Solar Orbiter Mission Operations Report #2

Period [24 February 20 - 01 March 20]

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APPROVAL

Title Solar Orbiter Mission Operations Report #2	
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CHANGE LOG

Reason for change	Issue Nr.	Revision Number	Date
Updated with reporting of new period of time	2	0	**02/03/2020**

CHANGE RECORD

Issue Number 2		Revision Number 0	
Reason for change	**Date**	**Pages**	**Paragraph(s)**
New issue	02/03/2020	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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Table of contents

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1 SUMMARY OF ACTIVITIES

Payload commissioning week 1 is complete.
Preparation for LTPs 1 and 2 has started. Ground station negotiation beyond 16 November 2020 for Venus flyby should complete soon.

DoY	Date	Activity
55	24/02/2020	***STP 1 start*** MAG interactive and non interactive RPW non interactive SPICE interactive and non interactive SPICE CMS interactive
56	25/02/2020	EUI interactive and non interactive PHI interactive RPW Rolls SSMM PS5 fixing
57	26/02/2020	SPICE interactive SPICE CMS interactive non interactive RPW Rolls
58	27/02/2020	METIS ineractive RPW Rolls MGA selected as safe mode antenna New TC init file in place
59	28/02/2020	EPD interactive and non interactive PHI interactive and non interactive SOLOHI interactive and non interactive RPW Rolls
60	29/02/2020	
61	01/03/2020	

At the end of the reporting period (DoY 061, 01/03) Solar Orbiter was at:

-   9.3 million km from the Earth (0.06 AU); the one-way signal travel time was 0 min 31 sec (31 sec).

-   146 million km from the Sun (0.98 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

TBC (being discussed with ADS) if STR defective pixels check is needed or not.

On 2020/02/19 between 05:11 and 09:11 UTC, 120 lost in space acquisition tests were performed with STR2. All were successful. Nevertheless two behaviors are further being investigated with ADS (first acquisition much faster than all others, times to enter AADP mode show a ramp).

On 2020/02/19 between 12:44 and 13:06 UTC, a full CCD FOTO dump of STR 2 was performed. All TM was successfully received and processed by FD.

The brightest pixel of the tracked stars are between 300 and 800 DU.

There is one triangular shaped object (artefact) around position x,y = 199,19 with the brightest pixel of 1332 DU. This is further being discussed with ADS. See picture below.
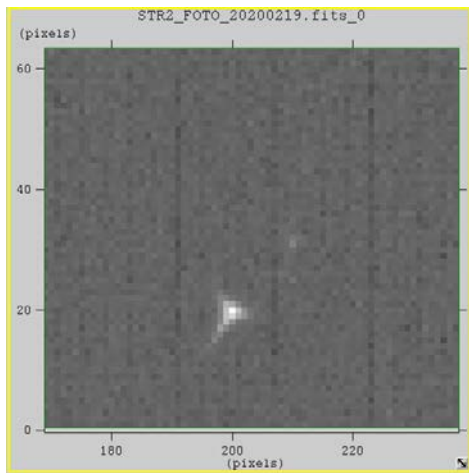
IMU B and STR B units were switched on for commissioning.

- o 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

- o AOCS Flags
  - Sun Distance set to FAR since launch
  - 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 @ 160.1 bar

2.1.2 *Mechanisms*

- o SADE
  - SADE A ON and IN-USE
  - SADE B OFF

- 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 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.

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2.1.4 *Thermal*

TL97 (MAG OBS) was regularly updated and is being fine-tuned. Latest setting is a regulation (in RAM only) of -90 to -88 degC.

Thermal configuration was updated from non op to op ranges for some instruments (decontamination heaters were not touched). This was performed at the end of the previous reporting period.

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.

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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. Low level thresholds (ex TH1_increase will need to be further fine-tuned as 12h setting is not adequate).

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.

Low latency SSMM packet store (PS5) was generating garbage as reported in SOL_SC-25. On DoY 057, 26/02/2020, PS5 was deleted and re-created, an SSMM FAT backup performed and storage re-enabled in SSMM PS-5. SSMM downlink was resumed on all PS, incl. SSMM PS5 (low latency data). The observed issue was due to a warm restart (post safe mode 3). Upon that warm-restart (on the old SSMM SW 02.06.00), the read pointer was placed after the write pointer and read uninitialized memory. The issue is solved in ASW 02.07.00 so should not occur again. Data in PS5 has been lost and PI teams informed accordingly.

New OMM routing had been applied as per end of previous reporting period in order to work around the OMM dump issues we have. This new routing was not working for diagnostic data. The issue is now understood, proper routing for diagnostics is in place, and the missed diagnostic data has been recovered from the diagnostic packet store. The SW behaviour will be documented via updates to FOP procedures.

TC latest TC init file provided by ADS was uplinked on 27/02 (DoY 059). This should solve the thermal issues and PCDU reconfigurations in case of further safe mode.

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)

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2.2   Instruments

EPD
First interactive activities successfully took place on 28/02 (ID 1 and 2).

EUI
First interactive activities successfully took place on 25/02.
There is on-going SY-CRP-000 work.

MAG
First and only interactive activity successfully took place on 24/02. MAG is behaving fully nominally and is configured for burst mode.
Thermal line 97 set points have been tuned multiple times. This is in relation to the MAG heaters which generate a significant, messy signal in MAG data which will be a problem for science. MAG team believes that these are thermoelectric currents, which are always unpredictable.

METIS
First interactive activities successfully took place on 27/02.

PHI
PHI SW upload (34K TCs) is complete.
PHI interactive activities continued on 28/02.

RPW
RPW is fully non interactive. STP PDORs are received on a weekly basis.
RPW is behaving overall nominally.
[DAS buffer overflow] as well as [Error during compression process.] events are being investigated by the team. The DAS events may be of concern.
Calibration roll data is being analyzed.
Strong interferences (80kHz and 120kHz) have been observed. These may impact science. Investigations continue.

SWA
Nothing to report. Not switched on yet.

SoloHi
Day 1 activities (28/02/2020) included running an SFT as well as a short heater command test. All activities were conducted successfully.

SPICE
SPICE switch on occurred on 24/02. Interaction with S20 is not fully understood yet (same behavior as SVT 1A and AR 255) and needs further investigation.

Activities on 26/02 (Bake-out test of the 2 CMS sensors and heater activity on the primary morrow) were successful.

STIX
Nothing to report. Not switched on yet.

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3 GROUND FACILITIES

3.1 Ground Stations

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

PN ranging is being commissioned and should soon replace standard ranging.

3.2 Control Centre

SolO MCS SW versionD3.15.9 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

MATIS (our automation tool) is used since 14/02 (DoY 045) to manage all links to the ground stations. It will shortly also further relieve the SPACONs by performing the default start of contact commanding.

MCS issues with the uplink of the huge number of commands are further being investigated.

MCS issues related to the OOL management on the off line datastream are further being investigated.

Gaps in data are further being investigated.

SOL-AR 348 has been raised.

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4 SPECIAL EVENTS

Charlie's last day in the FCT was on Friday… Thanks for all Charlie, and good luck for your future challenges! Bon vent !

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5 ANOMALIES

The following Anomaly Reports were raised in the reporting period:

Spacecraft

SOL_SC-28   [NECP] Unknown packet during dump of OMM PS REPORTS
SOL_SC-27   [NECP] Prime and Redundant TC_Rate are inverted
SOL_SC-26   [NECP] STR Reconfiguration during De-icing
SOL_SC-25   [NECP] SSMM generates garbage after warm restart on PS5
SOL_SC-24   [LEOP] PCDU Snapshot during Priming and Pressurisation
SOL_SC-23   [NECP] Contents of HPTM DS0W12 in HK corrupted for one sample

Ground Segment
SOL_348   [NECP] Gaps in data and unresponsiveness of ground processing tools

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 2		
	DoY 062, 02/03/20	EPD interactive and non EUI interactive and non PHI interactive and non
	DoY 063, 03/03/20	EUI interactive and non PHI interactive and non SoloHI interactive and non
	DoY 064, 03/03/20	EUI interactive and non SWA interactive
	DoY 065, 05/03/20	EUI interactive and non SoloHI interactive and non SPICE interactive and non
	DoY 066, 06/03/20	Metis interactive

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7 ANNEXES

7.1 Solo: FD assessment of test OCM (type-1)

On Friday 2020-02-14 the type-1 test OCM was carried out at 12:09:13.271 UTC.

From TM we see that the duration was 0.307 sec longer than predicted.

The commanded delta-v in inertial frame was   (-0.0390287, -0.287261, 0.0771908) m/s.
The achieved delta-v in inertial frame was   (-0.0377037, -0.287332, 0.0778807) m/s.
This corresponds to an underperformance of -0.00149554 m/s, which is -0.50% of the commanded delta-V magnitude and a deviation from the ideal direction by 0.285 deg.

The analysis of the tracking data supports these findings.
- Less than 1 sec error in duration.
- Less than 1% error in delta-v magnitude along the line of sight.

7.2 Solo: FD assessment of test OCM (type-2)

On Friday 2020-02-21 the type-2 test OCM was carried out at 07:00:14.068 UTC.

From TM we see that the duration was 0.307 sec longer than predicted. (Same as for type-1 test OCM).

The commanded delta-v in inertial frame was   (-0.0902296, 0.138492, 0.250369) m/s.
The achieved delta-v in inertial frame was   (-0.0899543, 0.138338, 0.249747) m/s.

This corresponds to an underperformance of -0.0006974 m/s, which is -0.23% of the commanded delta-V magnitude and a deviation from the ideal direction by 0.035 deg.

Since this maneuverer happened outside a pass, there is no estimate of the duration of the OCM from tracking data.

The tracking data nevertheless supports the above results in the sense that from it the error in delta-v magnitude along the line of sight is estimated to be between -1% and + 2%.

Future passes will help to narrow this number down, however, not very fast.

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