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Solar Orbiter Mission Operations Report #24

Period [28 September 20 - 25 October 20]

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1 SUMMARY OF ACTIVITIES

This report covers four nominal and quiet weeks of cruise in LTP 2 (STPs 115 to 118). This was a relatively quiet period on the instrument side as well, apart from EUI and SWA issues which are reported in the relevant MOR section.

On the MOC end, work continues to focus on the VGAM on 27/12 and the 5 weeks navigation window starting on 30/11 as well as CSW version 3.1.2 loading in January 2021.

DoY	Date	Activity
		STP 115
272	28/09/2020	CEB pass WOL
273	29/09/2020	CEB pass
274	30/09/2020	SA relubrication SWA internal reset
275	01/10/2020	CEB pass
276	02/10/2020	CEB pass, high winds, temporary data loss
277	03/10/2020	WOL
278	04/10/2020	NNO pass
		STP 116
279	05/10/2020	NNO pass WOL
280	06/10/2020	MLG pass
281	07/10/2020	CEB pass
282	08/10/2020	CEB pass
283	09/10/2020	CEB pass
284	10/10/2020	WOL
285	11/10/2020	CEB pass SA relubrication
		STP 117
286	12/10/2020	WOL CEB pass NNO pass

DoY	Date	Activity
287	13/10/2020	CEB pass
288	14/10/2020	
289	15/10/2020	CEB pass
290	16/10/2020	CEB pass EUI flood of EDAC errors EUI FSW update
291	17/10/2020	MLG pass WOL
292	18/10/2020	
293	19/10/2020	STP 118 CEB pass WOL SWA internal reset
294	20/10/2020	CEB pass, heavy rain, temporary data loss PHI UDP update EPD SIS table update
295	21/10/2020	CEB pass Pressure relief function parameter update
296	22/10/2020	NNO pass
297	23/10/2020	CEB pass
298	24/10/2020	WOL
299	25/10/2020	

At the end of the reporting period (DoY 299, 25/10) Solar Orbiter was at:

- 262.1 million km from the Earth (1.75 AU); the one-way signal travel time was 14 min 34 sec (874 sec).
- 146.8 million km from the Sun (0.98 AU).

2 SATELLITE STATUS

2.1 Platform

2.1.1 AOCS / propulsion

The AOCS configuration at the end of the reporting period is:

- AOCS in NCM mode
 - with attitude control based on Wheels (all 4 Wheels)
 - using the gyro stellar estimator (GSE) on STEADY gains
 - with inertial reference attitude guidance
- AOCS Sensors
 - IMU A (all 4 Channels) ON and IN-USE
 - IMU B (all 4 Channels) OFF and all 4 Channels PRESELECTED
 - ACC (all 4 Channels) OFF
 - FSS A (XP and ZM) ON and IN-USE, with FSS A XP having SUN Presence
 - FSS B (XP and ZM) OFF
 - STR A OFF since 05/06 (DoY 157), health set to 2
 - STR B ON (NEAT mode) and IN-USE since 05/06 (DoY 157), health set to 3

AOCS Actuators

- RW 1-4 ON and IN-USE used for Attitude Control since DoY 042 and LEOP day 1
- RW Momentum Target Levels @ 18/-18/-18/18 Nms
- CPS B OFF and PRESELECTED, CPS A OFF
- AOCS Flags
 - Sun Distance flag set to FAR since 13/09/2020 (DoY 257)
 - Flyby flag set to NO FLYBY since launch
- AOCS HK and TM mode configuration: Default since DoY 052 (21/02/2020)

- Propulsion system
 - Valves in default configuration (all TLVs + LFLV closed, except for LFLV 3+4)
 - The propulsion system is configured in regulated mode since launch
 - The pressure relief function is activated when needed
 - Pressure levels
 - HE tank pressure @ 149.3 bar (PT1)
 - PT2 (between pressure regulator and latch valves 1/2) @ 17 bar
 - NTO tank pressure @ 16.4 bar (PT3)
 - MMH tank pressure @ 16.4 bar (PT4)
 - PT5 (before latch valves 3/4 for MON) @ 16.4 bar
 - PT6 (before latch valves 3/4 for MMH) @ 16.4 bar
 - PT7 (between pressure regulator and latch valves 1/2) @ 17 bar
 - Pressure relief function was updated back to 40 days on 21/10 DoY 295 in RAM only; duration unchanged and at 8 cycles. SGM RAM values unchanged (18 days/8 cycles).

2.1.2 Mechanisms

- SADE
 - SADE A ON and IN-USE
 - SADE B OFF
 - SA @ 0 degrees since 243.04.19. The next scheduled rotation is on 329.19.25 (24/11) to 30 degrees.
- HGA APME
 - HGA Deployment Status = TRUE
 - HGA selected as PRIME Antenna (PM and SGM RAM)
 - APME A OFF and PRESELECTED
 - APME B OFF
- MGA APME
 - MGA Deployment Status = TRUE
 - MGA is selected as PRIME Antenna (SGM RAM) since DoY 058
 - APME A OFF and PRESELECTED
 - APME B OFF

2.1.3 *TT&C*

The performance of the subsystem is nominal

- TRSP-1 X-band up and down via HGA, 4 kbps uplink, downlink bit rate is selected according to the used ground station
- TWTA-1 is in use, RF power nominal (from Helix Current telemetry reading)
- TRSP-2 back-up uplink is configured for X-band reception at 7.8 bps via LGA-1 since DoY 178 26/06/2020. LGA-1 is the better antenna till at least end of LTP 3.
- TWTA-2 is OFF and in cold redundancy
- MGA is selected as safe mode antenna since DoY 058.
- PN ranging is fully validated and used by default since DoY 057 (26/02). This allows to currently be on the max TM bit rate.

DST 1 and 2 output power was reduced on 19/06 as the TWTA was in overdrive.

The change was also applied in SGM.

2.1.4 *Thermal*

The thermal configuration has been updated with CSW 3.1.1 loading which takes into account most changes since launch. The following changes (which will be included in CSW 3.1.2 under preparation) were applied during the safe mode recovery on 10/09:

TL044 (METIS Ebox)	updated to: -16.5°C / -16°C
TL045 (PHI Ebox)	updated to: : -16.5°C / -16°C
TL048 (MY RS zone)	updated to: : -15.5°C / -15°C
TL093 (EPD SIS)	updated to: : -24°C / -20°C
TL098 (MAG OBS)	updated to: : -90°C / -88°C

2.1.5 *Power*

The subsystem is in its nominal configuration and performing nominally.

- PCDU A OFF
- PCDU B ON and in use

PCDU A and B EEPROM table updates took place in flight on 05/06.

PCDU-B SGM & PM RAM health is set to 3 since 03/07 (to make B the preferred choice and avoid changing the SCV config in SGM EEPROM).

2.1.6 *Data handling*

The subsystem is in its nominal hardware and software configuration.

The SSMM is ON and fully configured in 3 MM Configuration.

The TC Link Monitor is configured to a time-out of 7 days since 04/06 (DoY 157).

This is the configuration for cruise which is now set as follows (TC link TH1/TC link TH1 increase/TC link TH2):

PM RAM: 7d/24h/7d + 70h

SGM RAM: 7d/12h/7d + 34h

The TM generation mode is configured to NOMINAL.

The current DMS configuration is:

Item	A	B
OBC PM	Active	Off
OBC CSW Image Select	1	1
OBC CSW Version	3.1.1	3.1.1
OBC CSW RAM version	3.1.1	3.1.1
OBC EEPROM Segs	1 : Code 2: Data	1 : Code 2: Data
RM PAP Prog. Set	1 (PM-A Nominal)	1 (PM-A Nominal)
RM	Enabled	Enabled
SSMM SV	Active	Off
SSMM ASW Image	1	1
SSMM ASW Version	02.07.00	02.07.00
RIU	Active	Off
OMM	On and in use (slave)	On and in use (Master)

Updated eclipse files for SGM EEPROM A and B (unique eclipse in the mission is during the EGAM in Nov 2021) were commanded to the SC on 22/1120.



2.2 Instruments

EPD

An EPS SIS table update took place on 20/10.

EUI

A flood of EDAC error events (> 11K events, filling up the CEL), occurred on 16/10 DoY 290. EUI believes this was caused by a big cosmic ray radiation hit. Nothing else was observed at spacecraft level.

The above caused a delay in the start of the EUI FSW update activities which could nevertheless be performed as planned.

Triggered by the high rate of events, MOC further investigated the overall general EUI data production rate. EUI still seems way above the provided constraints. This is of concern and will be addressed with the EUI team offline.

MAG

Nothing to report.

METIS

Nothing to report.

PHI

PHI UDP updates took place on 20/10/20 (DoY 294).

RPW

Nothing to report.

SWA

SWA got further isolated due to internal resets (leading to the known SpW FDIR trigger) on DoY 274 and 293 and was recovered in the next days.

SoloHi

Nothing to report.

SPICE

Nothing to report.

STIX

Nothing to report.



Decontamination heater status

Current status:

- SPICE OU = ON
- SPICE CE = ON
- METIS = OFF
- EUI OU = OFF

3 GROUND FACILITIES

3.1 Ground Stations

During the reporting period mission operations have been conducted with the three ESA stations.

There was a temporary LOS over CEB on 02/10 DoY 276 due to high wind speeds and the need to stow the antenna from about 09:45z to 11:30z leading to a temporary drop in TM/unexpected LoS.

There are therefore SSMM data gaps in this (ground reception time) period.

Loss of TM frames due to heavy rain occurred on CEB on two occasions (~09:38z-09:42z and ~11:04z-11:07z) on DoY 294 (20/10/20).

3.2 Control Centre

Solo MCS SW version D3.15.17 is used on all operational machines since 20/08/2020.

This version uses:

- GFTS SW version 3.1.6
- EDDS SW version 2.4.0 on 07/07 (with latest stream client now available)
- NIS SW version 5.2.0
- FARC SW version 3.2.1

Version 3.19.1 testing is complete. Installation on opslan is imminent.

PHI commands in a delayed TC file executed @293.23.04.00 remained unverified in the MCS although TM(1,x) packets received with proper timestamps. This is being further investigated by the MCS team.



4 SPECIAL EVENTS

None



5 ANOMALIES

The following Anomaly Reports were raised in the reporting period:

Spacecraft

None

Ground Segment

None

Non Conformance Reports

None



6 FUTURE MILESTONES

This is the timeline of future milestones:

Milestone	Date	Comment
LTP2	DoY 181, 29/06/20	LTP 2 runs till 01/01/2021 00:00
TCM	DoY 307, 02/11/20	Available TCM slot will be used
VGAM navigation window	DoY 335, 30/11/20 00:00 To DoY 004, 04/01/21 00:00	
VGAM	DoY 362, 27/12/20	
LTP3	DoY 001, 01/01/21	LTP 3 runs till 28/06/2021 00:00
CSW 3.1.2 upload	STP 131 DoY 017, 17/01/21 20:52 to DoY 024, 24/01/21 21:10	CSW 3.1.2 upload to the SC This will be a full SW load, requiring all instruments off. The new SW will address the AOCS pointing stability issues
Conjunction	DoY 030 30/01/21 to DoY 042 11/02/21	limited access to the SC (TM and TC) With the Sun Earth SC angle < 5 deg