Solar Orbiter Mission Operations Report #14

Period [27 May 20 - 01 June 20]

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APPROVAL

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CHANGE LOG

Reason for change	Issue Nr.	Revision Number	Date
Updated with reporting for new time period	14	0	**02/06/2020**

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

The week was mainly dedicated to bridging back into the new NECP timeline

DoY	Date	Activity
148	27/05/2020	***STP 14 continuation (PL NECP week 13)*** PHI Switch On, PHI SW upload open SPICE Door IU-11 WOL
149	28/05/2020	Alignment campaign
150	29/05/2020	EPD Switch On IT-5 IU-12 (EXTRA SLOT FOR EUI) IC-IIC campaign WOL
151	30/05/2020	IC-IIC campaign completion
152	31/05/2020	
153	01/06/2020	***STP 15 start (PL NECP week 14)*** HGA pattern repetition

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 153, 01/06) Solar Orbiter was at:

- 95.7 million km from the Earth (0.64 AU); the one-way signal travel time was 5 min 19 sec (319 sec).
- 82.0 million km from the Sun (0.54 AU).

2 SATELLITE STATUS

2.1   Platform

2.1.1 *AOCS / propulsion*

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

- o 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

- o 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 started with STRB complete. All STRB tables before and after the autonomous defective pixel detection activity show 0 defective pixels. Also, no event indicating defective pixels detection was received. STRB activities are complete. STRA defective pixel checks are pending.

  Lost in space acquisition tests open behaviors are further being iterated after initial feedback from ADS.

  A new FOTO dump took place on 20/05. The brightest star has a pixel of 2004 DU. No indication of a defective pixel or a strangely shaped artefact as in the dump from February could be found.

  STR-B alignment update in RAM on 18/05 was successful. STR-B alignment in SGM was performed on 25/05.

  The gyro bias and null space calibration was updated in SGM on DoY 135.

  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

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- o AOCS Flags
    - Sun Distance set to NEAR since 16/03/2020 (DoY 76)
    - Flyby set to NO FLYBY since launch

- o AOCS HK and TM mode configuration: Default since DoY 052 (21/02/2020)

- o 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
    - Pressure relief function period updated to 40 days on 17/04 (DoY 108) in RAM only; duration unchanged and at 8 cycles. SGM RAM values unchanged (18 days/8 cycles). The new RAM period applies following the pressure relief from 27/04.

2.1.2 *Mechanisms*

- o SADE
    - SADE A ON and IN-USE
    - SADE B OFF
    - SA @ 60 degrees since 127.19.52. The next scheduled rotation is on 152.20.30 to 70 degrees.

- o HGA APME
    - HGA Deployment Status = TRUE
    - HGA selected as PRIME Antenna (PM and SGM RAM)
    - APME A OFF and PRESELECTED
    - APME B OFF

- o 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

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 was estimated. The HGA pattern calibration was repeated on 01/06. Data is being analysed.

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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 and B EEPROM table updates have been tested and reviewed on ground and are pending upload to the spacecraft. The update in flight is scheduled for 28/05.

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.

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

The SSMM router configuration reports on 25/05 highlighted router configuration issues needing a cold restart of the SSMM. This cold restart was performed on 26/05. The issues to switch on MAG on 23/05 may also be related to SSMM issues too, despite a priori a clean MAG SSMM router configuration.

The SSMM behaviour is to be fully understood. A cold restart of the SSMM beyond NECP would be a significant issue.

It was also initially reported by PHI but applies to all HK. No HK from the HK SSMM packet store is available beyond one hour before the SpW overload. The issue is further being investigated, including checks in other packet stores. This is a new AR.

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
This configuration will soon need updating with the ground station pass reduction in June (and no longer daily passes).

The TM generation mode is configured to NOMINAL.

The ADS patch (3.0.3p5) for SOL_SC-06 ([LEOP] OMM packet stores cannot be dumped) has been applied on board on DoY 098 (07/04).
Patch CSW V3.0.3p6 for the instrument "cascade switch-off effect" was applied on 26/05 .

OBCPs: an issue with timing in the METIS OBCP was identified and is being addressed.

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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 CSW RAM version	3.0.3p6	
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 activated successfully on 29/05.

EUI
EUI reported an emergency situation on 30/05 with the request to abort the EUI commanding. In the end this was a false alarm. This involved once more MOC intervention over a weekend.

MAG
MAG participated to the comet tail observations.

METIS
METIS IT-5 completed successfully.

PHI
PHI SW upload was successful on 27/05. Several failed TCs and non-nominal events during the campaigns are to be noted.

RPW
Several failed TCs and non-nominal events during the campaigns are to be noted.
RPW participated to the comet tail observations.

SWA
During the SWA power on operations on the 30th May for the Comet Study, the internal FDIR that protects PAS had an out of limit and the SWA DPU powered PAS off. This has been analysed over the weekend and the initial cause has been found to be a 'too-short' time interval before switching on the PAS internal FDIR.
The issue is being addressed to allow successful PAS switch on in the future.
SWA participated to the comet tail observations.

SoloHi
Nothing to report.

SPICE
SPICE HS Door was opened on 27/05, with decontamination heaters to OFF on the next day. A new FSW update was performed, followed by intensive testing of the Filter Wheel mechanism to understand errors seen in previous NECP slots.

STIX
STIX NECP activities continued.

Decontamination heater status

Current status:
- SPICE OU = ON
- SPICE CE = OFF since DoY 149 (28/05)
- METIS = OFF since DoY 113 (22/04)
- EUI OU = OFF since DoY 106 (15/04)

Heat shield door status

The doors were touched during the weekend to protect some instruments.
Current status:
- Door 1 (SPICE) = CLOSED (since 21/04 DoY 112)
- Door 2 (EUI-FSI) = CLOSED (at end of reporting period)
- Door 3 (EUI-HRI) = CLOSED (at end of reporting period)
- Door 4 (METIS) = CLOSED
- Door 5 (PHI-FDT) = OPEN
- Door 6 (PHI-HRT) = OPEN (since 07/04, DoY 098)

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3 GROUND FACILITIES

3.1   Ground Stations

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

An unexpected loss of lock towards the end of CEB pass was observed on 30/05. This is further being investigated with the OMs. AR SOL-350 raised.

3.2   Control Centre

SolO MCS SW versionD3.15.10 is used on all operational machines since week 16/2020. 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

Version 3.15.12 was installed on devlan on 18/05 for FCT testing. Testing is ongoing.
Version 3.18 is under preparation.

MATIS (our automation tool) is used since 14/02 (DoY 045) to manage all links to the ground stations. Since 20/04 (DoY 111) MATIS is also used for some start of pass commanding. MATIS should take over full start of pass commanding activities in the coming weeks. This needs MCS version 3.18 to address all open MATIS issues.

A strange behavior was observed on 15/05 with many OOLs due to a toggling bit rate. An MCS SPR was raised.
Investigations continue on recent strange behaviors mainly affecting the commanding chain (verifier, signed integer TC par management), as well as file transfer issues from devlan to opslan). The commanding chain issues need urgent addressing/understanding and fixing if needed. Further verifier issues were observed during the week.

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4 SPECIAL EVENTS

None

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5 ANOMALIES

The following Anomaly Reports were raised in the reporting period:

Spacecraft

New
SOL_SC-47   [NECP] STIX Error - HW failure of HK monitored line. During STIX NECP
SOL_SC-49   [NECP] Pointing Stability Disturbance
SOL_SC-52   [NECP] SSMM missing HK before SpW overload

From last week
SOL_SC-51   [NECP] MAG switch on failure due to TC rejection after boot
SOL_SC-50   [NECP] SSMM issues following SpW Overload FDIR triggering...
SOL_SC-48   [NECP] EUI triggers Spacewire overload

Ground Segment

SOL-350   [NECP] unexpected loss of on board lock on 30/05 over CEB

Non Conformance Reports
None

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6 FUTURE MILESTONES

This is the timeline of future milestones:

Milestone	Date	Comment
Start of PL NECP week 14 (STP 15)		
	DoY 153, 01/06/20	HGA calibration test, public holiday WOL
	DoY 154, 02/06/20	IW-6_PAYLOAD + PLATFORM IC-SOU-80_2-8
	DoY 155 03/06/20	IC-SOU-80_9 IH-40 (non-interactive) IT6 B2 non interactive WOL
	DoY 156, 04/06/20	IT6 B2 interactive
	DoY 157, 05/06/20	IH-41 (non-interactive) IH-42 (non-interactive) SoloHI Door release WOL STR-A EEPROM dump PCDU EEPROM patch defective pixels STR A
	DoY 158, 06/06/20	IM-IIC campaign
	DoY 159, 07/06/20	
Beyond		
NECP plan available till LTP1 start		
LTP1 start on 15/06	DoY 167, 15/06/20	
LTP2 start on 29/06	DoY 181, 29/06/20	

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