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Solar Orbiter Mission Operations Report #5

Period [16 March 20 - 22 March 20]

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APPROVAL

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CHANGE LOG

Reason for change	Issue Nr.	Revision Number	Date
Updated with reporting of new period of time	5	0	**23/03/2020**

CHANGE RECORD

Issue Number 5	**Revision Number 0**		
Reason for change	**Date**	**Pages**	**Paragraph(s)**
New issue	23/03/2020	All	all

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

Distribution list

MOR distribution lists are maintained with the following mailing list groups in the ESA address book:

- SolO MOR
- SolO MOR cc

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1SUMMARY OF ACTIVITIES

Payload commissioning week 4 is complete.
The 0.95 AU Sun distance was crossed on 16/03/2020.
Re-using the words from Cesar:
“In view of the evolution of the Covid-19 spread and impact, with the purpose of firstly ensuring the health of our colleagues, but also securing access to the ESOC facilities to perform critical activities on ESA-operated spacecraft, the Solar Orbiter in-orbit commissioning has been put on hold”.

DoY	Date	Activity
76	16/03/2020	***STP 4 start*** Sun distance < 0.95 AU WOL 19:35 to 22:35
77	17/03/2020	SWA interactive -> HIS switch off due to internal FDIR -> interactive activities did not take place
78	18/03/2020	SPICE Interactive SWA interactive WOL 19:27 to 22:27
79	19/03/2020	PHI Interactive Flow decay OCM
80	20/03/2020	SPICE interactive -> postponed WOL 21:32 to 00:32
81	21/03/2020	
82	22/03/2020	CPS Purging

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 082, 22/03) Solar Orbiter was at:

- 18 million km from the Earth (0.12 AU); the one-way signal travel time was 1 min 00 sec (60 sec).
- 139.7 million km from the Sun (0.933 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

- 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

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.

SOL_SC-36 [Survival heaters and set points when switching on some instrument units] was raised. On 17/03/2019 SWA HIS was out of its operational temperature range at switch on and was therefore switched off (by internal FDIR). EPD team reported being too cold too for their next switch on.

The EPD-SIS TCS set points were updated to [-34,-30 degC] which is the SIS operational switch on range on 18/03. On 18/03 the SWA-HIS TCS set points were updated to [-22,-20 deg C].

There seems to be a hole between thermal settings and some PL units switch on. This is further being investigated with ADS.

(1) It needs to be confirmed if what is observed in flight is different from what was predicted in the thermal ground simulations.

(2) A full revisit of instrument op ranges (with as a potential consequence the need to change thermal set points) is required. After an initial analysis, it seems only SWA-HIS and EPD-SIS are affected.

(3) The applicable changes will then need to be fed back in operational procedures and constraints.

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 with an artificial time-out of 400 days since 21/03/2020.

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.

SOL_SC-28 AR investigations continued ([NECP] Unknown packet during dump of OMM PS REPORTS) with specific OOM_A dumps performed upon ADS request.

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
EPD was commanded off on 21/03.
See thermal section above. The EPD-SIS TCS set points were updated to [-34,-30 degC] which is the SIS operational switch on range.

EUI
EUI remains on in engineering mode, with instrument controlled decontamination heaters on.

MAG
MAG was commanded off on 21/03.

METIS
Nothing to report, METIS is OFF.

PHI
A small issue with one UDP not being updated correctly was addressed. Another UDP will need some refinement as it does not work as expected. The rest of the PHI interactive activities on 20/03 were smooth.
PHI was commanded off on 21/03.

RPW
RPW was commanded off on 21/03.

SWA
Due to the survival heater set point settings being lower than the SWA HIS operational temperature switch on range, instrument internal FDIR triggered and the HIS instrument was switched off. The HIS interactive activities on 17/03 did therefore not take place.

All planned interactive activities on 18/03 were performed successfully (SWA ON, EAS 1&2 ON).

On 18/03 the SWA-HIS TCS set points were updated to [-22,-20 deg C] which is the SWA-HIS operational temperature range. The target temperature was reached in about 2 hours.

SoloHi
Nothing to report. SoloHI is OFF.

SPICE
Interactive activities were successful.
The detector assembly (DA) door was opened. This door is not expected to be operated never again and will remain open for the rest of the mission.
SPICE was commanded off on 21/03.

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) = CLOSED
- Door 2 (EUI-FSI) = OPEN
- Door 3 (EUI-HRI) = OPEN
- Door 4 (METIS) = CLOSED
- Door 5 (PHI-FDT) = OPEN
- Door 6 (PHI-HRT) = CLOSED

2.3 Ground Stations

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

2.4 Control Centre

SolO MCS SW versionD3.15.9 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 is installed on devlan and going through testing.

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.

Offline BEHV task kept on crashing and rebooting over the weekend.
As part of the data gap investigations, some gap issues in the reporting period were due to the MCS and the TM provision Services stopping to update.
The TC history gap problems in ARES/Webmust are now understood. They are due to ARES/WebMust not taking into account PB verification.

3 SPECIAL EVENTS

NECP is on hold.

4 ANOMALIES

The following Anomaly Reports were raised in the reporting period:

Spacecraft

SOL_SC-37	[NECP] Spice event ENG_PKT_SPW_TIMEOUT received
SOL_SC-36	Survival heaters and set points when switching on some instrument units
SOL_SC-35	Steering the APMEs via CSW function always creates Aperiodic and Periodic Alarms

Ground Segment

None

Non Conformance Reports

None

5 FUTURE MILESTONES

This is the timeline of future milestones:

Milestone	Date	Comment
Start of PL NECP week 5		On hold
	Week 13	Uplink of 8 weeks of Fdyn and FCT products in current week 13
Beyond		
	DoY 091, 31/03/20	SA steering to 30 deg offset