Daily Downlink Tagup

Monday, July 13, 2020 (DOY 195)
WOY 29

Agenda & Logistics

- Quicklook + Instrument Weekly 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/2020

OCAMS Slides available at:
ODOCS at 7.0 Mission Operations System/SPOC/OCAMSFlightProducts/Downlink

Quicklook Status

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

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

Yellow Performance Status impacts LELT only

Downlink Schedule (times in UTC)

- ***Current Data Rate: 600 kbps***

WOY	DOY	Start Date	HGA Start	End Date	HGA End	Duration	Note
29	195	7/13/2020	14:18	7/13/2020	20:19	06:01	***In Progress***
29	196	7/14/2020	14:22	7/14/2020	19:32	05:10	TR2T3 will reduce downlink duration by 1 hour
29	197	7/15/2020	14:18	7/15/2020	20:19	06:01	**Crit-2 Downlink**
29	198	7/16/2020	14:23	7/16/2020	20:12	05:49	
29	199	7/17/2020	14:18	7/17/2020	20:19	05:31	**Crit-3 Downlink**
29	200	7/18/2020	16:21	7/18/2020	20:19	03:58	
29	201	7/19/2020	15:31	7/19/2020	20:19	05:12	
30	202	7/20/2020	14:18	7/20/2020	18:57	04:39	

NOTES / ISSUES:
None

SIGNIFICANT EVENTS:
1. DSCO Returned to Nominal Operations, DOY 194/1917z, Closed
   On DOY 194/1917z, DSCO returned to nominal operations. Further details have been provided by the NAD from the supporting mission set.

RED EQUIPMENT STATUS:

SPC/DSS	EQUIPMENT	ETRO
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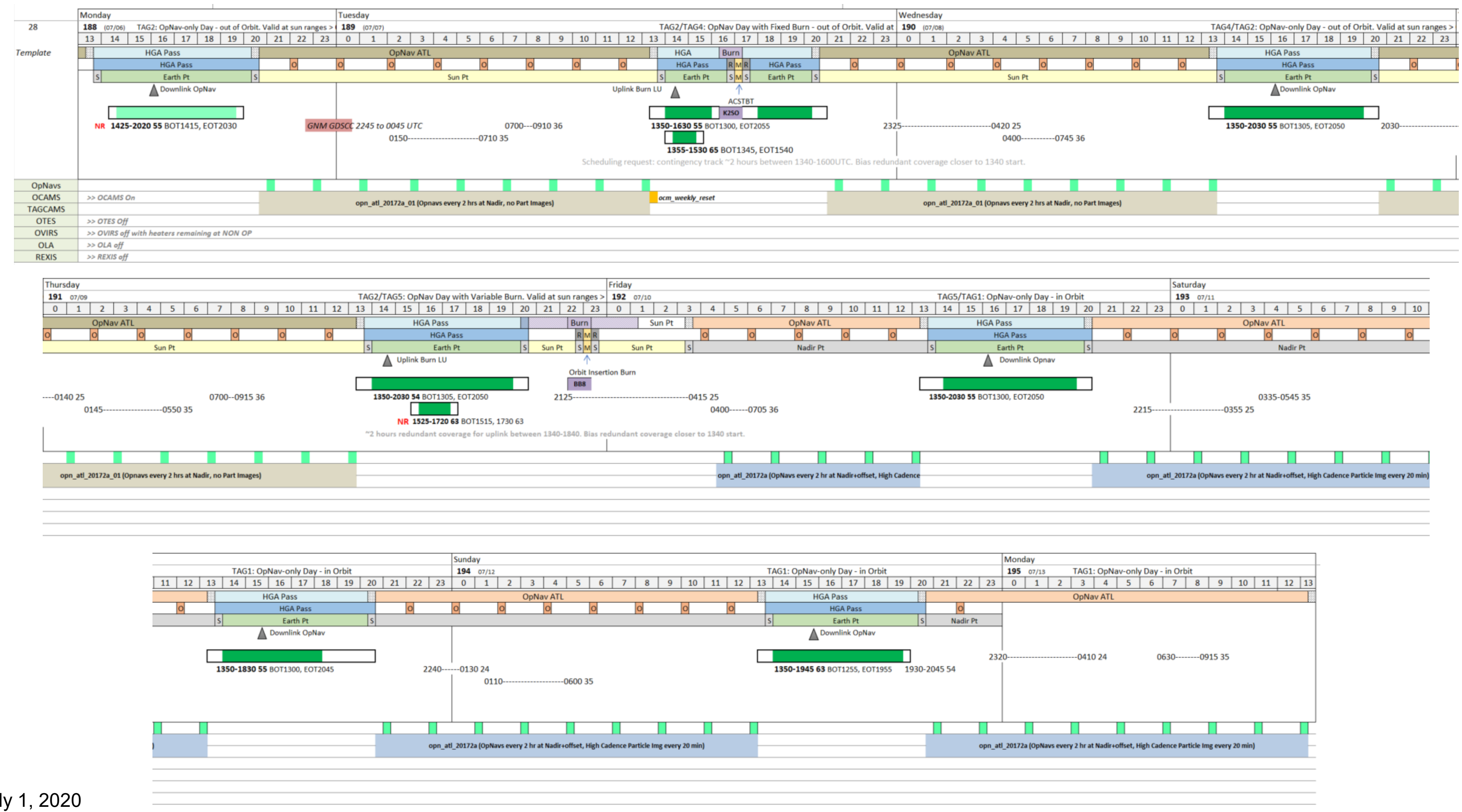
SPC40	RRT6	195/0800z
SPC40	SGA3	204/0000z
DSS63	HEMT-L1	208/1530z
DSS14	HEMT-S1	211/2300z
DSS54	NDA	222/1417z
SPC60	TLP16	222/1530z
SPC60	MCD3-1	222/1600z
DSS14	X500kw-R	244/2300z
SPC60	HMA3	267/1530z
SPC60	NMC-SR1	350/1530z
DSS63	EAC	365/1600z

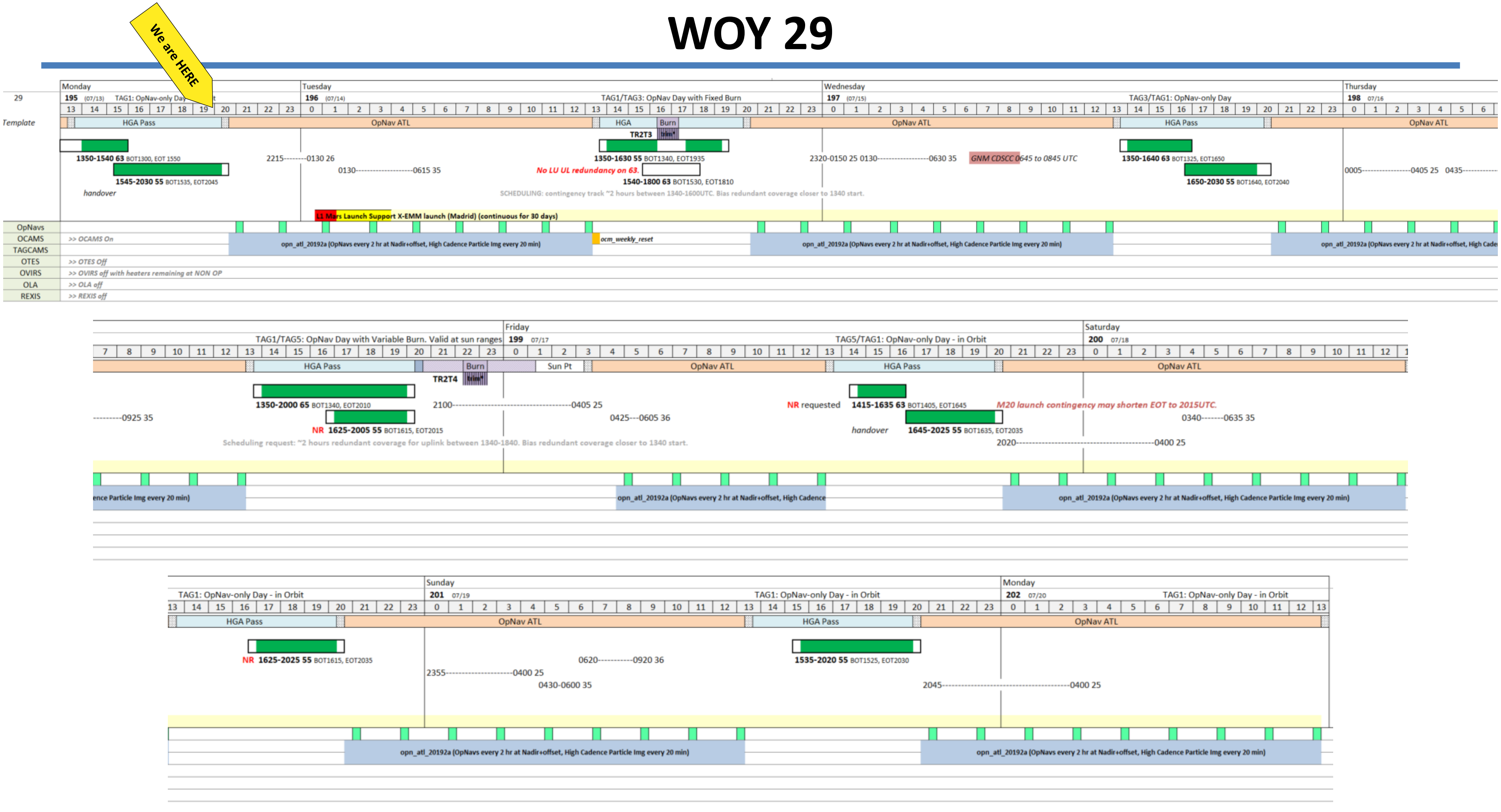
OpNavs and Particle Imaging, Orbit Insertion
WOY 28 COMPLETE



July 1, 2020
L+1392 days
Earth Range = 256,000,000 km (1.71 AU) (↑)
Sun Range = 171,000,000 km (1.14 AU) (↑)
Bennu Range = 20 km (departed orbit on 6/20 for the reboot)
Sun-Probe-Earth Angle = 35.1 deg (↓)
One Way Light Time = 00:14:14 hh:mm:ss (↑)
Round Trip Light Time = 00:28:29 hh:mm:ss (↑)
Day until Matchpoint Rehearsal = 41

OpNavs and Particle Imaging in Orbit, Trim Burns TR2T3 and TR2T4

WOY 29



July 8, 2020
L+1399 days
Earth Range = 261,000,000 km (1.74 AU) (↑)
Sun Range = 174,000,000 km (1.17 AU) (↑)
Bennu Range = 15 km (orbit insertion this week)
Sun-Probe-Earth Angle = 34.1 deg (↓)
One Way Light Time = 00:14:31 hh:mm:ss (↑)
Round Trip Light Time = 00:29:02 hh:mm:ss (↑)
Day until Matchpoint Rehearsal = 34

Uplink Summary

UPLINK

WOY 29 (DOY 195 – 202 ; July 13-July 20, 2020)

- Background seq, sci genies/genie bottle, ATFs, payload sequences uplinked 2020-193

Ephemeris Updates

- OD266 ephemeris update uplinked 2020-193
- OD267 ephemeris update will be uplinked 2020-196
- OD268 ephemeris update will be uplinked 2020-198
- OD269 ephemeris update will be uplinked 2020-200

Other Files

- N/A

Execution Summary

Executed (times In UTC):

- 2020/188 (Monday, July 6) – 2020/189 (Tuesday, July 7)
  - OpNavs only
    - » # of NavCam OpNav images expected/**received**: 18/**18**
    - » # of MapCam OpNav images expected/**received**: 18/**18**
- 2020/189 (Tuesday, July 7) – 2020/190 (Wednesday, July 8)
  - OpNavs only, crit 2.
    - » # of NavCam OpNav images expected/**received**: 18/**18**
    - » # of MapCam OpNav images expected/**received**: 18/**18**
- 2020/190 (Wednesday, July 8) – 2020/191 (Thursday, July 9)
  - OpNavs only
    - » # of NavCam OpNav images expected/**received**: 18/**18**
    - » # of MapCam OpNav images expected/**received**: 18/**18**
- 2020/191 (Thursday, July 9) – 2020/192 (Friday, July 10)
  - OpNavs only, crit 2
    - » # of NavCam OpNav images expected/**received**: 10/**10**
    - » # of MapCam OpNav images expected/**received**: 5/**5**
    - » # of NavCam particle images expected/received: 29/**29**
- 2020/192 (Friday, July 10 – 2020/193 (Saturday, July 11)
  - OpNavs only
    - » # of NavCam OpNav images expected/**received**: 18/**18**
    - » # of MapCam OpNav images expected/**received**: 9/**9**
    - » # of NavCam particle img expected/received: 33/**33**
- 2020/193 (Saturday, July11) – 2020/194 (Sunday, July 12)
  - OpNavs only
    - » # of NavCam OpNav images expected/**received**: 18/**18**
    - » # of MapCam OpNav images expected/**received**: 9/**9**
    - » # of NavCam particle img expected/received: 33/**33**
- 2020/194 (Sunday, July 12) – 2020/195 (Monday, July 13)
  - OpNavs only
    - » # of NavCam OpNav images expected/**received**: 18/**18**
    - » # of MapCam OpNav images expected/**received**: 9/**9**
    - » # of NavCam particle img expected/received: 33/**32***
      - 2 partial Particle Images, 1 missing Particle image. Will be attempting a DSN replay to recover

Execution Summary

Up Next (times In UTC):

- 2020/195 (Monday, July 13) – 2020/196 (Tuesday, July 14)
  - OpNavs only
    - # of NavCam OpNav images expected/**received**: 18/
    - # of MapCam OpNav images expected/**received**: 9/
    - # of NavCam particle img expected/received: 33/
- 2020/196 (Tuesday, July 14) – 2020/197 (Wednesday, July 15)
  - OpNavs only (crit 2)
    - # of NavCam OpNav images expected/**received**: 18/
    - # of MapCam OpNav images expected/**received**: 9/
    - # of NavCam particle img expected/received: 33/
- 2020/197 (Wednesday, July 15) – 2020/198 (Thursday, July 16)
  - OpNavs only
    - # of NavCam OpNav images expected/**received**: 18/
    - # of MapCam OpNav images expected/**received**: 9/
    - # of NavCam particle img expected/received: 33/
- 2020/198 (Thursday, July 16) – 2020/199 (Friday, July 17)
  - OpNavs only (crit 3)
    - # of NavCam OpNav images expected/**received**: 10/
    - # of MapCam OpNav images expected/**received**: 5/
    - # of NavCam particle img expected/received: 29/
- 2020/199 (Friday, July 17– 2020/200 (Saturday, July 18)
  - OpNavs only
    - # of NavCam OpNav images expected/**received**: 18/
    - # of MapCam OpNav images expected/**received**: 9/
    - # of NavCam particle img expected/received: 33/
- 2020/200 (Saturday, July18) – 2020/201 (Sunday, July 19)
  - OpNavs only
    - # of NavCam OpNav images expected/**received**: 18/
    - # of MapCam OpNav images expected/**received**: 9/
    - # of NavCam particle img expected/received: 33/
- 2020/201 (Sunday, July 19) – 2020/202 (Monday, July 20)
  - OpNavs only
    - # of NavCam OpNav images expected/**received**: 18/
    - # of MapCam OpNav images expected/**received**: 9/
    - # of NavCam particle img expected/received: 33/

Downlink Summary

Data Rate: 600 kbps

		Partition	(MB)	(MB)	(MB)	(MB)	(MB)	(%)	(%)
DOY (Day before WOY begins)	194	*OpNav*	0.00	0.00	N/A	219.86	219.86	31.41%	0.00%
Science Downlink Time (s)	19800	*OTES*	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%
Data Rate (MBps):	0.075	*REXIS*	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%
New OCAMS OpNav (MB):	21.11	*OLA*	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%
New TAG OpNav (MB):	198.747	*OVIRS*	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%
New TagCams NonOpNav (MB):	0	*OCAMS*	0.00	0.00	7.06	364.37	371.43	10.06%	0.00%
Low Pri Data for Overflow (MB):	0	*Tagcams / Overflow*	0.00	0.00	N/A	0.00	0.00	0.00%	0.00%
DOY	195	*OpNav*	0.00	0.00	N/A	219.86	219.86	31.41%	0.00%
Science Downlink Time (s)	9496	*OTES*	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%
Data Rate (MBps):	0.075	*REXIS*	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%
New OCAMS OpNav (MB):	21.11489	*OLA*	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%
New TAG OpNav (MB):	198.7471	*OVIRS*	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%
New TagCams NonOpNav (MB):	0	*OCAMS*	0.00	0.00	7.06	364.37	371.43	10.06%	0.00%
Low Pri Data for Overflow (MB):	0	*Tagcams / Overflow*	0.00	0.00	N/A	0.00	0.00	0.00%	0.00%
DOY	196	*OpNav*	0.00	0.00	N/A	219.86	219.86	31.41%	0.00%
Science Downlink Time (s)	19800.00	*OTES*	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%
Data Rate (MBps):	0.075	*REXIS*	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%
New OCAMS OpNav (MB):	21.11489	*OLA*	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%
New TAG OpNav (MB):	198.7471	*OVIRS*	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%
New TagCams NonOpNav (MB):	0	*OCAMS*	0.00	0.00	7.06	364.37	371.43	10.06%	0.00%
Low Pri Data for Overflow (MB):	0	*Tagcams / Overflow*	0.00	0.00	N/A	0.00	0.00	0.00%	0.00%
DOY	197	*OpNav*	0.00	0.00	N/A	219.86	219.86	31.41%	0.00%
Science Downlink Time (s)	19086.00	*OTES*	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%
Data Rate (MBps):	0.075	*REXIS*	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%
New OCAMS OpNav (MB):	21.11489	*OLA*	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%
New TAG OpNav (MB):	198.7471	*OVIRS*	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%
New TagCams NonOpNav (MB):	0	*OCAMS*	0.00	0.00	7.06	364.37	371.43	10.06%	0.00%
Low Pri Data for Overflow (MB):	0	*Tagcams / Overflow*	0.00	0.00	N/A	0.00	0.00	0.00%	0.00%
DOY	198	*OpNav*	0.00	0.00	N/A	122.15	122.15	17.45%	0.00%
Science Downlink Time (s)	19800.00	*OTES*	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%
Data Rate (MBps):	0.075	*REXIS*	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%
New OCAMS OpNav (MB):	11.7305	*OLA*	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%
New TAG OpNav (MB):	110.4151	*OVIRS*	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%
New TagCams NonOpNav (MB):	0	*OCAMS*	0.00	0.00	7.06	320.20	327.26	8.86%	0.00%
Low Pri Data for Overflow (MB):	0	*Tagcams / Overflow*	0.00	0.00	N/A	0.00	0.00	0.00%	0.00%
DOY	199	*OpNav*	0.00	0.00	N/A	219.86	219.86	31.41%	0.00%
Science Downlink Time (s)	12422.00	*OTES*	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%
Data Rate (MBps):	0.075	*REXIS*	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%
New OCAMS OpNav (MB):	21.11489	*OLA*	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%
New TAG OpNav (MB):	198.7471	*OVIRS*	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%
New TagCams NonOpNav (MB):	0	*OCAMS*	0.00	0.00	7.06	364.37	371.43	10.06%	0.00%
Low Pri Data for Overflow (MB):	0	*Tagcams / Overflow*	0.00	0.00	N/A	0.00	0.00	0.00%	0.00%
DOY	200	*OpNav*	0.00	0.00	N/A	219.86	219.86	31.41%	0.00%
Science Downlink Time (s)	15425.00	*OTES*	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%
Data Rate (MBps):	0.075	*REXIS*	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%
New OCAMS OpNav (MB):	21.11489	*OLA*	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%
New TAG OpNav (MB):	198.7471	*OVIRS*	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%
New TagCams NonOpNav (MB):	0	*OCAMS*	0.00	0.00	7.06	364.37	371.43	10.06%	0.00%
Low Pri Data for Overflow (MB):	0	*Tagcams / Overflow*	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%
DOY (WOY Transition)	201	*OpNav*	0.00	0.00	N/A	219.86	219.86	31.41%	0.00%
Science Downlink Time (s)	14854.00	*OTES*	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%
Data Rate (MBps):	0.075	*REXIS*	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%
New OCAMS OpNav (MB):	21.11489	*OLA*	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%
New TAG OpNav (MB):	198.7471	*OVIRS*	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%
New TagCams NonOpNav (MB):	0	*OCAMS*	0.00	0.00	7.06	364.37	371.43	10.06%	0.00%
Low Pri Data for Overflow (MB):	0	*Tagcams / Overflow*	0.00	0.00	N/A	0.00	0.00	0.00%	0.00%

Need for Retransmit? Need for Replay?

- **DOY 195**
  - Gap #1: between 2020-07-13 15:28:39.124 and 2020-07-13 15:31:06.591 GRT that contains 1227 NavCam image packets and 527 OCAMS engineering packets (~9725 VC2 frames).
  - Gap #2: between 2020-07-13 16:12:05.540 and 2020-07-13 16:12:05.869 GRT contains just two NavCam image packet (22 VC2 frames).
  - Resulting in two Particle Images failing checksum check.
  - We believe this may be data that was transmitting during the scheduled station handover today. **A DSN replay will be initiated Tomorrow and is expected to fill in the missing data.**

List of Unexpected Alarms, Watch Items, ISAs, PFRs

Unexpected Alarms:

- **None**

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

ISA #	Date	Criticality	Type	Priority	Title	Detailed Description - Action Plan	Status
15286	7/6/2020	3	Ground minor	Normal	K2SO Late Update MPF Delivery	There was an issue in the K2SO MPF delivery that caused the late update to fail in maneuver automation. FDS resolved the problem and redelivered.	In Progress
15127	6/13/2020	4	Spacecraft minor	Normal	TAGCAMS: (06/13/20) NavCam 1 8x1 Pixel Repeating Pattern	On June 13, 2020 and June 14, 2020 49 NavCam 1 images (both long and short exposures) were corrupted by an 8x1 pixel pattern that repeats every 64 columns and shifts in row by 3 pixels. The DN values for those pixels are unphysically low, ranging from about 40-140 DN.	In Progress
15074	6/9/2020	4	Spacecraft minor	Normal	TAGCAMS: (06/09/20) NavCam 1 Corrupting Pattern in Short-Exposure Image	On June 9, 2020 a single, short-exposure optical navigation NavCam 1 image (20200609T110000S046_ncm_L0_V009.fits) was corrupted by a repeating pattern of anomalously-valued pixels with DN values around 680. The pattern was 15x1 pixels and 7x1 pixels separated by 9 columns.	In Progress
14961	6/14/2020	4	Spacecraft minor	Normal	TAGCAMS: (6/14/2020) Uncorrectable ECC Errors	A red alarm was received for uncorrectable ECC errors (TGM_UncEccEr=58645) when the HGA pass started on 6/14/2020. The counts began with the transfer of the first image taken at 2020-165-20:57:48.500.	In Progress
13071	1/30/2020	3	Ground minor	Normal	STL invalid CRCs problem caught in action	During setup for an interactive test, frames were being rejected by the FEDS for invalid CRCs. The Test Engineer discovered the problem and assembled a group of people to troubleshoot while frames were in the process of being rejected. Please reference ISA #6476 for details on the initial discovery of this problem. During setup for an interactive test, frames were being rejected by the FEDS for invalid CRCs. The Test Engineer discovered the problem and assembled a group of people to troubleshoot while frames were in the process of being rejected. Please reference ISA #6476 for details on the initial discovery of this problem.	In Progress

Science Status and/or PI Status

- No Science Weekly tagup this week

- Ad Hoc SOPG Discussion of SOCR-194 (TAG Debris Survey) planned for OpsWG this week. Anjani will be reaching out individually to the necessary SOPG personnel to support this discussion.

Looking Ahead

<table>
<tr><th colspan="7">28</th><th colspan="7">29</th><th colspan="7">30</th></tr>
<tr><td>188</td><td>189</td><td>190</td><td>191</td><td>192</td><td>#</td><td>#</td><td>195</td><td>196</td><td>197</td><td>198</td><td>199</td><td>#</td><td>#</td><td>202</td><td>203</td><td>204</td><td>205</td><td>206</td><td>#</td><td>#</td></tr>
<tr><td>7/6</td><td>7/7</td><td>7/8</td><td>7/9</td><td>7/10</td><td>##</td><td>##</td><td>7/13</td><td>7/14</td><td>7/15</td><td>7/16</td><td>7/17</td><td>##</td><td>##</td><td>7/20</td><td>7/21</td><td>7/22</td><td>7/23</td><td>7/24</td><td>##</td><td>##</td></tr>
<tr><td>M</td><td>T</td><td>W</td><td>R</td><td>F</td><td>Sa</td><td>Su</td><td>M</td><td>T</td><td>W</td><td>R</td><td>F</td><td>Sa</td><td>Su</td><td>M</td><td>T</td><td>W</td><td>R</td><td>F</td><td>Sa</td><td>Su</td></tr>
<tr><td></td><td>K2SO</td><td></td><td>BB8</td><td></td><td></td><td></td><td colspan="7"></td><td colspan="7"></td></tr>
<tr><td colspan="7">xm2034 - Post-MP Reboot/Recovery</td><td colspan="7">xm2035 - Trans to Orbit, OpNavs</td><td colspan="7"></td></tr>
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<tr><td colspan="7"></td><td colspan="7"></td><td colspan="7">xm2034 - Post-MP Reboot/Recovery</td></tr>
<tr><td colspan="7">xm2030 - OpNav</td><td colspan="7"></td><td colspan="7"></td></tr>
<tr><td colspan="7">xm2031, xm2032, xm2033 - MP/R</td><td colspan="7"></td><td colspan="7"></td></tr>
<tr><td colspan="7">xm2029 - OpNav</td><td colspan="7">xm2030 - OpNav</td><td colspan="7"></td></tr>
<tr><td colspan="7"></td><td colspan="7">xm2031, xm2032, xm2033 - MP/R</td><td colspan="7">xm2031, xm2032, xm2033 - MP/R</td></tr>
<tr><td colspan="7">xm2028 - OpNavs</td><td colspan="7">xm2029 - OpNav</td><td colspan="7">xm2030 - OpNav</td></tr>
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Reminders, Go Backs…

- **Upcoming Daily Downlink Tagups:**
  - Monday, 07/20
  - Monday, 07/27
  - Monday, 08/03

Backup

Instrument Weekly Status

- **Instrument Status**
  - **OCAMS (Bashar) – On and nominal**
  - **OTES (Chris) – Off and nominal**

- **Other Comments**

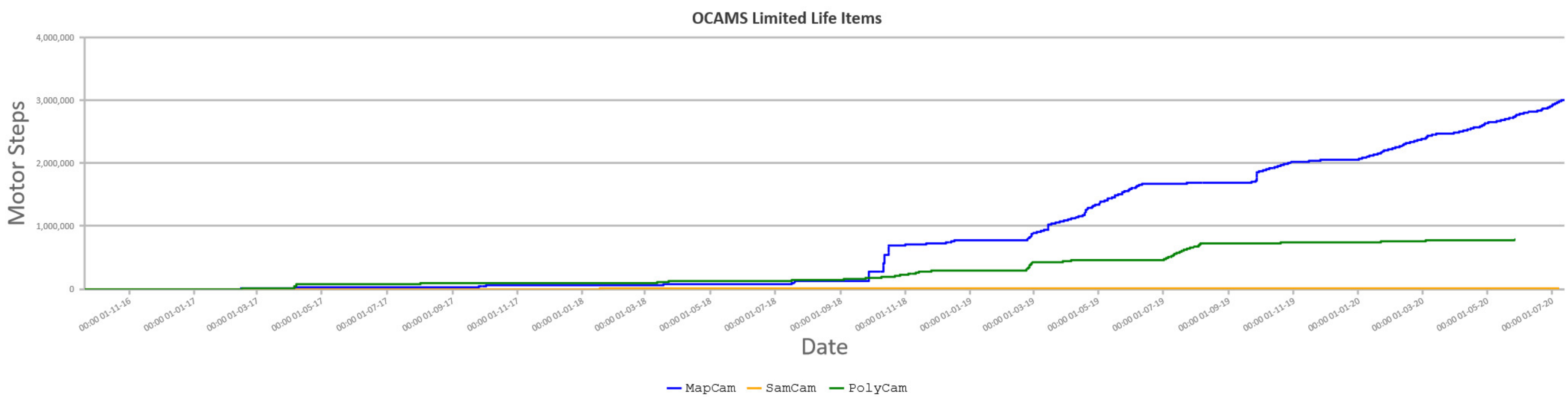
SPOC Watch Item List

- **None, all watch items now closed.**

OCAMS Mechanism Life Tracking

	Launch (steps)	Flight (steps)	Total (steps)	NTE (steps)
MapCam	1,057,475	3,014,553	4,072,028	5,000,000
SamCam	738,110	16,929	755,039	958,384
PolyCam	1,775,496	794,981	2,570,477	8,876,160

Status as of July 13, 2020



OLA Limited Life Laser Tracking

	Launch (hours)	Flight (hours)	NTE Margin (hours)
LELT	110.70	215.35	1,085.01
HELT	212.50	333.79	983.80

Status as of June 15, 2020

LELT has failed