



Daily Downlink Tagup

Thursday, July 12, 2018 (DOY 193)

L+22 Payload File Loads, Checkouts & Calibrations

OSIRIS-REX™
ASTEROID SAMPLE RETURN MISSION

Revision 1

Release Date 7/13/18



Agenda

- **Logistics**
- **Quicklook Status**
- **DSN Schedule**
- **Observation Timeline**
- **Uplink/Execution/Downlink Summary**
- **Need for Retransmit, need for Replay?**
- **ODOCS Locations**
- **Go-backs / Additional Comments**

Logistics

- **Daily Downlink Tagups will run from 7/12/18 – 7/13/18 and 7/16/18 – 7/20/18 to cover the L+22 activities. There are no planned weekend tagups.**
- **Daily Downlink Slides available shortly after each Tagup at:**
NEW LOCATION: OSIRIS-REx Bennu Proximity Operations\Science Implementation\Downlink_Daily_Summary
- **Instrument Downlink Checklist Templates available at:**
 - \7.4 SPOC\Operations\Downlink (NON-US persons access)\Downlink Checklist Reports\OCAMS\TEMPLATE_Downlink Checklist - OCAMS_CCv0003.docx
 - \7.4 SPOC\Operations\Downlink (NON-US persons access)\Downlink Checklist Reports\OLA\TEMPLATE_Downlink Checklist - OLA_CCv0002.docx
 - \7.4 SPOC\Operations\Downlink (NON-US persons access)\Downlink Checklist Reports\OTES\TEMPLATE_Downlink Checklist - OTES_CCv0002.docx
 - \7.4 SPOC\Operations\Downlink (NON-US persons access)\Downlink Checklist Reports\OVIRS\TEMPLATE_Downlink Checklist - OVIRS_CCv0002.docx
 - \7.4 SPOC\Operations\Downlink (NON-US persons access)\Downlink Checklist Reports\REXIS\TEMPLATE_Downlink Checklist - REXIS_CCv0002.docx
- **Personnel Contact List**
 - **Contact lists for all IS/IE's and SPOC Ops are available on ODOCS.**
Location: 7.0 Mission Operations Systems/SPOC/Operations

Quicklook Status

	Health			Safety			Performance			Powered State	GO/NO-GO
OCAMS										OFF	GO
OLA										OFF	GO
OTES										OFF	GO
OVIRS										OFF	GO
REXIS										ON	GO
	Thermal	Power	Command Response	Alarms	Trending	Limited Life & Mechanisms	Data Completeness	Pipeline Status	Science Concurrence		

DSN Schedule – WOY 28 - 30

Round-trip Light Time = 00:08:43 (↑)

Current Data Rate: 916 kbps

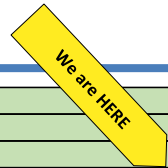
	Monday 07/09	Tuesday 07/10	Wednesday 07/11	Thursday 07/12	Friday 07/13	Saturday 07/14	Sunday 07/15
64	1645 65 2100		1750 55 2100		1705 65 2110		
WEEK	DDOR N/S H 0320-0420 24 0105-0305 26		DDOR N/S 0345 0445 26		DDOR N/S 0315 0415 26		DDOR N/S 0310 0410 26
28	36 0515-0825 DDOR N/S H 0320-0420 34		0600 34 0945 DDOR N/S 0315 0415 36		DDOR N/S 0310 0410 34		
64	1625 65 1855		1620 55 2020		1620 54 2030		1615 54 2040
WEEK			DDOR N/S 0245 0345 24		DDOR N/S 0250 0350 26 0000 24 0250		0015 25 0320
29	34 0215-0530		0430 35 0855		0430 35 0745 DDOR N/S 0245 0345 36		DDOR N/S 0250 0350 34
xx025					0230 36 0530		0300 34 0705
64	1605 55 2045		1745 55 2120		1610 55 2030		1600 54 2000
WEEK			2305 25 0305		1600 55 2020		1555 54 2115
30	0220 36 0710				1550-2025 65		

Downlink Schedule

Start Date	WOY	DOY	DL START (UTC)	DL END (UTC)	DL START (MST)	DL END (MST)	TOTAL DOWNLINK	AVAILABLE SCIENCE DURATION
2018-07-09	28	190	16:40:16	21:00:05	09:40:16	14:00:05	03:43:20	03:13:20
2018-07-11	28	192	17:45:22	21:00:00	10:45:22	14:00:00	02:38:09	02:08:09
2018-07-13	28	194	17:00:27	21:09:55	10:00:27	14:09:55	03:32:59	03:02:59
2018-07-16	29	197	16:20:27	18:56:23	09:20:27	11:56:23	01:59:27	01:29:27
2018-07-17	29	198	16:15:30	20:21:21	09:15:30	13:21:21	03:29:22	02:59:22
2018-07-18	29	199	16:15:33	20:31:18	09:15:33	13:31:18	03:39:16	03:09:16
2018-07-19	29	200	16:10:35	20:41:15	09:10:35	13:41:15	03:54:11	03:24:11
2018-07-20	29	201	16:15:38	20:21:13	09:15:38	13:21:13	03:29:06	02:59:06
2018-07-21	29	202	00:10:39	07:06:12	17:10:39 (201)	00:06:12	06:19:04	05:49:04
2018-07-22	29	203	01:33:37	08:56:09	18:33:37 (202)	01:56:09	06:46:03	06:16:03

Launch+22 mo Checkout and Cal Timeline

WOY 28



WOY	28																								28																							
Date	11-Jul-18																								12-Jul-18																							
DOY	192																								193																							
Hour (UTC)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Template			DDOR				ATL: max 5 hrs				HGA: 3-5 hrs																DDOR					ATL: max 5 hrs																
S/C Pointing	Solar Opposition												Earth Pt												Sun Pt																							
OCAMS	ocams_pwr_on within ocm_l22_lut_load_n_test																																															
	ocm_l22_lut_load_n_test Start: 09:00:00, Dur: 03:17:00																																															
	ocams_pwr_off with "YES_XFER" within ocm_l22_lut_load_n_test																																															
OVIRS	ovirs_pwr_on within ovr_bpm_lut_l22 sequence																																															
	ovr_bpm_lut_l22 Start: 09:00:00, Dur: 01:23:00																																															
	hlfp_spm_safe_ovirs within ovr_bpm_lut_l22 sequence																																															
	~10:25:00 Begin Decon Cooldown																																															
OTES																																																
OLA																																																
REXIS																																																
	Call rexis_pwr_on within Internal Cal sequence																																															
	rex_intcal_8 hrs Start: 13:00:00, 1hr warmup. Dura																																															

28																								28																								28																								
13-Jul-18																								14-Jul-18																								15-Jul-18																								
194																								195																								196																								
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
		DDOR				ATL: max 5 hrs					HGA: 3-5 hrs															DDOR					ATL: max 5 hrs																			DDOR					ATL: max 5 hrs																	
Sun Pt												Earth Pt												Sun Pt																																																
72 hr Decon Heater Cooldown reached at 10:25:00 DOY 195																																																																								
with 1hr warmup																																																																								
Call rexis_pwr_off within Internal Cal sequence																																																																								
tion: 82:18:00																																																																								
REXIS Internal Cal End at ~23:00:00																																																																								

Launch+22 mo Checkout and Cal Timeline

WOY 29

WOY	29																							29																																																																				
Date	16-Jul-18																							17-Jul-18																																																																				
DOY	197																							198																																																																				
Hour (UTC)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23																																												
Template	DDOR		ATL: max 5 hrs		Sol. Op		Sun Pt		Earth Pt		DDOR		ATL: max 5 hrs		Sol. Op		Sun Pt		Earth Pt		DDOR		ATL: max 5 hrs		Sol. Op		Sun Pt		Earth Pt																																																															
S/C Pointing	Sol. Op																							Sun Pt																							Sun Pt																							Earth Pt																						
OCAMS	ocm_health_chk Start:06:15:00, Dur:01:26:00																							ocm_rts Start:09:00:00, Duration:01:43:00																							ocm_std_cal Start:08:05:00, Dur:01:19:00																																													
OVIRS																								Call ovirs_pwr_on with 1hr warmup Start:08:00:00																							ovr_22mo_cal_sp2 Start:09:00:00 Dur:02:35:00																																													
OTES	Call otes_pwr_on 05:00:00																																																																																											
	OTES powered-on, 3 hr warmup																																																																																											
	ote_health_chk Start:09:00:00, Dur:00:31:00																																																																																											
	Call hlfp_spm_safe_otes Start:09:40:00																																																																																											
OLA	Call ola_pwr_on in ola_22mo_checkout																							Call ola_pwr_on in ola_22mo_part2																																																																				
	ola_22mo_checkout Start:09:00:00, Dur:05:22:00																							ola_22mo_part2 Start:09:00:00, Dur:04:04:00																																																																				
	ola powered off -14:22:00																							ola powered off -13:05:00																																																																				
REXIS																																																																																												

WOY	29																							29																																													
Date	18-Jul-18																							19-Jul-18																																													
DOY	199																							200																																													
Hour (UTC)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23																					
Template	DDOR		ATL: max 5 hrs		Sun Pt		Sun Cal Att		Earth Pt		DDOR		ATL: max 5 hrs		Sun Pt		Inertial/Sun/Sol. Opposi		Sun Pt		Earth Pt		DDOR		ATL: max 5 hrs		Sun Pt		Earth Pt																																								
	ocams_pwr_on 07:30:00																							Solar Analog (sci_atl_18200a_01atf) Start:08:01:26, Dur:01:38																							MapCam Aliasing Colors Start:10:20:00, Dur:02:10:00																						
	ovr_18mo_chk on SP=8 Start:06:15:00 Dur:02:15:00																																																																				
	ovr_22mo_cal_sp8 Start:08:40:00 Dur:02:00:00																																																																				
	Call hlfp_spm_safe_ovirs within ovr_22mo_cal_sp8																																																																				
	Set OVR decon heater to Op Set Pt																																																																				

Uplink Summary

UPLINK

- **Payload Library r40 Uplinked 2018/183 (2018-7-2)**
- **WOY 28 Products Uplinked 2018/183 (2018-7-2)**
 - This bundle included the OVIRS LUT Load for SP=2 and SP=8, SP Checkout, OCAMS LUT Load, Checkout and Pseudo-Library, and REXIS Internal Cal
- **WOY 29 Products Uplinked 2018/190 (2018-7-9)**

This bundle included

 - Checkout OLA, OTES, REXIS, OCAMS and OVIRS
 - OTES, REXIS and OVIRS Checkouts are repeats from L+18
 - OCAMS RTS (repeat from L+18), OLA Part 2 Checkout, OVIRS SP=2 Cal and SP=8 Cal + Solar Cal, REXIS Cal Part 1 and 2, and TAGCAMS Checkout
 - ATF and sequences for OCAMS Solar Analog and sequence for MapCam Aliasing

Execution Summary

- **Instrument Status:**
 - REXIS currently powered on and gathering internal cal data
 - All other payloads powered off
 - OVIRS Decon Heater cooling to Non-Ops Set points
- **DOY 192 *COMPLETE***
 - Power-on OCAMS
 - OCAMS LUT Test on Side 1 using ver 1 LUTs, then load ver 2 LUTs and repeat LUT Test on Side 1
 - OCAMS swap to Side 2
 - OCAMS LUT Test on Side 2 using ver 1 LUTs, then load ver 2 LUTs and repeat LUT Test on Side 2
 - Power-off OCAMS using OCAMS power-off block

 - In parallel to OCAMS activity, Power-on OVIRS to Side 1
 - OVIRS SP=2 BPM and LUT ROI load
 - Power cycle OVIRS and perform SP=2 Checkout
 - OVIRS SP=8 BPM and LUT ROI load
 - Power cycle OVIRS and perform SP=8 Checkout
 - Power-off OVIRS using safing block, which will kickoff Decon Heater Cooldown
- **DOY 193 *IN PROGRESS***
 - REXIS Internal Cal sequence start at 14:00 UTC
 - Will run continuously for ~82 hours, including while S/C slews to Earth pt for HGA pass on DOY 194
- **Up Next (*times are approximate*):**
 - 2018/194 (Friday, July 13)**
 - Continue REXIS Internal cal
 - Continue OVIRS cooldown

Downlink Summary for DOY 192

Current Data Rate: 916 kbps

DOWNLINK

- **Partition Status as of 17:00 UTC:**

	Expected Data Vol (MB)	Expected Data Vol (Mb)	Expected Partition Fill (%)	Current Partition Fill (%)
OpNav	0.0	0	0	0
OCAMS	802.5	6416	22	0
OLA	0.0	0	0	0
OTES	0.0	0	0	0
OVIRS	20.85	166	2	0
REXIS	0.0	0	0	0
TAGCAMS	0.0	0	0	0

List of Unexpected Alarms, Watch Items, ISAs

- **Unexpected OVIRS alarm - OVR_LIVE_MAX Red High (one OVR_LIVE_MAX event expected, two received)**
 - **Possibly related to a timing issue - OVIRS investigating**

Need for Retransmit? Need for Replay?

DOY 192 – *All data received*



OSIRIS-REX™
ASTEROID SAMPLE RETURN MISSION

OCAMS LUT UPLOAD STATUS FROM DOY 192 ACTIVITIES
DAILY DOWNLINK MEETING 20180712

- Bashar Rizk**
- Christian d'Aubigny**
- Mike Fitzgibbon**
- Chuck Fellows**
- Dave Hamara**



OCAMS Look-Up Table (LUT) Update

- OCAMS has 12 on-board LUT's available to it that recode the data numbers in OCAMS images in order to achieve a lossy compression that typically saves a factor of 2 in space (16 bit→8 bit).
- Formerly (at launch) only 4 different kinds of LUT's were used, of which the square-root LUT's would get the most use
- A study completed last fall, based on SPC processing of simulated images, confirmed the utility of the square root LUT's with suggestions on how to improve them, mostly by adopting more realistic floors and ceilings for the range of data processed by the LUT
- Eight new square-root LUT's were specified, more closely tuned to the range of realistic data
- This upload inserted these 8 new square-root LUT's into slots 5→12
- All slots were tested, un-LUTed and LUTed

ID	LUT
1	Square
2	Chop6
3	Chop8
4	Square Chop 1
5	SC150_11500
6	SC200_11500
7	SC1000_11500
8	SC2000_11500
9	SC150_9000
10	SC200_9000
11	SC1000_9000
12	SC2000_9000

Sequence of Events

- **DOY 192 (7/11 09-12 Z): OCAMS LUT Uploads and Tests (Pre- and Post-Upload)**
 - **624 of 624 images expected down** (208 MC, 208 SC, 208 PC)
- **No Missing Packets**
- **No Failed Checksums**
- **LUT commands successfully submitted and completed**
- **Image Commands successfully submitted and completed**
- **Instrument Health Nominal**

Exp Time (msec)	Dark	Dark2	Lamp	Bright
MapCam	90	9884	90	9884
SamCam	220	9884	220	9884
PolyCam	200	9884	200	9884

Issues

- **OCAMS Internal: Forgot to command the lamps to turn themselves off during the ambient light/star field imaging**
 - This did not prevent exercising and testing the LUT's
 - Lamp images to verify correct LUT operation (primary verification mechanism)

LUTing and De-LUTing appear to be working Correctly

ID	LUT	MapCam Image Name	De-LUT OK?	Av. Signal (DN)
0	None	20180711T094904S115_map_LOsscal	N/A	9589
1	Square	20180711T094913S358_map_LOsscal	Yes	9589
2	Chop6	20180711T094922S003_map_LOsscal	Yes	9589
3	Chop8	20180711T094930S658_map_LOsscal	Yes	9583
4	Square Chop 1	20180711T094939S294_map_LOsscal	Yes	9576
5	SC150_11500	20180711T094947S916_map_LOsscal	Yes	9573
6	SC200_11500	20180711T094956S563_map_LOsscal	Yes	9573
7	SC1000_11500	20180711T095005S166_map_LOsscal	Yes	9570
8	SC2000_11500	20180711T095013S770_map_LOsscal	Yes	9573
9	SC150_9000	20180711T095022S878_map_LOsscal	Yes	8773
10	SC200_9000	20180711T095031S490_map_LOsscal	Yes	8773
11	SC1000_9000	20180711T095040S117_map_LOsscal	Yes	8774
12	SC2000_9000	20180711T095048S775_map_LOsscal	Yes	8778



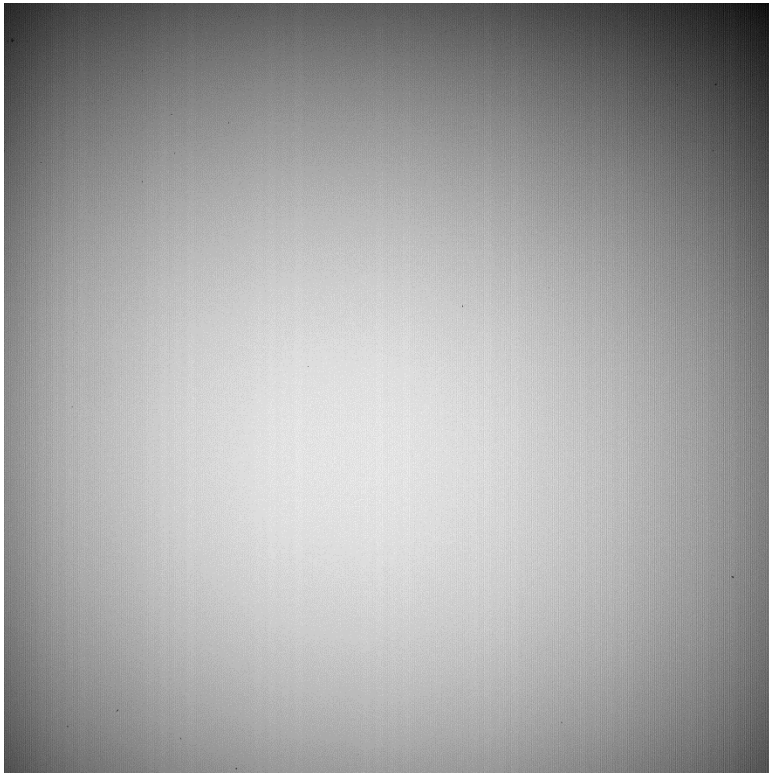
LUTing and De-LUTing appear to be working Correctly

- **PolyCam and SamCam show similar correct behavior**

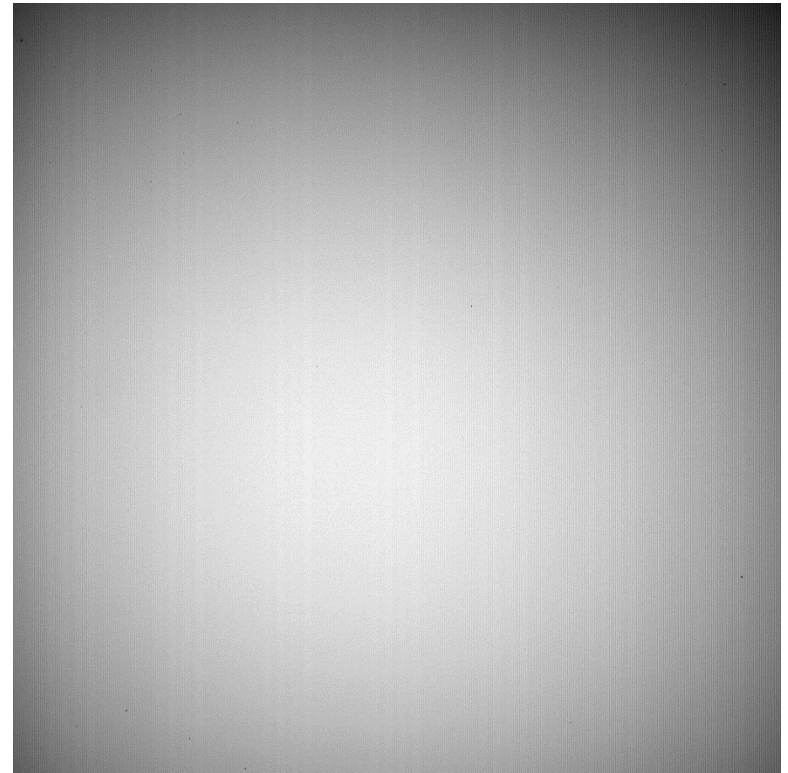
ID	LUT	PolyCam	SamCam
0	None	10890	10618
1	Square	10884	10599
2	Chop6	10872	10579
3	Chop8	10865	10564
4	Square Chop 1	10856	10545
5	SC150_11500	10690	10378
6	SC200_11500	10687	10371
7	SC1000_11500	10682	10366
8	SC2000_11500	10675	10362
9	SC150_9000	8916	8820
10	SC200_9000	8917	8820
11	SC1000_9000	8918	8821
12	SC2000_9000	8922	8824



MapCam UNLUTed vs LUT5 (images compared)

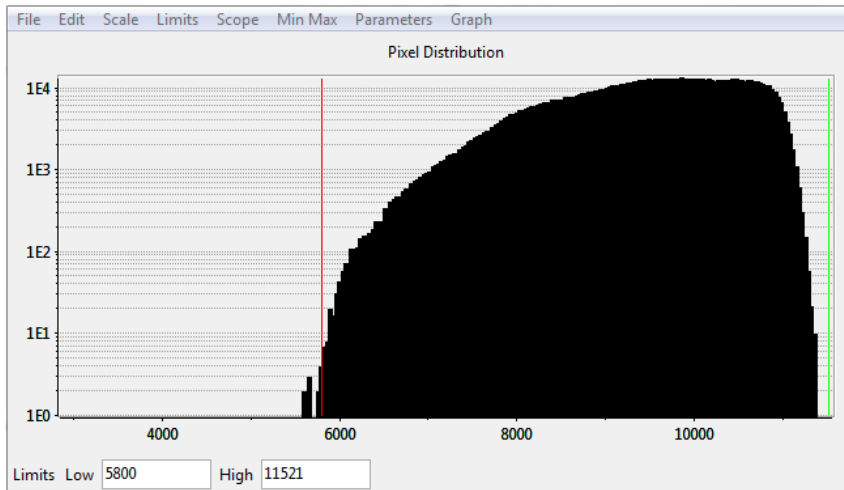


Un-LUTed

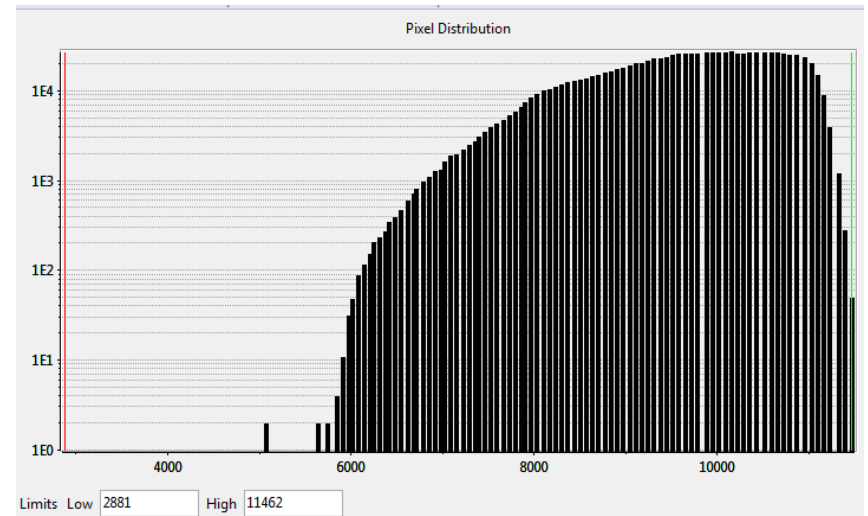


LUT 5

MapCam UNLUTed vs LUT5 (Histograms Compared)



Un-LUTed



LUT 5



OSIRIS-REX™
ASTEROID SAMPLE RETURN MISSION

OVIRS BPM AND LUT ROI LOAD AND CHECKOUT STATUS - DOY 192
DAILY DOWNLINK MEETING 20180712



OVIRS Activity and Downlink Status – 7/12/2018

L+22 month SuperPixel=2 (SP2) Load checkout

- **Status:**
 - Activity executed at 7/11/18 10:00 UTC (40 minutes)
 - All expected engineering and science data packets have been received
 - Analysis of the SP2 and SP8 (after the SP2 loads) indicates the activity was successful and the load products and command sequences for changing Super Pixel mode work effectively.
 - OVIRS is healthy and configured for the next activity.
 - OVIRS detector is cooling for the L+22 calibration
- **Issues (details on following slides):**
 - OVIRS Timestamp was incorrect for a 2 minute span after the the SP2 load.
 - OVIRS “heartbeat” telemetry was not present after the OVIRS reset command
 - OVIRS Watchdog Counter was Red High (1) after the OVIRS reset command

OVIRS Activity and Downlink Status – 7/12/2018

L+22 month SuperPixel=2 (SP2) Load checkout

- **Issues #1**

OVIRS Timestamp was incorrect for a 2 minute span after the the SP2 load.

- **Background: OVIRS is susceptible to clock “fast forward” when reset in bootloader mode. Reset in bootloader mode is the SOP for continuing activities after a LUT or BPM load.**
- **This doesn’t effect execution of the activity, but make data analysis more challenging (sorting out where the incorrect time stamped data fits). The time that the data was recorded on the S/C is available to assist with data analysis, but is harder to access.**
- **We were trying to avoid power cycling OVIRS when in SP2 mode in case we are unable to change the configuration back, but due to these issues it is probably best to power cycle OVIRS after a LUT or BPM load.**

OVIRS Activity and Downlink Status – 7/12/2018

L+22 month SuperPixel=2 (SP2) Load checkout

- **Issues #2**

OVIRS “heartbeat” telemetry was not present after the OVIRS reset command

- This is normal and expected behavior. If enough heartbeats are missed (3), OVIRS will be safed. This hasn't happened in STL or Flight testing, but we may adjust our command sequence to avoid this possibility (power cycling would do the trick). We have missed 2 heartbeats during this activity.

- **Issues #3**

- **OVIRS Watchdog Counter was Red High (1) after the OVIRS reset command**

- This is normal and expected behavior. The post load power-cycle clears this telemetry point.

Science Status and/or PI Status

Go-backs / Additional Comments

Backup
