACTY	MARGIN	OPNAV	SCI	ENGR	TOTAL	CPACTY	MARGIN	CAROVR		
doy hh:mm	doy hh:mm	(Mb)	(Mb)	(Mb)	(Mb)	(Mb)	(Mb)	(%)	(Mb)	(Mb)	(Mb)	(Mb)	(Mb)	(%)	(Mb)		
SP_031EA_G70METNON297_PRIME	297 09:26	297 18:26	0	2533	78	2611	3559	948	27%	0	744	53	3408	3632	224	6%	0
SP_031EA_M70ARRNON299_PRIME	299 03:07	299 10:11	0	3151	114	3265	3565	300	8%	0	264	42	3570	3064	-506	-17%	506
SP_031EA_G34ARRNON299_PRIME	299 10:11	299 18:11	506	0	0	506	3565	3059	86%	0	377	47	930	1132	201	18%	0

DATA VOLUME REPORT

Event	Start	End	CAPS	CDA	CIRS	INMS	ISS	MAG	MIMI	RADAR	RPWS	UVIS	VIMS	PROBE	ENGR	TOTAL
	doy hh:mm	doy hh:mm	(Mb)	(Mb)	(Mb)	(Mb)	(Mb)	(Mb)	(Mb)	(Mb)	(Mb)	(Mb)	(Mb)	(Mb)	(Mb)	(Mb)
OBSERVATION_NOR	296 10:56	297 09:26	449.7	20.2	309.6	121.3	496.0	160.1	218.7	0.0	667.4	0.0	90.0	0.0	0.0	2533.1
SP_031EA_G70METNON297_PRIME	297 09:26	297 18:26	179.9	8.1	86.4	48.5	0.0	64.0	87.5	0.0	267.0	2.5	0.0	0.0	0.0	743.9
DAILY TOTAL SCIENCE	296 10:56	297 18:26	629.6	28.3	396.0	169.9	496.0	224.1	306.2	0.0	934.4	2.5	90.0	0.0		
OBSERVATION_NOR	297 18:26	299 03:07	325.1	14.6	193.7	12.2	580.0	143.2	149.9	720.0	395.6	85.1	528.0	0.0	0.0	3147.3
OBSERVATION_SI	297 18:26	299 03:07	0.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0
SP_031EA_M70ARRNON299_PRIME	299 03:07	299 10:11	86.5	5.1	0.0	1.3	0.0	50.3	40.7	0.0	79.6	0.3	0.0	0.0	0.0	263.7
SP_031EA_G34ARRNON299_PRIME	299 10:11	299 18:11	97.9	5.7	86.4	1.4	0.0	46.9	46.3	0.0	90.1	2.2	0.0	0.0	0.0	377.1
DAILY TOTAL SCIENCE	297 18:26	299 18:11	509.5	25.4	284.1	14.9	580.0	240.4	236.9	720.0	565.4	87.6	528.0	0.0		



031TI (T20) RADAR Option Average MAPS Rates

AVERAGE DATA RATE REPORT (calculated over observation periods and downlink passes)

Event	Start doy hh:mm	End doy hh:mm	CAPS (bps)	CDA (bps)	INMS (bps)	MAG (bps)	MIMI (bps)	RPWS (bps)	UVIS (bps)
SP_031NA_G70OBSNON297_NA	296 10:56	297 09:26	5552.0	249.9	1498.0	1976.0	2700.0	8240.0	0.0
SP_031EA_G70METNON297_PRIME	297 09:26	297 18:26	5552.0	249.9	1498.0	1976.0	2700.0	8240.0	76.0
SP_031NA_M70OBSNON299_NA	297 18:26	299 03:07	2763.0	123.8	103.3	1217.2	1273.7	3362.3	723.4
SP_031EA_M70ARRNON299_PRIME	299 03:07	299 10:11	3400.0	199.6	50.0	1976.0	1600.0	3129.9	10.8
SP_031EA_G34ARRNON299_PRIME	299 10:11	299 18:11	3400.0	199.6	50.0	1628.8	1609.1	3129.9	76.0

031TI (T20) RADAR Option DSN Requests

- A Madrid-to-Goldstone handover is required at the end of the segment in order to provide enough capability to empty the SSRs.
- The Madrid 70-m appears to be in maintenance in *ap_downlink*. However, the maintenance requirement can be pushed later in the pass so that it does not conflict with the Cassini request for time. (Per John Smith, MP). Ignore the *ap_downlink* message about the maintenance conflict.
- The Goldstone 70-m is in maintenance all day, so the Goldstone pass is an array of BWGs (DSS-25 and DSS-26). At the time of the segment delivery, the DSN predicts for 34 arrays were not in *ap_downlink*. W. Khoo of SCO provided the necessary predicts to John Smith of MP, which are represented in the CIMS requests. Ignore the *ap_downlink* complaints about not finding view periods for the Goldstone passes.

CASSINI DSN COVERAGE SUMMARY for 031TI_T20_OR3_030519.apf generated on 2003-May-19 14:55:21
 (+ = pass overlaps with previous pass; * = in conflict with DSN weekly maintenance)

C ANT	ID	BOT_TO_EOT	DUR	XMT_AT	2WAY_PERIOD	DUR	DL_PERIOD	DL_PERIOD	DUR	NOT	CALS	RADIO_CONFIG	DATA_RATES
		ERT	hh:mm	ERT	ERT	hh:mm	ERT	SCET	hh:mm		min	UD D UD MAR	kbps
G 70MET	14	297T10:45-19:45	09:00	297T10:55	13:33-19:45	06:12	297T10:45-19:45	297T09:26-18:26	09:00	---	15/15 XX	- - -	--0 110,124,142,124,110
M 70ARR	54	299T04:25-11:30	07:05	299T04:35	07:13-11:30	04:17	299T04:26-11:30	299T03:07-10:11	07:04	---	15/15 XX	- - -	--0 142
+M 70ARR	63	*299T04:25-11:30	07:05	299T04:35	07:13-11:30	04:17	299T04:26-11:30	299T03:07-10:11	07:04	---	15/15 XX	- - -	--0 142
SP_031EA_G34ARRNON299_PRIME has no matching pass in DSN view periods													
+G 34ARR	26	299T09:55-18:15	08:20	299T10:05	10:11-18:11	08:00	299T10:11-18:11	299T10:11-18:11	08:00	---	15/15 XX	- - -	--0 47
+G 34ARR	25	299T09:55-18:15	08:20	299T10:05	10:11-18:11	08:00	299T10:11-18:11	299T10:11-18:11	08:00	---	15/15 XX	- - -	--0 47



031TI (T20) RADAR Option OpMode Strategy

Start	End	Request
=====		
2006-296T10:56:00	2006-296T10:56:49	ENGR_031SC_DFPW296_PPS
2006-298T07:21:29e	2006-298T07:21:38	ENGR_031SC_RADWU398_PPS
2006-298T10:21:29e	2006-298T10:22:13	ENGR_031SC_RADRWA398_PPS
2006-298T14:14:29e	2006-298T14:35:42	ENGR_031SC_RADRCS298_PPS
2006-298T17:14:29e	2006-298T17:37:17	ENGR_031SC_DFPWBIAS298_PPS

031TI (T20) RADAR Option Notes & Liens

- **Pointing Strategy**
 - Waypoint strategy is FR-safe.
 - SP Turns have are FR-safe and have sufficient time allocated to them.
 - **LIEN: Hydrazine usage for RADAR has not been modeled or even estimated.**
- **Data Volume**
 - No issues. SSRs have at least 8% margin in P4 during observation periods and at least 5% margin on the DSN capability.
- **CIMS**
 - None. All expected requests have been delivered.
- **Power Issues**
 - None.
- **MP Guidelines and Constraints**
 - DSN maintenance conflicts have been avoided (albeit through an unusual DSN strategy: Mad 70m-34m array handing off to Gold 34m-34m array)
 - 950 km flyby; transition to RCS complete at -01:15 (23153 km altitude); transition to RWA begins at +01:23 (24822 km altitude)

TWT/OST Integration Constraint and Guideline Checklist

Below are Target Working Team (TWT) and Orbiter Science Team (OST) constraints that must be followed during segment implementation. Any exceptions to constraint numbers 3, 4, 6, or 7 must be approved by the Science Planning Manager.

Constraint	C=Comply V=Violate N/A=Not Applicable	Comments	Disposition
1. A. SP has checked all waypoints turns to and from waypoints.	C		
B. All initial downlink attitudes have been checked as waypoints.	C		
2. All turns to and from waypoints checked for violations and margins. <input type="checkbox"/> CAPS <input type="checkbox"/> CDA <input type="checkbox"/> CIRS <input type="checkbox"/> INMS <input type="checkbox"/> ISS <input type="checkbox"/> MIMI <input type="checkbox"/> MAG <input type="checkbox"/> NAV <input checked="" type="checkbox"/> RADAR <input type="checkbox"/> RPWS <input type="checkbox"/> RSS <input type="checkbox"/> UVIS <input type="checkbox"/> VIMS Each Prime Instrument agrees to accept a reduction in observation time during implementation if problems arise.	C	SP also checked SP turns; no problems found	
3. Custom handoffs limited to:			
A. ± 3 hours from targeted Icy Satellite flyby			
B. ± 3 hours from targeted Titan Flyby	C		
C. OpNavs preceding/following a downlink			
4. Minimum 30. min SPASS Prime request duration outside ±5 min. from targeted satellite flyby (5 min. integer duration if >30 min.)	C		
5. Live and Ground Movable Blocks include appropriate time margins.	C	K. Klaasen's margin for flyby is min. according to memo dated .	
6. Waypoints changes are ≤3 per day	C		
A. All turns that accomplish the waypoint strategy are requested by SP or OpNav.	C		
7. Live Movable Blocks limited to the following orbits: 7, 8, 9, 10, 12, 28, 51, 56, 57, 60, 63, 64	N/A		

Guideline	Yes / No	Comments
1. Were repeatable/reusable templates used where possible?	Yes	
2. During Pre-Integration: Was 30 min. used for 90° RWA turns and/or 10 min. for RCS turns?	Yes	

(DOUBLE-CLICK TO MAKE CHANGES)