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Solar Orbiter Mission Operations Report #20

Period [27 July 20 - 02 August 20]

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APPROVAL

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CHANGE LOG

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CHANGE RECORD

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1SUMMARY OF ACTIVITIES

This report covers a quiet cruise week in LTP 2.

On the platform side, the main issue was the STR power cycle due to FDIR on 27/07. This is further being investigated.

On the payload side, it was a very quiet week!

DoY	Date	Activity
209	27/07/2020	***STP 106*** WOL STR B FDIR trigger and STR B power cycle CEB pass
210	28/07/2020	
211	29/07/2020	CEB pass STR B health back to 3 Update of OBDB Gyro Torque compensation flag back to TRUE Update of OBDB and SGM Gyro consistency thresholds
212	30/07/2020	NNO pass
213	31/07/2020	CEB pass
214	01/08/2020	WOL SA rotation (56 to 30 deg)
215	02/08/2020	

At the end of the reporting period (DoY 225, 02/08) Solar Orbiter will be at:

- 235.3 million km from the Earth (1.57 AU); the one-way signal travel time was 13 min 05 sec (785 sec).
- 112.7 million km from the Sun (0.75 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. AR SOL_SC-61 was raised.

  During the pass on 27/07/2020, DoY 209, STR 2 was power cycled due to FDIR triggering due to a STR local timeout check, with health decreased to 2.
  Until 2020-07-27T12:57:06, when STR 2 entered INI mode, both, the absolute and mode frame counters were increasing. Thus, no frozen STR SW.
  With the mode transition from NEAT to INI, a TM (157,1), boot report, was generated. In there, it reports a L0_RAM_DED reset type. This is a reset after double error detection in RAM.
  After 183 seconds, the STR Local Timeout Check triggered and re-booted the STR.
  STR 3 entered NEAT again at 2020-07-27T13:00:37 and is back in the loop since 2020-07-27T13:12:15.
  Everything looks nominal since then.
  It therefore looks like either a transient 1553 error, or a STR double RAM error.
  While the STR was not tracking, the GSE innovation on SC Z increased to -0.01 deg.
  No de-pointing was observed, when the STR came back into the loop, only some small higher noise in NCM-G than in NCM-F.
  Health was set back to 3 during next pass on 29/07. The issue is further being looked into. SOL_SC-AR 63 was raised.

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

As part of the pointing AR investigations and following ADS request, the wheels have gone through various levels in the STPs 102 to 104. Inverting the wheel speed direction is being looked into and will be commanded in one of the next STPs.

OBDB and SGM Gyro consistency thresholds were updated. The "IboomDep" threshold (used also in NCM) needed updating to the same high values as NCM "ncmOP Operational" and OCM. IboomDep threshold is used when we transition to NCM & NCM-T entry.

The values were patched in the current SGM too to be aligned with to come SGM values for v3.1.1.

- 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)

The gyroscopic torque compensation was re-enabled on 29/07.
The ADS investigation is complete and the flag was set back to its default value.

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. This new packet will be enabled at least till STP 110.

- 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 @ 149.8 bar (PT1)
    - PT2 (between pressure regulator and latch valves 1/2) @ 17.0 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) @ 17.0 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*

- SADE
  - SADE A ON and IN-USE
  - SADE B OFF
  - SA @ 56 degrees since 206.19.34. The next scheduled rotation is on 214.14.40 (01/08) 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
- 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.

Regulation limits for TL#48 (-Y panel zone heater) were changed on 30/06 from [0.5, 1.0] to [-11.5, -11] on ADS request. This activity is part of ongoing investigations for the pointing stability AR. TCL048 set points were then updated to [-15.5,-15] at ADS request on 09/07.

SIS heater line set-points (TL 93) were updated from [-34, -30] to [-24, -20] as per PI request on 22/07. This update was requested to reduce the thermal shock for SIS in cases of prolonged Switch-Off as well as to reduce the time needed for SIS to reach the IRIS motor temperatures after the EPD ICU Switch On.

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 was set to 3 on 03/07 (to make B the preferred choice and avoid changing the SCV config in SGM EEPROM). After the safe mode post CSW 3.1.1 PCDU B will be in use again.

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

S13 downlink usage was attempted on 13/07. The configuration on MOC end had to be updated to complete the 2 file transfers on PS4 (HK) and 5 (low latency).
The MCS could then not inject the data (AR SOL_SC-62). After further investigation it turns out that most instruments do not follow GDIR requirement 1440 imposing even 16-bit words for SpW packets.

The SSMM relies on the requirement that all packets have an overall even length (GDI-1440 specifies “..even number of 16-bit words..”) and odd ones can cause misalignments in the FDU building process.

This is no issue with S15. The main difference is that S15 reads the packets as they are stored in memory and the HW guarantees that they don’t overlap. In S13 they are first transferred from memory to the Supervisor then packed by ASW into the FDUs.
ASW reads the packet length in the process, but uses 32-bit data variables and counts accordingly, misalignments are inevitable.

The issue is being further iterated with all instrument teams to see if this can be changed with new instrument SW for the instruments not following the requirement.

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:

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
Nothing to report.

EUI
Nothing to report.

MAG
Nothing to report.

METIS
Nothing to report.

PHI
Nothing to report.

RPW
Nothing to report.

SWA
Nothing to report.

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 NNO and CEB ESA stations.

3.2 Control Centre

SolO MCS SW version D3.15.16 is used on all operational machines since 20/07/2020.
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 3.18 is installed on most devlan servers and clients for testing since 23/07.

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

SOL_SC-63 STR rec 04 trigger due to STR local timeout check

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 28/12/2020 00:00
	week 37 07/09 to 11/09	CSW upload on the SC This implies a SC safe mode hence all instruments off that week
	27/12/2020	VGAM