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Solar Orbiter Mission Operations Report #4

Period [09 March 20 - 15 March 20]

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Reference	SOL-ESC-RP-10100
Issue/Revision	4.0
Date of Issue	16/03/2020
Status	Issued



APPROVAL

Title Solar Orbiter Mission Operations Report #4	
Issue Number 4	Revision Number 0
Author Sylvain Lodiot	Date 16/03/2020
Approved By	Date of Approval
Sylvain Lodiot, Solo SOM	

CHANGELOG

Reason for change	Issue Nr.	Revision Number	Date
Updated with reporting of new period of time	4	0	16/03/2020

CHANGE RECORD

Issue Number	Revision Number		
Reason for change	Date	Pages	Paragraph(s)
New issue	16/03/2020	All	all

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

Payload commissioning week 3 is complete.

The 0.95 AU Sun distance will be crossed on 16/03/2020.

Refer to the special events section for “ Corona virus” related topics.

DoY	Date	Activity
69	09/03/2020	<i>STP 3 start</i> SPICE interactive SWA interactive SPICE D-heater OP WOL 20:06 to 23:06
70	10/03/2020	SWA interactive EUI interactive Open HS door WOL 00:00 to 03:00
71	11/03/2020	SWA interactive WOL from 19:55 to 22:55
72	12/03/2020	SWA interactive METIS D-heater OFF
73	13/03/2020	METIS interactive METIS Open door and CAP release METIS D-heater ON Addition of a SWA interactive slot WOL from 19:49 to 22:49
74	14/03/2020	
75	15/03/2020	In-orbit thermal correlation

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 075, 15/03) Solar Orbiter was at:

- 15.2 million km from the Earth (0.1 AU); the one-way signal travel time was 0 min 51 sec (51 sec).
- 143 million km from the Sun (0.954 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 FAR since launch
 - 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).

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 a time-out of 3 days.

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

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.

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

Nothing to report.

EUI

Many error events from EUI were received on 12/03. These are explained and SY-CRP-000 is being updated accordingly.

MAG

Thermal investigations continue.

METIS

The METIS IT-3 activity completed successfully on 13/03. This included the opening of the METIS door and the ejection of the MCAP. Success of the METIS cap ejection was visible on SC rates.

PHI

Some PHI NECP activities are being replanned.

RPW

Investigations on issues reported in previous MORs continue.

SWA

All interactive activities were successfully executed.

In particular,

SWA DPU TFF patch applied successfully

SWA EAS Power-up completed successfully

SWA HIS HVPS completed successfully

SoloHi

Nothing to report.

SPICE

IC-SOU-20 and IC-SOU-30 activities were successfully executed.

STIX

Nothing to report. Not switched on yet.



3 GROUND FACILITIES

3.1 Ground Stations

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

3.2 Control Centre

Solo MCS SW version D3.15.9 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.



4 SPECIAL EVENTS

Following ESOC directives linked to the Coronavirus all staff have moved to tele-working unless their presence at ESOC is absolutely necessary for nominal operations.

No external visitors (e.g. PIs) are authorised on site.

Instrument interactive activities continue, with all instrument teams from remote. It is understood this is less efficient and means some activities may take longer. Nevertheless METIS activities have run in this way since a while now and were successful so it is possible.

Webcams are available, so our MCS screens can be streamed. The quality is not perfect, but this offers viable alternatives and has been used already too.

Various discussions and meetings have and will continue to take place with the teams with concerns or specific needs/questions.

Please ensure requests to MOC are limited in the next weeks, to limit the need for the team to go on site. This applies to all instrument commanding requests. Also ensure as far as possible that deliveries related to non-interactive activities are limited (once per week would be ideal) and please triple check them such that no other re-deliveries are needed (due for example to mistakes in initial inputs or incomplete inputs, which would mean having to go on site again).

These measures apply until further notice. Thank you for your understanding.

It is assumed some instrument teams may soon start having issues to operate. Please inform MOC accordingly. We'll then look at the issues on a case per case basis.



5 ANOMALIES

The following Anomaly Reports were raised in the reporting period:

Spacecraft

SOL_SC-34	[NECP] SPICE TM (1,x) SSC management does not work as required
SOL_SC-33	[NECP] SWA TM (1,x) SSC management does not work as required

Ground Segment

None

Non Conformance Reports

None

6 FUTURE MILESTONES

This is the timeline of future milestones:

Milestone	Date	Comment
Start of PL NECP week 4		For PL, only interactive activities are reported
	DoY 076, 16/03/20	Sun Distance Flag set to Near Sun WOL from 19:35 to 22:35 Sun distance < 0.95 AU
	DoY 077, 17/03/20	SWA interactive (HIS-ON)
	DoY 078, 18/03/20	SPICE SOU Interactive SWA interactive (HIS-ON) WOL from 19:27 to 22:27
	DoY 079, 19/03/20	PHI Interactive (Activity has changed wrt original plan) Flow decay OCM
	DoY 080, 20/03/20	SPICE interactive WOL from 21:32 to 21/03/2020 00:32
	DoY 081, 21/03/20	
	DoY 082, 22/03/20	CPS Purging
Beyond		
	DoY 088, 28/03/20	De-icing slew is cancelled. It was wrongly scheduled < 0.95 AU.
	DoY 091, 31/03/20	SA steering to 30 deg offset



7 ANNEX 1, ASSESSMENT OF OF/OT MANOEUVRES

Four OF/OT manoeuvres have been carried out. In summary: all worked as expected with no unusual occurrences. Further down a few details.

The OF/OT manoeuvres took place on:

- 1.) Monday 2020-02-24 at 08:30:00.107 UTC (CPS-B)
- 2.) Monday 2020-02-24 at 09:00:00.109 UTC (CPS-A)
- 3.) Sunday 2020-03-08 at 07:00:00.106 UTC (CPS-B)
- 4.) Sunday 2020-03-08 at 07:30:00.109 UTC (CPS-A)

From TM the first manoeuvre took 0.001 sec less than the predicted 7.5 sec, the other three were spot on.

The requirement was to use at least 0.8518 g of oxidiser per thruster per manoeuvre. This requirement was fulfilled with a minimum usage of at least 1.0 g per thruster per manoeuvre each time.

For all four manoeuvres the commanded delta-v in S/C frame was (0.0,0.0, 0.0) mm/s

The achieved delta-v in S/C frame by manoeuvre 1 was

{0.09080270375271487, -0.044242578662998, 0.045718565948339935} mm/s

The achieved delta-v in S/C frame by manoeuvre 2 was

{-0.02239572127107399, -0.050397458440120, -0.044936118051391394} mm/s

The achieved delta-v in S/C frame by manoeuvre 3 was

{0.07755406609428095, -0.0432055943646572, 0.033409562508788496} mm/s

The achieved delta-v in S/C frame by manoeuvre 4 was

{-0.02216660689875549, -0.0511023662959463, -0.045405196556494810} mm/s

This corresponds to errors of 0.111 mm/s, 0.071 mm/s, 0.095 mm/s and 0.072 mm/s in S/C frame respectively.

The analysis of the tracking data supports these findings. ORB reports inertial delta-v between 0.8 mm/s and a few mm/s for the first two manoeuvres. Their assessment of the last two manoeuvres has not been done yet.