



Daily Downlink Tagup

Wednesday, May 22, 2019 (DOY 142)

OSIRIS-REX™
ASTEROID SAMPLE RETURN MISSION



Agenda & Logistics

- **Quicklook + Weekly Instrument Status**
- **DSN Schedule**
- **Observation Timeline**
- **Uplink/Execution/Downlink Summary**
- **Alarms, Watch items, ISAs, PFRs**
- **Need for Retransmit, need for Replay?**
- **Science / PI Comments**
- **Go-backs / Additional Comments**

Daily Downlink Summaries available shortly after each Tagup at on the OREx Ops Wiki:
https://orexwiki.lpl.arizona.edu/wiki/Main_Page (LDAP login)

Daily Downlink Slides available shortly after each Tagup at:

OSIRIS-REx Bennu Proximity Operations/Science Implementation/Downlink_Daily_Summary/2019

Quicklook & Weekly Status

Team	Status	Comment
Spacecraft	G	No issues
<i>Electrical Power System</i>	G	No issues
<i>Flight Software</i>	G	No issues
<i>Fault Protection</i>	G	No issues
<i>G&NC</i>	G	No issues
<i>Mechanisms</i>	G	No issues
<i>Propulsion</i>	G	No issues
<i>Telecom</i>	G	No issues
<i>Thermal</i>	G	No issues
<i>Payload Interfaces</i>	G	No issues

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

TAGCAMS Safing Event – DOY 142

- **On DOY 142, TAGCAMS was marked as failed and powered off by the aliveness Fault Protection check. NavCam was powered off and both NavCam and NFTCam were marked as failed at 2019/142 at ~12:40.**
 - **Prior to the safing, TAGCAMS produced “bad” housekeeping data. This data could not be recognized, so after 3 minutes of bad data, the instrument requested safing**
 - **This is unlike the TAGCAMS safing event on DOY 124, where the instrument was safed after non response to 3 Aliveness Checks.**
- **SPOCFlight Alarm and GDS Paging notice were distributed**
- **MSA and GNC teams analyzed data and deemed TAGCAMS safe to recover.**
- **NavCam was recovered during the HGA Pass on DOY 142.**
 - **The TAGCAMS and LM teams determined that no test image was required upon recovery**
- **All but the last NavCam images taken from 2019-141 21:00:00 – 2019-142 12:40:00 were received during the DOY 142 downlink**
- **An ISA will be opened and linked to the previous TAGCAMS safing ISA to track the root cause of this event**

M24D Quicklook

OSIRIS-REx Nav Team Maneuver Quick-look Error Report

Report Date: 21-May-2019 18:11:08 UTC

M24D

Nominals:

Nav Design Times:

21-MAY-2019 17:00:00.000 [UTC] Start time at spacecraft

21-MAY-2019 17:00:10.490 [UTC] End time at spacecraft

21-MAY-2019 17:07:09.762 [UTC] Start time at Earth

21-MAY-2019 17:07:20.252 [UTC] End time at Earth

8.017 [cm/s] Total Magnitude

76.031 [deg] RA

-33.470 [deg] Dec

10.490 [s] Duration (Nav Design)

78.843 [deg] Look angle

114.155 [deg] Angle from heliocentric velocity vector

429.762 [s] One-way light time

8.446 [GHz] Received downlink frequency, 2-way tracking

0.056 [Hz per mm/sec] Conversion factor

0.016 [m/s] Delta-range rate

0.874 [Hz] Expected Doppler shift seen by DSN

Actuals:

0.868 [Hz] Actual Doppler shift seen by DSN

7.960 [cm/s] Delta-V magnitude, given perfect pointing

-0.057 [cm/s] Delta-V magnitude error, given perfect pointing

-0.712 [%] Percentage Delta-V magnitude error, given perfect pointing

78.924 [deg] Look angle, given perfect magnitude

0.080 [deg] Look angle error, given perfect magnitude

Downlink Schedule (times in UTC)

- **Current Data Rate: 1375 kbps**

WOY	DOY	Start Date	HGA Start	End Date	HGA End	Duration	Note
21	140	2019-05-20	14:14	2019-05-20	20:30	6:16	*Madrid DT will reduce Duration by 3 hours. 1.3 Mbps COMPLETE
21	141	2019-05-21	14:04	2019-05-21	18:35	4:31	*M24D will reduce downlink duration by 1 hr COMPLETE
21	142	2019-05-22	14:04	2019-05-22	18:35	4:31	COMPLETE
21	143	2019-05-23	13:24	2019-05-23	15:36	2:12	
21	144	2019-05-24	14:07	2019-05-24	18:36	4:29	
21	145	2019-05-25	14:04	2019-05-25	20:36	6:32	*M25D will reduce downlink duration by 40 minutes
21	146	2019-05-26	14:04	2019-05-26	20:36	6:32	1.3 Mbps
							Memorial Day
22	147	2019-05-27	14:04	2019-05-27	20:36	6:32	*Madrid DT 14:30 – 19:53 will reduce Duration by 5 hours. 1.3 Mbps

RED EQUIPMENT STATUS:

SPC/DSS

 SPC60
 DSS54
 DSS14
 SPC10
 SPC10
 DSS63
 SPC60
 DSS63

EQUIPMENT

 MCD3-1
 NDA
 X500kw-R
 RSR2
 SGA1
 MSI
 VSR
 EAC

ETRO

 149/1428z
 150/1530z
 151/2300z
 151/2300z
 151/2300z
 171/1430z
 350/1648z
 355/1621z

Uplink Summary

UPLINK

WOY 21 (2019-140 – 2019-147)

- BG Seq, Sci Genies, Payload Sequences [uplinked 2019-137](#)

Ephemeris Updates

- Ephemeris Update: od136 [uplinked 2018-136](#)
- Ephemeris Update: od138 [uplinked 2018-138](#)

Other Files

- TAGCAMS recover commanding [uplinked 2018-142](#)

Execution Summary

Instrument Status:

- OCAMS, OTES, OVIRS are powered on. REXIS and OLA Powered off.

Executed (times in UTC):

- 2019/140 (Tuesday, May 20)
 - Nadir+1-deg Offset OpNav Only (One NavCam pair + One MapCam + One Landmark for Particle Monitoring / 2 hrs)
 - » # of NavCam images expected/received : 24 / 24
 - » # of MapCam images expected/received : 8 / 8
- 2019/141 (Wednesday, May 21)
 - Nadir+1-deg Offset OpNav Only (One NavCam pair + One MapCam + One Landmark for Particle Monitoring / 2 hrs)
 - » # of NavCam images expected/received : 27/24* due to safing, last 3 images (after 12:40) were not acquired. Missing OpNav image was Crit 4.
 - » # of MapCam images expected/received : 9/9
 - OLA OPTICS and ELECTRONICS Preheat began ~14:00

Up Next (times In UTC):

- 2019/142 (Wednesday, May 22 after HGA Pass)
 - Nadir+1-deg Offset OpNav Only (One NavCam pair + One MapCam + One Landmark for Particle Monitoring / 2 hrs)
 - » # of NavCam images expected/received : 27
 - » # of MapCam images expected/received : 9
- 2019/143 (Thursday, May 23 after HGA Pass)
 - Late Update Ephemeris and Possible Timeshift expected to be uplinked at the start of the HGA Pass on DOY 143
 - Will re-center Equatorial Station #5 (waive-off possible)
 - Nadir+1-deg Offset OpNav Only (One NavCam pair + One MapCam + One Landmark for Particle Monitoring / 2 hrs)
 - » # of NavCam images expected/received : 24
 - » # of MapCam images expected/received : 9
 - NET 15:45 OTE Deep space Cal
 - NET 15:33 OLA powered ON
 - Equatorial Station #5 – 6 AM: Linear scans Optimized to OVIRS boresight with OLA, OCAMS and OTES riding along. Linear scan overshoots the limb of Bennu by 24 mrad. Spacecraft will look at 9AM toward the sunlit side.
 - # of MapCam Images Expected: 925
 - OTES Data Expected: 33.4 MB
 - OVIRS Data Expected: 413.2 MB
 - OLA Data Expected: 24.6

Downlink Summary

- **Current Data Rate: 916 kbps**

Downlink

- Today's Partition Status :

	Part. Start Vol (MB)	New Data Vol (MB)	Partition Fill (MB)	Expected Partition Fill (%)	Current End Partition (%)	Comments
<i>OpNav</i>	0.00	319.24	319.24	45.61%	0.00%	
<i>OTES</i>	0.00	7.53	7.53	2.73%	0.00%	
<i>REXIS</i>	0.00	0.00	0.00	0.00%	0.00%	
<i>OLA</i>	0.00	0.00	0.00	0.00%	0.00%	
<i>OVIRS</i>	0.00	10.13	10.13	0.97%	0.00%	
<i>OCAMS</i>	0.00	7.06	7.06	0.19%	0.00%	
<i>Tagcams/Overflow</i>	0.00	0.00	0.00	0.00%	0.00%	

Downlink Summary

- **Tomorrow's Data Rate: 916 kbps**

Downlink

- Tomorrow's Expected Partition Status :

	Part. Start Vol (MB)	New Data Vol (MB)	Partition Fill (MB)	Expected Partition Fill (%)	Expected End Partition (%)	Comments
<i>OpNav</i>	0.00	319.24	319.24	45.61%	0.00%	
<i>OTES</i>	0.00	7.53	7.53	2.73%	0.00%	
<i>REXIS</i>	0.00	0.00	0.00	0.00%	0.00%	
<i>OLA</i>	0.00	0.00	0.00	0.00%	0.00%	
<i>OVIRS</i>	0.00	10.13	10.13	0.97%	0.00%	
<i>OCAMS</i>	0.00	7.06	7.06	0.19%	0.00%	
<i>Tagcams/Overflow</i>	0.00	0.00	0.00	0.00%	0.00%	

Need for Retransmit? Need for Replay?

List of Unexpected Alarms, Watch Items, ISAs, PFRs

Unexpected Alarms

- None

New or Updated Watch Items, ISA's and PFR's

- **ISA # 9895 – SPOC systems down 5/20/19**
 - ISA Status: New
 - ISA Type: Ground Major
 - ISA Criticality: 2 – significant impact
- **ISA # 9704 - 4 Uplinks Failed in Full-Duration SS Test**
 - ISA Status: In Progress
 - ISA Type: Ground Minor
 - ISA Criticality: 4 – no significant impact
- **ISA # 9628 – Red alarm notifications were not received by MSA personnel for the TAGCAMS safing event**
 - ISA Status: In Progress
 - ISA Type: Ground Minor
 - ISA Criticality: 3 – minimal impact
- **ISA # 9318 – OCAMS-OpNavs in WOY 16 Science ATF had Wrong Exposure Time**
 - ISA Status: In Progress
 - ISA Type: Ground Minor
 - ISA Criticality: 4 – no significant impact
- **ISA # 9024 - SPOC failed to process MapCam OpNav images within 30 minutes**
 - ISA Status: Monitor
 - ISA Type: Ground minor
 - ISA Criticality: 3 – minimal impact
- **ISA #8913 – Products Sent Outside Uplink Window (preceding the window start)**
 - ISA Status: Resolved
 - ISA Type: Ground minor
 - ISA Criticality: 4 – no significant impact
- **ISA # 8809 – SPOC FEDS to SPOCFLIGHT data delivery drop outs**
 - ISA Status: In Progress
 - ISA Type: Ground minor
 - ISA Criticality: 3 – minimal impact
- **ISA # 8767 - Re-occurrence: STL intermittent downlink issues during setup**
 - ISA Status: In Progress
 - ISA Type: Ground minor
 - ISA Criticality: 3 – minimal impact

Science Status and/or PI Status

Looking Ahead – Science Observation Forecast

https://orexwiki.lpl.arizona.edu/wiki/Detailed_Survey

<u>Task Name</u>	<u>Related DP #</u>	<u>MRD</u>	<u>Baseline Finish</u>	<u>WOY BL Finish</u>
Detailed Survey Science Observations				
Equatorial Stations				
MapCam Observations				
270° (6 AM) 5 km Mapcam Images (PRI.)	35cm Shape model	149a, 149b, 149c	5/23/2019	2019-21
225° (6 AM) Off-Nadir Mapcam Images (PRI.)	IP-13	149a, 149b, 149c	5/23/2019	2019-21
135° (8:40 PM) 5 km Mapcam Images (PRI.)	35cm Shape model	149a, 149b, 149c	5/30/2019	2019-22
225° (8:40 PM) Dust Plume Search 5 km Mapcam Images (PRI.)	RD-8, AP-8, AP-9, AP-10	149a, 149b, 149c, 142b2	5/31/2019	2019-22
90° (6 PM) 5 km Mapcam Images (PRI.)	35cm Shape model	149a, 149b, 149c	6/6/2019	2019-23
OLA Observations				
6:00 am station: OLA Scans (PRI.)	OLA Shape model	678b	5/23/2019	2019-21
6:00 pm station: OLA Scans (PRI.)	OLA Shape model	678b	6/6/2019	2019-23
OTES Observations				
6:00 am station: OTES Spectra (PRI.)	SA-28, TA-007, SA-43	140a, 140b, 147, 155	5/23/2019	2019-21
6:00 am station, Off-Nadir: OTES Spectra (RED.)		140	5/23/2019	2019-21
8:40 pm station: OTES Spectra (PRI.)	SA-28, TA-007, SA-43	140a, 140b, 147, 155	5/30/2019	2019-22
8:40 pm station, Dust Plume Search: OTES Spectra	RIDE ALONG	140, 143, 147	5/31/2019	2019-22
6:00 pm station: OTES Spectra (PRI.)	SA-28, TA-007, SA-43	140a, 140b, 147, 155	6/6/2019	2019-23
OVIRS Observations				
6:00 am station: OVIRS Spectra (PRI.)	SA-28, SA-43, IP-24	140a, 149d, 155, 183a1	5/23/2019	2019-21
6:00 am station, Off-Nadir: OVIRS Spectra (PRI.)	SA-28, SA-43, IP-24	140a, 149d, 155, 183a1	5/23/2019	2019-21
8:40 pm station: OVIRS Spectra (PRI.)	SA-28, SA-43, IP-24	140a, 149d, 155, 183a1	5/30/2019	2019-22
8:40 pm station, Dust Plume Search: OVIRS Spectra	RIDE ALONG	140, 149d, 143	5/31/2019	2019-22
6:00 pm station: OVIRS Spectra (PRI.)	SA-28, SA-43, IP-24	140a, 149d, 155, 183a1	6/6/2019	2019-23

Looking Ahead

19						20						21						22									
126	127	128	129	130	###	###	133	134	135	136	137	###	###	140	141	142	143	144	###	###	147	148	149	150	151	###	###
5/6	5/7	5/8	5/9	5/10	###	###	5/13	5/14	5/15	5/16	5/17	###	###	5/20	5/21	5/22	5/23	5/24	###	###	5/27	5/28	5/29	5/30	5/31	6/1	6/2
M	T	W	R	F	Sa	Su	M	T	W	R	F	Sa	Su	M	T	W	R	F	Sa	Su	M	T	W	R	F	Sa	Su
xm1927 - Orbit B Global Week 1																											
						xm1927 - Orbit B Global Week 1																					
												xm1927 - Orbit B Global Week 1															
xm1924 - OpNav, PMon Only (3x1 mosaics)						xm1925 - Orbit B Particle Imaging 1						xm1926 - Orbit B Particle Imaging 2						xm1927 - Orbit B Global Week 1									
xm1923 - 6:00pm / 90° station						xm1924 - OpNav, PMon Only (3x1 mosaics)						xm1925 - Orbit B Particle Imaging 1						xm1926 - Orbit B Particle Imaging 2									
xm1922 - 8:40pm / 130° station						xm1923 - 6:00pm / 90° station						xm1924 - OpNav, PMon Only (3x1 mosaics)						xm1925 - Orbit B Particle Imaging 1									
xm1921 - 6:00am / 270° station						xm1922 - 8:40pm / 130° station						xm1923 - 6:00pm / 90° station						xm1924 - OpNav, PMon Only (3x1 mosaics)									
xm1920 - 10:00am / 330° station						xm1921 - 6:00am / 270° station						xm1922 - 8:40pm / 130° station						xm1923 - 6:00pm / 90° station									
xm1919 - 12:30pm / 0° station						xm1920 - 10:00am / 330° station						xm1921 - 6:00am / 270° station						xm1922 - 8:40pm / 130° station									

Go Backs / Additional Comments

- **Monday, 5/27, there will be no Daily Downlink Tagup due to the Memorial Day Holiday. Downlink Charts will be uploaded to ODOCS in lieu of the meeting.**

Weekly Instrument Status

- **Status reports.**
- **OCAMS - nominal.**
- **OLA - Off and nominal.**
- **OTES - On, and nominal.**
- **OVIRS - On, and nominal.**
- **REX- Off and nominal.**

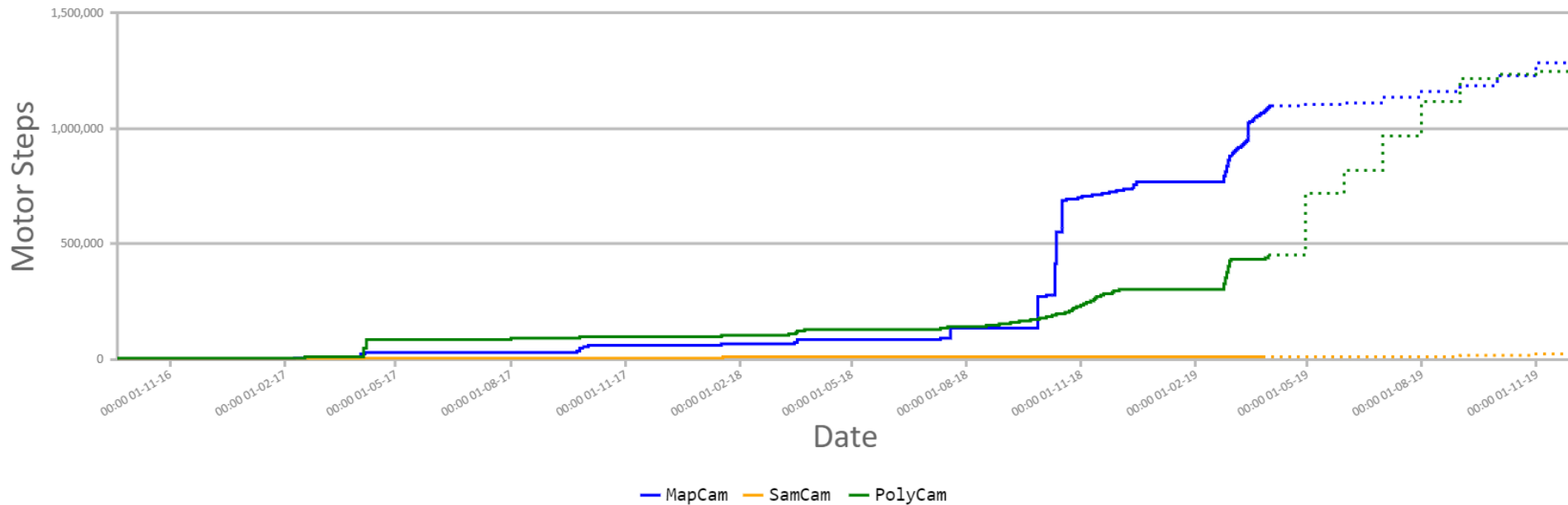
- **OVIRS – data we’ve seen looks good. Pipeline issues over the weekend, but we hope to have everything processed soon**
- **OTES – 10 am station had some spectra with phase inversion issue. Data down and submitted for blessing, plans for IDing bad spectra are going around the team.**
- **OCAMS/IPWG – some pictures have a handful of saturated pixels for the brightest pixels in a given image.**

OCAMS Mechanism Life Tracking

	Launch (steps)	Flight (steps)	NTE (steps)
MapCam	1057475	1207201	3400320
SamCam	738110	15246	958384
PolyCam	1775496	462567	8876160

Status as of April 19, 2019

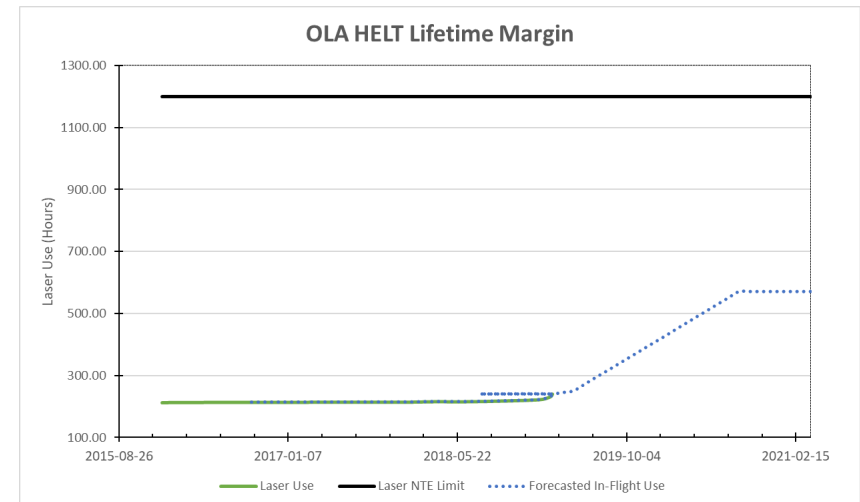
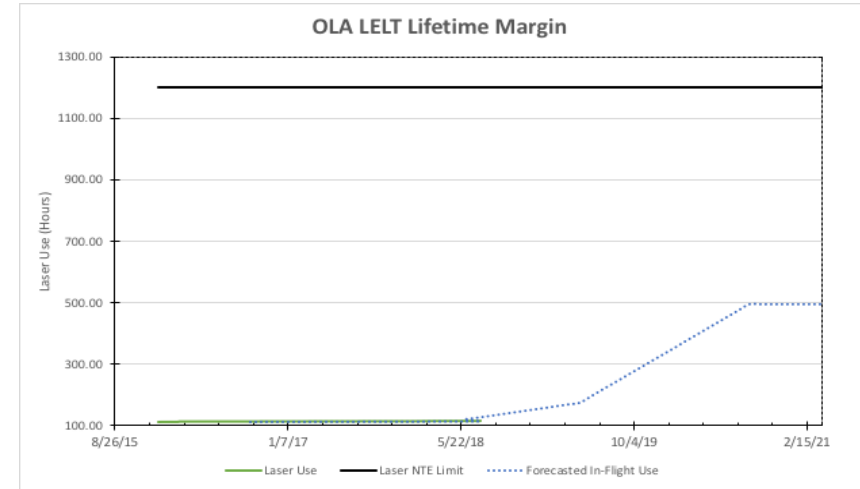
OCAMS Limited Life Items



OLA Limited Life Laser Tracking

	Launch (hours)	Flight (hours)	NTE Margin (hours)
LELT	110.70	4.29	1,085.01
HELT	212.50	39.04	983.80

Status as of April 19, 2019





SPOC Watch Item List

Todays Date: 05/03/2019		SPOC Watch Item List									
Status	Date Added	Date Removed	Item ID	Instrument	Title	Watch Item Description	Impact Type	Watch Item Age	ISA # or TCR #	Watch Item Action	Watch Item Action Plan
Open	9/30/16		Item1	REXIS	CCD Hot Pixels	Some hot pixels were noted on the CCD array.	Hardware Performance	945		Watch	None as of now. If this item trends up, an assessment of masking pixels will need to be made. Update 08/06/2018: REXIS team reports that no additional hot pixels have been noted since the opening of this item, but they will continue to monitor.
Open	4/3/18		Item10	OLA	OLA T0 Intensity	L+10 day, L+6 mo, and L+10 mo On-orbit checkouts showed that OLA's T0 signal intensity (Return Intensity) is an order of magnitude lower than expected as compared with pre-launch spacecraft and stand-alone test data. The L+18 calibrations revealed that the T0 intensity is at pre-launch levels on both the Gold and Silver sides of OLA. SPOC has opted to close ISA 2257 and continue to monitor T0 intensity as a watch item.	Instrument Performance	395		Watch	Monitor the T0 Intensity at the L+22 and L+30 OLA checkouts Update 08/06/2018: Based on results from L+18 and L+22, OLA has not been able to discern a temperature dependency with t0 Intensity value. We will continue to watch, but may never fully understand the cause. OLA can still operate as expected despite the inconsistency seen in the t0 value.
Open	9/5/18		Item11	OCAMS	OCAMS Error on Polycam Startup	During power on of the OCAMS cameras there is the possibility of a 4 byte packet being created due to line noise. SPOCFLIGHT is unsure what to do with this packet, so flags it as an error. So far this has only occurred twice during flight, both times with Polycam but it is possible this could occur with any of the OCAMS cameras. As OCAMS has only been used sparingly during Cruise, it is not certain how frequently this error will occur.	Instrument Performance	240		Watch	Will monitor for future occurrences across all of the OCAMS cameras and assess if any action is warranted.

Anomaly Response & Status

ISA #	Date Created	Type	Priority	Title	Detailed Description - Action Plan	Notes	Status	Resolved Date	Need Date
9318	4/23/19	Ground minor	Normal	OCAMS-OpNavs in WOY 16 Science ATF Had Wrong Exposure Time	In the OpNav Teams review of the week 1916 PEF, they identified two MapCam-OpNav images inside the SOW that were not planned with the requested exposure times. These were originally requested with 5ms, but changed to 3ms in a subsequent delivery of the OpNav Request. The updated shortened exposure time did not get implemented in the Science Plan. OpNav Team has decided that the loss/degradation of these two images due to overexposure does not require a rebuild (not a health or safety concern).		In Progress	TBD	TBD
9024	4/14/19	Ground minor	Normal	SPOC failed to process MapCam OpNav images within 30 minutes	An issue came about which delayed the processing of OCAMS MapCam OpNav images. It is not immediately known what caused the issue.		Monitor	TBD	TBD
8809	3/25/19	Ground minor	Normal	SPOC FEDS to SPOCFlight data delivery drop outs	OPnav group has reported: Data delivery drop outs for NavCam OpNavs from 3/24 2300 and 3/25 0100 epochs, and MapCam OpNavs from 3/24 2300 and 3/25 0100 and 0300 epochs. This data showed up on the SPOC FEDS but not on SPOCFlight. Initial replays were attempted but did not resolve the issue, which is expected given that the data was on the FEDS.		In Progress	TBD	TBD
7704	1/10/19	Spacceraft Major	Normal	Potential particles detected in NavCam images while in Benuu Orbit-A Phase	Investigation and detailed image analysis are underway to determine if particles detected in a pair of NavCam images taken on 01/06/19 may have originated from Benuu (or from other causes such as cold traps on the spacecraft, cosmic rays, etc.) MPB convened to determine if it was safe for the spacecraft to remain in orbit and agreed to remain in orbit but to collect more data for the remaining weeks of the orbit phase as a precaution. The details of the additional and more efficient and targeted observations are being worked.		In Progress	TBD	TBD
7518	1/4/19	Ground Major	High	CenturyLink National Outage	A nationwide CenturyLink outage did not allow normal ground activities for OSIRIS-REx including uplink, downlink, and moving data between elements. Outage Start December 27, 2018 08:40 GMT Outage Stop December 29, 2018 10:12 GMT Approximately 50 hours		Monitor	TBD	TBD
7246	12/6/18	Ground Minor	High	FOB connection down	A FOB connectivity issue was discovered when team members were looking for the 12/06/18 downlink of OpNav images (criticality 3) on the FOB. The OpNav images were obtained via SpocFlight. Investigation ongoing.		In Progress	TBD	TBD
5708	8/22/18	GroundMino	Normal	FEDS not reconstructing packets that encounter a frame counter rollover	SPOC noticed a missing image line for one image. The image line had a packet in it which one of the frames within rolled over the frame counter. The packet was not reassembled and was not available from the FEDS at both LM and the SPOC.		Monitor	4/17/19	TBD

Current ISA Status

#	Status	Priority	Subject	Assignee	Updated
9318	In Progress	Normal	OCAMS-OpNavs in WOY 16 Science ATF Had Wrong Exposure Time	Karl Harshman	5/2/19 11:00
9024	Monitor	Normal	SPOC failed to process MapCam OpNav images within 30 minutes	Karl Harshman	4/25/19 19:05
8809	In Progress	Normal	SPOC FEDS to SPOCFlight data delivery drop outs	Karl Harshman	4/15/19 10:28
8767	In Progress	Normal	Re-occurrence: STL intermittent downlink issues during setup	Mike Skeen	3/29/19 14:44
8672	In Progress	Normal	JPL Firewall Config Changed without LM Notification - affected Matlab license access/use and Maneuver Automation	Andy Calloway	4/12/19 8:43
8542	In Progress	Normal	M3D Late Update Products unable to be Radiated	Mark Fisher	3/15/19 10:17
7994	In Progress	Normal	ACSTBT Overburn	Ryan Olds	2/18/19 12:19
7704	In Progress	Normal	Potential particles detected in NavCam images while in Bennu Orbit-A Phase	Ron Mink	3/28/19 12:37
7518	Monitor	High	CenturyLink National Outages	Andy Calloway	4/17/19 14:04
7246	In Progress	High	FOB connection down	Paul Falkenstern	4/12/19 9:08
5708	Monitor	Normal	FEDS not reconstructing packets that encounter a frame counter rollover	Mark Fisher	4/26/19 9:47