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Solar Orbiter Mission Operations Report #7

Period [06 April 20 - 12 April 20]

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APPROVAL

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CHANGE LOG

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Updated with reporting of new period of time	7	0	14/04/2020

CHANGE RECORD

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Note: no change record is kept for this document since every new issue corresponds to a new reporting period.



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1 SUMMARY OF ACTIVITIES

DoY	Date	Activity
97	06/04/2020	STP 7 start (PL NECP week 6) WOL from 22:00 to 07/04/2020 01:00 IT-4_1 Interactive METIS METIS SW crash, with cascade effect on RPW and SPICE (switch off) IA-5 Interactive SWA
98	07/04/2020	IP-4 Interactive PHI IA-5 Interactive SWA RPW back on
99	08/04/2020	WOL from 22:00 to 09/04/2020 01:00 IC-SOU-50 Interactive SPICE -> postponed, replaced by SPICE on IT-4_2-11 Interactive METIS -> redefined activity IP-4 Interactive PHI
100	09/04/2020	No pass
101	10/04/2020	WOL from 22:00 to 11/04/2020 01:00
102	11/04/2020	
103	12/04/2020	

The table above only reports interactive activities. Many non-interactive activities run throughout the week for multiple instruments.

At the end of the reporting period (DoY 103, 12/04) Solar Orbiter was at:

- 26.9 million km from the Earth (0.179 AU); the one-way signal travel time was 1 min 30 sec (90 sec).
- 126.6 million km from the Sun (0.846 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 ON (NEAT mode) and IN-USE
 - STR B OFF

STR defective pixels check discussion is on-going.

Lost in space acquisition tests open behaviors are further being investigated with ADS.

The STR triangular shaped object (artefact) is further being discussed with ADS.

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 set to NEAR since 16/03/2020 (DoY 76)
 - Flyby 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
 - NTO tank pressure @ 16.5 bar
 - MMH tank pressure @ 16.45 bar
 - HE tank pressure @ 150 bar

2.1.2 *Mechanisms*

- SADE
 - SADE A ON and IN-USE
 - SADE B OFF
 - SA @ 30 deg since 091.11.17.17 (31/03). The next scheduled rotation is on 120.00.47.14 to 56 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 will be selected as PRIME Antenna (SGM RAM) on DoY 058
 - APME A OFF and PRESELECTED
 - APME B OFF

The Fdyn attitude colleagues calibrated the MGA and the HGA. The MGA is fine, but for the HGA a 3dB half cone angle of 0.64 deg is estimated, while the nominal value in the FDDDB is 1.0 deg. This finding is still to be further analysed, validated and confirmed internally. However, for the next 8 weeks (commands already on board) HGA re-positioning commands are based on a 3 dB half cone angle of 0.60 deg to be on the safe side. Ground station signal strength data is being analysed too.

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-2 since DoY 044 13/02/2020
- 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.

2.1.4 *Thermal*

TL97 (MAG OBS) latest setting is a regulation (in RAM only) of -90 to -88 degC.

Thermal configuration is configured for the op range for some instruments (decontamination heaters were not touched).

In orbit thermal characterisation data acquired on 15/03 is being analysed offline.

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 EEPROM tables are pending final clean up.

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 back to a time-out of 3 days since 31/03 (DoY 091). Configuration for cruise is now set as follows (TC link TH1/TC link TH1 increase/TC link TH2):

PM RAM: 72h/24h/142h

SGM RAM: 72h/12h/106h

The TM generation mode is configured to NOMINAL.

SSMM ASW 02.07.00 was uploaded on DoY 052 in both ASW images and both supervisors.

The ADS patch for SOL_SC-06 ([LEOP] OMM packet stores cannot be dumped) [has been applied on board on DoY 098 \(07/04\)](#).

[Following METIS SW crash, a cascade of SpW errors and instrument isolation activities from the S/C FDIR, led to RPW and SPICE being switched off on top of METIS. This was later confirmed by ADS to be a known issue with the CSW and the way the S20 is handled. An instrument failure should not affect other instruments. SOL_SC-38 was raised.](#)

The current DMS configuration is:

Item	A	B
OBC PM	Active	Off
OBC CSW Image Select	0	0
OBC CSW Version	3.0.3p1	3.0.3p1
OBC EEPROM Segs	1 : Code 2: Data 3-8 : Profiles	1 : Code 2: Data 3-8 : Profiles
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)

2.2 Instruments

EPD

Nothing to report.

EUI

Nothing to report.

MAG

Nothing to report.

METIS

See SOL_SC ARs 41, 42, 43.

Activity IT4_1 could not be performed successfully, as the execution of commands in the provided MDOR in step 2.1 of the timeline failed (TM(1,8) - FORMAT ERR).

By request of the instrument team the first command of the MDOR was resent twice with modified arguments. The first one failed with a different TM(1,8) (MMS_MAR_ERROR).

At the execution time of the second one, a SpW link error event was generated followed by a TM(5,4) for the crash of the METIS SW.

This led to a cascade of SpW errors and instrument isolation activities from the S/C FDIR, with METIS, RPW and SPICE being switched off (SPICE HS door was also closed).

This was later confirmed by ADS to be a known issue with the CSW and the way the S20 is handled, as an instrument failure should not affect the others.

Activities on 09/04 consisted in testing the ramp up of the high voltage elements and performing acquisitions. The timeline was not fully completed due to issues at the beginning which caused a delay of 1.5 hour. Several steps were skipped in order to switch off the instrument in time for the end of the pass and the slot on 23/04 is being considered for executing them.

PHI

IP-4 performed the commissioning of the Image Stabilization System (ISS). The ISS and the other functions of the instrument operated nominally during the interactive sessions. There was an issue while updating a UDP due to its updated interface. A solution was found during the interactive activity. TBC if a new operational constraint will be needed for further updates, or if the issue will be fixed via SW.

At PHI switch on BAD_CONTEXT events were received. The cause is understood and a fix will be available with the next PHI software version.

Three events regarding the FPA sensor temperatures were observed. These need further investigation as they do not seem “physical”.

RPW

RPW was unexpectedly switched off on 06/04 (see SOL_SC-38) and switched back on the following day.

**SWA**

The SWA IA-5 activities on EAS-1 were interrupted by the SpW errors generated during the METIS NECP activities. This led to a ~1 hour delay in the timeline. The SWA IA-5 activities on EAS-1 and -2 were largely executed. Some activities will roll over to the scheduled slot on 16/04.

Very many errors about TM sequence/group flags, as multiple groups are interleaved on a single APID. AR SOL_SC-40 raised.

SoloHi

Nothing to report. SoloHI is OFF.

SPICE

SPICE was unexpectedly switched off on 06/04 (see SOL_SC-38) and switched back on 08/04. The planned IC-SOU-50 was postponed to 17/04. It is hoped that further SPICE switch on will not need to be interactive anymore.

STIX

Nothing to report. Not switched on yet.

Decontamination heater status

Current status:

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

Heat shield door status

Current status:

- Door 1 (SPICE) = OPEN (since 08/04, DoY 099)
- Door 2 (EUI-FSI) = CLOSED (since 31/03, DoY 091), movement allowed = false
- Door 3 (EUI-HRI) = CLOSED (since 31/03, DoY 091), movement allowed = false
- Door 4 (METIS) = CLOSED
- Door 5 (PHI-FDT) = OPEN
- Door 6 (PHI-HRT) = OPEN (since 07/04, DoY 098)

3 GROUND FACILITIES

3.1 Ground Stations

During the reporting period mission operations have been conducted with the CEB ESA station.

3.2 Control Centre

Solo MCS SW version D3.15.9 is used on all operational machines since week 08/2020. This version uses:

- GFTS SW version 3.1.6
- EDDS SW version 2.3.0
- NIS SW version 5.2.0
- FARC SW version 3.2.1

MCS SW version D3.15.10 [will be installed on opslan week 16](#).

MATIS (our automation tool) is used since 14/02 (DoY 045) to manage all links to the ground stations.

MCS issues related to SC file transfer, OOL management of the offline datastream and data gap issues (including EDDS) are further being investigated.

DARC has been updated to run consolidation based on reception time. A patch on EDDS to fix management of TC packet reports in play back TM [is pending](#).

[MCS is flooded with messages “Cannot deregister AddFile_FARCmodel_solmca \[...\] with naming service”](#). This is being investigated.



4 SPECIAL EVENTS

None.

5 ANOMALIES

The following Anomaly Reports were raised in the reporting period:

Spacecraft

SOL_SC-43 IT-4 part #2	[NECP] METIS: HVU MCP current OOL seen during HV ramp down in
SOL_SC-42	[NECP] METIS: Configure VLDA commands fail during IT-4 part #2
SOL_SC-41	[NECP] METIS SW crash while patching the PCU offset map (IT-4 part#1)
SOL_SC-40	[NECP] SWA Segmentation (Group) Flags not behaving as expected
SOL_SC-38	[NECP] SpW Errors following METIS commanding

From previous week:

SOL_SC-39 MAG consuming slightly more power than before the power down on 21/03 (so called “high power mode” observed on ground too)

Ground Segment

None

Non Conformance Reports

None

6 FUTURE MILESTONES

This is the timeline of future milestones:

Milestone	Date	Comment
Start of PL NECP week 7 (STP 8)		For PL, only interactive activities are reported
	DoY 104, 13/04/20	WOL from 22:00 to 14/04/2020 @ 01:00
	DoY 105, 14/04/20	STIX IX-1 SWA IA-5
	DoY 106, 15/04/20	WOL from 22:00 to 16/04/2020 @ 01:00 STIX IX-1 SWA IA-5
	DoY 107, 16/04/20	STIX IX-1 SWA IA-5
	DoY 108, 17/04/20	WOL from 22:00 to 18/04/2020 @ 01:00 EPD ID-53 PHI IP-5 SPICE -> replan of activities from previous week
	DoY 109, 18/04/20	
	DoY 110, 19/04/20	
Beyond		
NECP Plan currently goes till 03/05. Beyond that will be (re)defined after Easter.		