esoc

European Space Operations Centre
Robert-Bosch-Strasse 5
D-64293 Darmstadt
Germany
T +49 (0)6151 900
F +49 (0)6151 90495
www.esa.int

Solar Orbiter Mission Operations Report #15

Period [02 June 20 - 07 June 20]

Prepared by **Sylvain Lodiot**

Reference **SOL-ESC-RP-10100**
Issue/Revision **15.0**
Date of Issue **07/06/2020**
Status **Issued**

European Space Agency
Agence spatiale européenne

APPROVAL

Title Solar Orbiter Mission Operations Report #15	
Issue Number 15	**Revision Number** 0
Author Sylvain Lodiot	**Date** 07/06/2020
Approved By	**Date of Approval**
Sylvain Lodiot, SolO SOM	Sylvain Lodiot Digitally signed by Sylvain Lodiot Date: 2020.06.07 20:47:53 +02'00'

CHANGE LOG

Reason for change	Issue Nr.	Revision Number	Date
Updated with reporting for new time period	15	0	**07/06/2020**

CHANGE RECORD

Issue Number 15	**Revision Number 0**		
Reason for change	**Date**	**Pages**	**Paragraph(s)**
New issue	07/06/2020	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

Table of contents

1SUMMARY OF ACTIVITIES

This is the last but one NECP week. Several platform NECP activities took place.

DoY	Date	Activity
154	02/06/2020	***STP 15 continuation (PL NECP week 14)*** IW6 NECP campaign IC-SOU-80_2-8
155	03/06/2020	SPICE IC-SOU-80_9
156	04/06/2020	TC link monitor update METIS IT6
157	05/06/2020	STR A EEPROM dump STR A defective pixels Swap to STR B PCDU EEPROM patch IMU200 set point update to solve the STIX Aspect System disturbances WOL SoloHI door deployment
158	06/06/2020	IM-IIC campaign No ground contact
159	07/06/2020	No ground contact

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:

- 111.5 million km from the Earth (0.74 AU); the one-way signal travel time was 6 min 12 sec (372 sec).
- 78.8 million km from the Sun (0.52 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 defective pixels check is complete. The default STR-A defective pixel tables were dumped on 05/06 with empty tables. The autonomous STR-A defective pixel detection function was then initiated and the resulting dumped tables were empty once again.

  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.

  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)

- 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*

- 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

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. ADS reports a slight bias of 0.1 to 0.2 degrees. Fdyn analysis is on-going.

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*

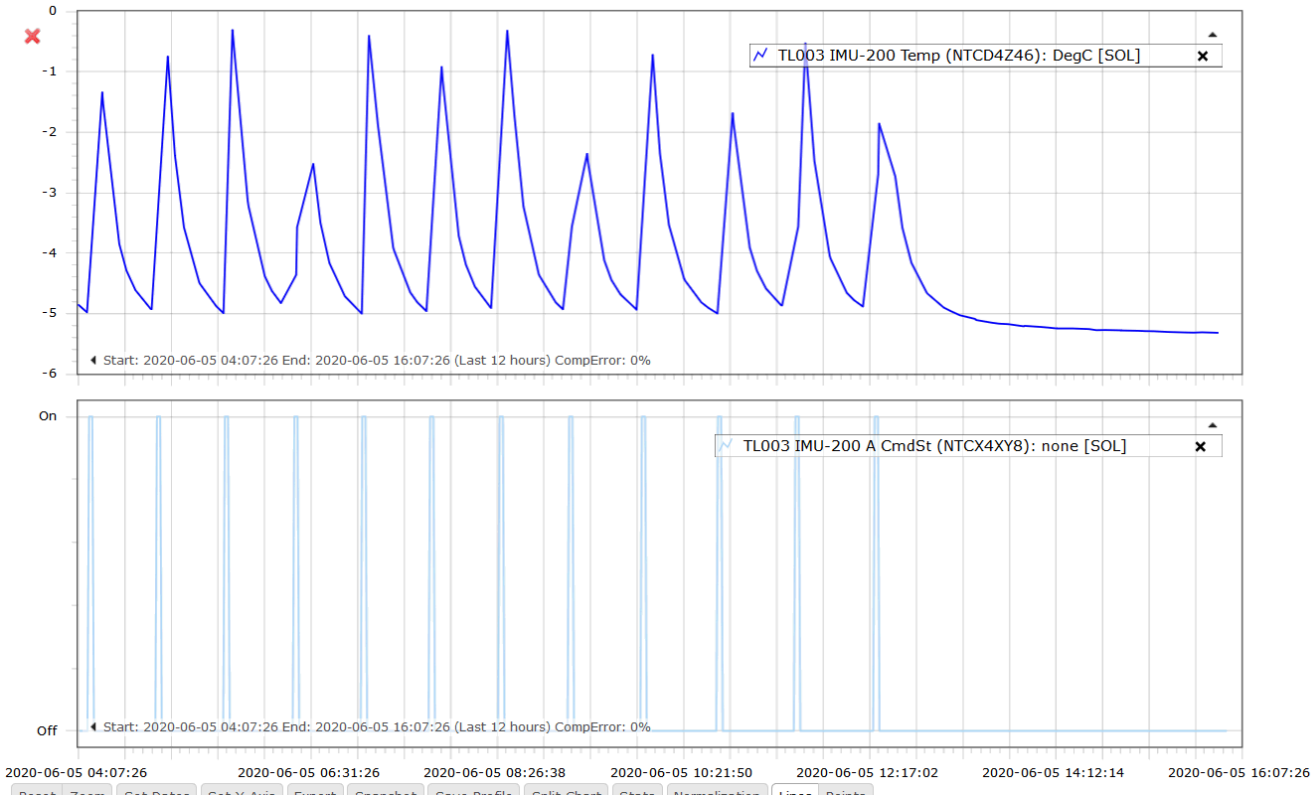
TL97 (MAG OBS) latest setting is a regulation (in RAM only) of -90 to -88 degC.

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.

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. This should solve the STIX issue. The set points may need further tuning (including FDIR update in the future), as a final solution.



TL3 IMU200 regulated temperature and heater activation.

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.

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.

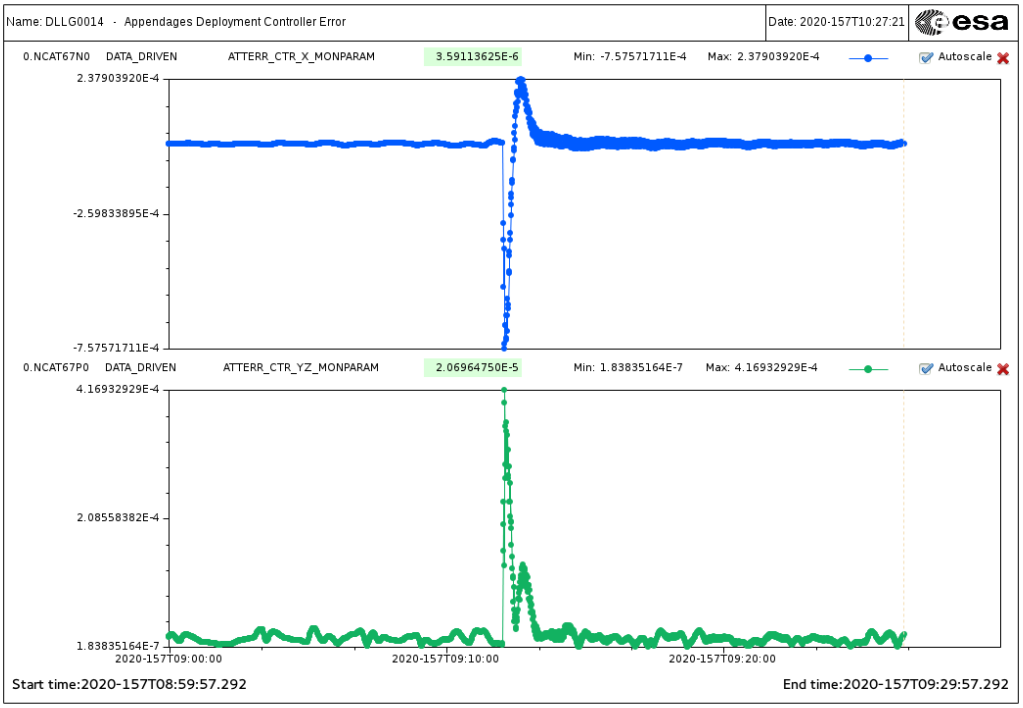
METIS
The full IT-6B2 Metis campaign was totally unsuccessful and will need repeating in cruise.

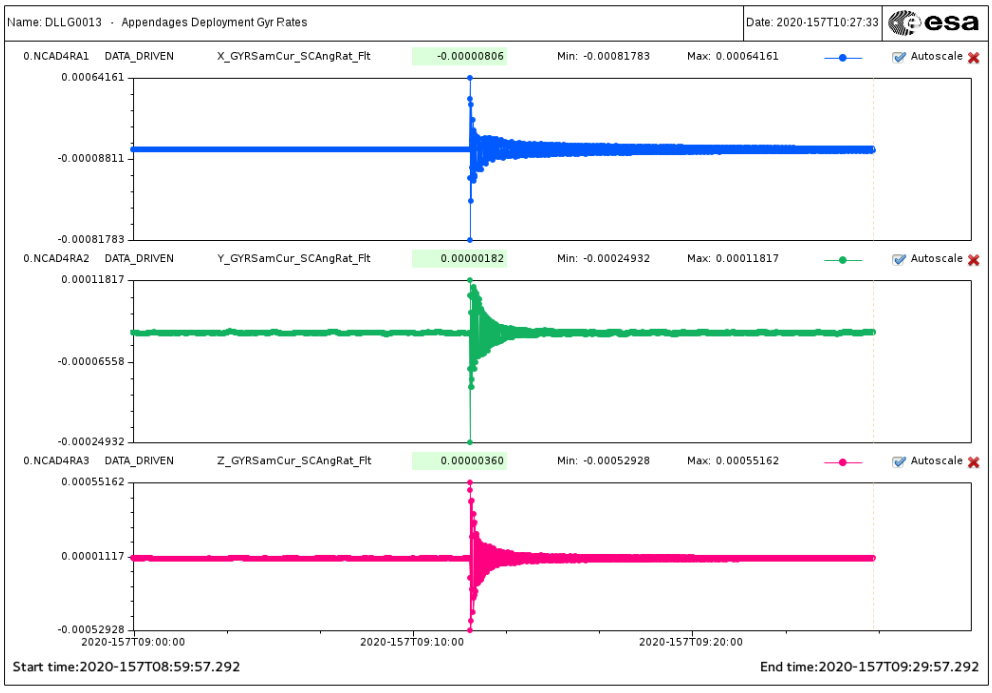
PHI
Nothing to report.

RPW
Nothing to report.

SWA
Following the PAS internal FDIR trigger last weekend (current limit during switch on with immediate switch off), all PAS activities have been removed from the MTL. PAS will remain off until the identified solution is in place (modification of switch on sequences).
AR Sol_SC-53 was raised.

SoloHi
SoloHI Door deployment was declared successful on 06/06.
ADS reported angular rate measurements at max [8.1e-4 2.5e-4 5.5e-4] rad/s, i.e. larger on X as expected and at the expected order of magnitude of 3e-4 rad/s. The time profile, with oscillations damping over several minutes is also as expected, confirming the shape of a one shot disturbance on the S/C . Control error mostly on X (7.5e-4 rad = 0.043 deg) as expected.


Name: DLLG0014 - Appendages Deployment Controller Error
Date: 2020-157T10:27:21
0.NCAT67N0 DATA_DRIVEN ATTERR_CTR_X_MONPARAM 3.59113625E-6 Min: -7.57571711E-4 Max: 2.37903920E-4 Autoscale
2.37903920E-4
-2.59833895E-4
-7.57571711E-4
0.NCAT67P0 DATA_DRIVEN ATTERR_CTR_YZ_MONPARAM 2.06964750E-5 Min: 1.83835164E-7 Max: 4.16932929E-4 Autoscale
4.16932929E-4
2.08558382E-4
1.83835164E-7
2020-157T09:00:00
2020-157T09:10:00
2020-157T09:20:00
Start time:2020-157T08:59:57.292
End time:2020-157T09:29:57.292


Name: DLLG0013 - Appendages Deployment Gyr Rates
Date: 2020-157T10:27:33
0.NCAD4RA1 DATA_DRIVEN X_GYRSamCur_SCAngRat_Flt -0.00000806 Min: -0.00081783 Max: 0.00064161 Autoscale
0.00064161
-0.00008811
-0.00081783
0.NCAD4RA2 DATA_DRIVEN Y_GYRSamCur_SCAngRat_Flt 0.00000182 Min: -0.00024932 Max: 0.00011817 Autoscale
0.00011817
-0.00006558
-0.00024932
0.NCAD4RA3 DATA_DRIVEN Z_GYRSamCur_SCAngRat_Flt 0.00000360 Min: -0.00052928 Max: 0.00055162 Autoscale
0.00055162
0.00001117
-0.00052928
2020-157T09:00:00
2020-157T09:10:00
2020-157T09:20:00
Start time:2020-157T08:59:57.292
End time:2020-157T09:29:57.292

SPICE
Despite the snow over MLG, SPICE activities from DOY 155 were successful with SPICE LUT updated on-board.

STIX
STIX aspect system disturbances is believed to be understood. See thermal section.

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)

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 on 30/05 is understood (AR SOL-350). The error (only at CEB station) is already known. It occurs during the station configuration when the X-band polariser moves. It is a design issue and transparent for the missions because it is reconfigured manually before the BOT. But it is the first time this happens when the polariser does not move (ie during pass). The issue will be further followed for reoccurrences.

Last hours of MLG on 03/06 were lost due to heavy snow. Downlink could not be stopped on time leading to SSMM data loss. MOC will look into implementing a protection to stop dumps in case of loss of lock during passes.

3.2 Control Centre

SolO MCS SW versionD3.15.10 is used on all operational machines since 05/05/2020.
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 3.15.14 was installed on devlan on 05/06 for FCT testing. A version 3.15.15 will be required to fully fix the DL FT. In the meantime patches 3.15.12 to 3.15.14 will be installed on opslan as addressing other urgent MCS fixes.
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

SOL_SC-53 [NECP] SWA PAS FDIR at Switch ON

Ground Segment

None

Non Conformance Reports

None

6 FUTURE MILESTONES

This is the timeline of future milestones:

Milestone	Date	Comment
Last PL NECP week 15 (STP 16)		
	DoY 160, 08/06/20	METIS IT-7, SOL-SGS-TN-0036 0.3+Rolls WOL
	DoY 161, 09/06/20	
	DoY 162 10/06/20	redirect APID 924 to PS 5 WOL
	DoY 163, 11/06/20	SWA-HIS table update ESOC public holiday
	DoY 164, 12/06/20	Time correlation test WOL ESOC public holiday
	DoY 165, 13/06/20	
	DoY 166, 14/06/20	IX-6 1Hz-TM for MAG end SA relubrication
Beyond		
LTP1 start on 15/06	DoY 167, 15/06/20	
LTP2 start on 29/06	DoY 181, 29/06/20	