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# Solar Orbiter Mission Operations Report #18

## Period [22 June 20 - 28 June 20]

|                       |                         |
|-----------------------|-------------------------|
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# APPROVAL

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| Sylvain Lodiot, Solo SOM                                 |                          |

# CHANGE LOG

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# CHANGE RECORD

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## 1 SUMMARY OF ACTIVITIES

The second cruise week is complete. This completes LTP1. LTP 2 starts on 29/06.

This second cruise week saw the completion of the payload checkout (which ran offline via MTL) followed by several CEB passes (over 2 weeks, till 05/07) for data downlink. A return to a cruise ground station pattern with 3 passes per week will then take place. The ground station negotiation for the first half of 2021 is well advanced.

On the platform side, a swap to LGA 1 as backup antenna took place on 26/06. The main focus from the FCT is the preparation for CSW 3.1 (and 3.1.1) uplink to the spacecraft early September.

On the payload side, the RPW numerous compression events were finally disabled. SWA issues (PAS/HIS) continue to be addressed.

| <b>DoY</b> | <b>Date</b> | <b>Activity</b>                                    |
|------------|-------------|--|
| 174        | 22/06/2020  | <b>STP 101</b><br>WOL<br>CEB pass                  |
| 175        | 23/06/2020  | WOL<br>CEB pass                                    |
| 176        | 24/06/2020  | WOL<br>CEB pass                                    |
| 177        | 25/06/2020  | WOL<br>CEB pass                                    |
| 178        | 26/06/2020  | WOL<br>Swap to LGA 1 as backup antenna<br>CEB pass |
| 179        | 27/06/2020  | WOL<br>CEB pass                                    |
| 180        | 28/06/2020  | WOL  |

At the end of the reporting period (DoY 180, 29/06) Solar Orbiter was at:

- 169.4 million km from the Earth (1.13 AU); the one-way signal travel time was 9 min 25 sec (565 sec).
- 81.2 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:

- 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

STR-A EEPROM dump was attempted on 05/06. Only 2 out of 4 memory bank dumps were successful. The other 2 failed. This is further being investigated and may lead to an AR.

STR A FOTO dump took place on DoY 160 to complete the STR defective pixel activities.

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

- 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)

As part of the AR SOL\_SC-49 investigations (pointing), the gyroscopic torque compensation was disabled on 15/06.

A new TM packet was also defined to gain more visibility. This packet is generated at 8 Hz and will remain enabled for a few more STPs. This new packet makes an increase of 6 kbps.

- 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 @ 16.45 bar (PT3)
    - MMH tank pressure @ 16.4 bar (PT4)
    - HE tank pressure @ 149.2 bar (PT1)
    - PT2/7 (between pressure regulator and latch valves 1/2) @ 16.8 bar
    - PT5 (before latch valves 3/4 for MON) @ 16.44 bar
    - PT6 (before latch valves 3/4 for MMH) @ 16.4 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.

The OCM on 15/06 targeted 14.5 cm/s. The OCM over-performed by 1.65%. The directional error was 0.71 deg. The propellant used was 136.8 grams.

### 2.1.2 Mechanisms

- SADE
  - SADE A ON and IN-USE
  - SADE B OFF
  - SA @ 70 degrees since 152.20.30. The next scheduled rotation is on 181.18.55 (29/06) to 60 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](#)
- 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*

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

Significant work has been done on SOL\_SC-49 [NECP] Pointing Stability Disturbance.

To address the STIX Aspect System disturbances, the IMU200 set-points (TL 3) were updated to [-8; -7], with an immediate effect on the heater.

Thermal line 48 (MY panel heater) set points were updated to [0.5; 1 deg] on 15/06 as part of the AR SOL\_SC-49 investigations (pointing).





### **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.

### 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. SSMM issues following the SpW overload are further being investigated.

SSMM rerouting activities took place as follows:

- (a) SOC request: all of the EPD "selective" APIDs currently routed to store #7 (namely 844, 860, 908, 1612) re-routed to store #6, EPD bulk science
- (b) reroute APID 924 from the EUI SSMM science packet store (PS12) to the low latency packet store (PS5) following EUI request at the end of the NECP

The TC Link Monitor is configured back 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 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.

The current DMS configuration is:

| <b>Item</b>          | <b>A</b>                              | <b>B</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<br>2: Data<br>3-8 : Profiles | 1 : Code<br>2: Data<br>3-8 : Profiles |
| RM PAP Prog. Set     | 1<br>(PM-A Nominal)                   | 1<br>(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**

Nothing to report.

### **PHI**

Nothing to report.

### **RPW**

Numerous compression events (1000s/day) are finally disabled.

### **SWA**

SWA HIS was identified on by MOC during a solar array rotation during STP 102. SWA team to ensure HIS is in the proper state for any further SA rotations in future STPs. SWA PAS and HIS issues continued to be addressed during the reporting period.

### **SoloHi**

Nothing to report.

### **SPICE**

Nothing to report.

### **STIX**

Nothing to report.

### **Decontamination heater status**

Current status:

- SPICE OU = ON
- SPICE CE = ON since DoY 155 (06/06)
- METIS = OFF since DoY 113 (22/04)
- EUI OU = OFF since DoY 106 (15/04)

## 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 D3.15.15 is used on all operational machines since 16/06/2020.

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 3.15.16 is installed on devlan.

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.



## **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:

| <b>Milestone</b> | <b>Date</b>               | <b>Comment</b>  |
|------------------|---------------------------|---|
| LTP2 start       | DoY 181, 29/06/20         |   |
|                  | week 37<br>07/09 to 11/09 | CSW upload on the SC<br><br>This implies a SC safe mode hence all instruments off that week |
|                  | 27/12/2020                | VGAM  |