RPW Operation Centre

ROC Concept and Implementation Requirements Document

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1	3	20/12/2016	Yvonne de Conchy	Third release

Acronym List

Acronym	Definition
AIT	Assembly Integration Test
AIV	Assembly Integration Validation
ANT	(Electrical) antennas
CDPP	Centre de Physique des Plasmas
CIRD	Concept and Implementation Requirements Document
CNES	Centre National d'Etudes Spatiales
CoI	Co Investigator
CP	Cruise Phase
DPU	Digital Processing Unit
EDDS	EGOS Data Dissemination System
EMP	Extended Mission Phase
ESA	European Space Agency
ESAC	European Space Astronomy Centre
ESOC	European Space Operation Centre
FDIR	Failure Detection Isolation and Recovery
FOP	Flight Operation Plan
GIGL	Groupe d'Informatique Générale du LESIA
HK	Housekeeping parameters
IOR	Instrument Operation Request
IT	Instrument Team
IOP	Instrument Operation Planner
LEOP	Launch & Early Operations Phase
LESIA	Laboratoire d'Etudes Spatiales et d'Instrumentations en Astrophysiques
LLVM	Low Latency Virtual Machine
PMP	Project Management Plan
NECP	Near Earth Commissioning Phase
NMP	Nominal Mission Phase
OS	Operating System
PI	Principal Investigator
RFP	RPW Flight Procedure
RGS	RPW Ground Segment
ROC	RPW Operation Centre
RPW	Radio and Plasma Waves
RSS	ROC Software System
SDP	Software Development Plan
S/C	Spacecraft
S/W	Software
SBM	Selective Burst Mode
SGSE	Software Ground Support Equipment

SIRD	Solar Orbiter Science Implementation Requirements Document
SMOC	Solar Orbiter Mission Operation Centre
SOOP	Solar Orbiter Operation Plan
SOV	System Operation Validation
SSMM	Solid State Mass Memory
SSOC	Solar Obriter Science Operation Centre
SVT	System Validation Tests
TC	Telecommand
TM	Telemetry
VM	Virtual Machine

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1 GENERAL

1.1 Scope of the Document

The RPW Operation Centre (ROC) is in charge of the ground segment activities for the Radio and Plasma Waves (RPW) instrument [RD1] on-board Solar Orbiter spacecraft (S/C).

The ROC Concept and Implementation Requirements Document (CIRD) presents the ROC objectives and general organization, especially it defines the responsibilities of the key personnel involved in the ROC project.

It also addresses the top-level requirements relative to the ROC implementation. It encompasses all of the tasks assigned to the ROC concerning the preparation and application of the RPW ground segment science and operation activities.

CIRD shall comply the requirements defined at the Solar Orbiter level, namely: the Solar Orbiter Science Management Plan (SMP) [AD1], the Solar Orbiter Science Implementation Requirements Document (SIRD) [AD2] and the Experiment Interface Document Part A (EID-A) [AD3].

1.2 Applicable Documents

This document responds to the requirements of the documents listed in the following table:

Mark	Reference/Iss/Rev	Title of the document	Authors	Date
AD1	SOL-EST-PL-00880/02/02	Solar Orbiter Science Management Plan	Richard Marsden	16/02/2012
AD2	Solar_Orbiter_SIRD_v1.2_DM_2013-03-18	Solar Orbiter Science Implementation Requirements Documents(SIRD)	Daniel Müller	18/03/2013
AD3	SOL.EST.RCD.0050/05/00	Experiment Interface Document Part A (EID-A)	Erik de Witt	16/03/2015
AD4	SOLO-RPWSY-PT-1235-CNES/1/0	RPW Instrument Calibration Plan	Milan Maksimovic RPW teams	11/12/2015
AD5	RPW-GEN-PLN-00130-LES/02/00	RPW Operations Concept	Milan Maksimovic	08/03/2012
AD6	RPW-SYS-SRD-00040-LES/02/01	RPW Science Requirements	Milan Maksimovic	16/06/2015
AD7	RPW-SYS-SOW-001518-LES/01/01	RPW Science Performance	Milan Maksimovic	12/06/2015

1.3 Reference Documents

This document is based on the documents listed in the following table:

Mark	Reference/Iss/Rev	Title of the document	Authors	Date
RD1	SOLO-RPWSY-IF-55-CNES_0401.pdf/05/02 (=EID-B)	Experiment Interface Document Part B (EID-B) for RPW	RPW Team	29/07/2015
RD2	RPW-SYS-SSS-00013-LES/03/05	RPW Software System Specification	Philippe Plasson	03/06/2015
RD3	SOL-ESC-PL-00001/1/1	Solar Orbiter Mission Implementation Plan	Ignacio Tanco	31/01/2013

RD4	SOL-ESC-IF-05011/1/0	Solar Orbiter Data Delivery Interface Control Document	Luca Michienzi	10/09/2013
RD5	SOL-SGS-ICD-0003/0/2	Solar Orbiter Instrument Operation Request Interface Control Document	Christopher Watson	19/08/2014
RD6	SOL-SGS-TN-0009/2/2	Metadata Definition for Solar Orbiter Science Data	A. de Groof	23/07/2015
RD7				

1.4 About this document

1.4.1 Access policy

This document is accessible without any restriction.

Any modification of the CIRD requires formal approval of the RPW Ground Segment Project Manager before publication.

2 RPW SCIENCE OBJECTIVES

RPW will make key measurements in support of the first three, out of four top-level scientific questions, which drive Solar Orbiter overall science objectives:

- How and where do the solar wind plasma and magnetic field originate in the corona?
- How do solar transients drive heliospheric variability?
- How do solar eruptions produce energetic particle radiation that fills the heliosphere?
- How does the solar dynamo work and drive connections between the Sun and the heliosphere?

Here is the summary of the specific RPW Science Objectives.

Solar & Interplanetary Radio Burst

- What is the role of shocks and flares in accelerating particles near the Sun?
- How is the Sun connected magnetically to the interplanetary medium?
- What are the sources and the global dynamics of eruptive events?
- What is the role of ambient medium conditions on particle acceleration and propagation?
- How do variations and structure in the solar wind affect low frequency radio wave propagation?

Electron density & temperature measurements with the Quasi-Thermal Noise spectroscopy

- Precise measurement of both the electron density and temperature, with accuracies respectively of a few % and around 10 %, at perihelion.
- Study the non-thermal character of the electron distributions at perihelion.

Radio emission processes from electron beams: Langmuir waves and electromagnetic mode conversion

- Measurements for the first time in the Solar Wind of both the electric and magnetic field waveforms at high time resolution (up to 500 kSs).
- Study of the mode conversion from Langmuir to electromagnetic waves.
- Study of the energy balance between electron beams, Langmuir waves and e.m. radio waves at several radial distances

Solar wind microphysics and turbulence

- Measure of the waves associated with the plasma instabilities that are generated by temperature anisotropies in the solar wind.
- First DC/LF electric field measurements in the inner heliosphere and over a large radial distance in the solar.

Shocks, Reconnection, Current Sheets, and Magnetic Holes

- Identification & study of the reconnection process in current sheets with thickness down to the ion scales and smaller.
- Determination of the interplanetary shock structure down to the spatial and temporal scales comparable and smaller than the typical ion scales.
- Determination of different particle energisation mechanisms within shocks and reconnection regions.
- Distinguish different radio burst generation mechanisms.

Interplanetary Dust

- Determination, in combination with the EPD instrument, the spatial distribution, mass and dynamics of dust particles in the near-Sun heliosphere, in and out of the ecliptic.

To cover its specific Science Objectives, RPW will measure magnetic and electric fields at high time resolution using a number of sensors, to determine the characteristics of electromagnetic and electrostatic waves in the solar wind. More precisely, RPW will:

- Make the first-ever high accuracy, high-sensitivity and low noise measurements of electric fields at low frequencies (below ~1 kHz) in the inner Heliosphere.
- Measure the magnetic and electric fields of the solar wind turbulence with high sensitivity and dynamic range along the spacecraft trajectory.
- Store high-resolution data from scientifically interesting regions such as in-situ shock crossings, in-situ Type III events and others.
- Measure the satellite potential with high temporal resolution permitting to estimate the density fluctuations in the solar wind and allowing higher accuracy particle instrument measurements.
- Measure the quasi thermal noise and Langmuir waves around the local plasma frequency
- Measure for the first type the high frequency magnetic counterpart of Langmuir waves associated with in-situ Type III bursts
- Observe the solar and interplanetary radio burst
- Observe the radio counterpart of dust particle impacts
- Detect on-board in-situ shock crossings and store the corresponding data

- Detect on-board in-situ Type III events and store the corresponding data

3 RPW INSTRUMENT

RPW will provide *in situ* and remote sensing measurements of both electrostatic and electromagnetic fields and waves in a broad frequency range, typically from a fraction of Hertz to a few tens of MHz.

RPW is developed by a consortium composed of the following institutes/agencies:

- LESIA, Observatoire de Paris, CNRS, UPMC, Université Paris Diderot, Meudon, France
- CNES, Centre Spatial de Toulouse, France
- LPP, CNRS, Ecole Polytechnique, UPMC, Université Paris Sud, Palaiseau, France
- LPC2E, CNRS, Université d'Orléans, Orléans, France
- IAP (Institute of Atmospheric Physics), Academy of Sciences, Prague, Czech Republic
- Astronomical Institute (AsI) of the CSRC, Prague, Czech Republic
- IRF (Swedish Institute of Space Physics, Uppsala) and KTH (Royal Institute of Technology, Stockholm) Sweden
- Space Research Institute (IWF), Gräz, Austria
- Space Sciences Laboratory (SSL) of the University of California Berkeley

In addition, the SSL is strongly contributing to the RPW science through the science synergy with the FIELDS instrument on the NASA Solar Probe Plus mission.

Table 1 presents the instrument sub-systems.

Name	Short name	Description	Responsible
Time Domain Sampler	TDS	TDS captures waveform up to 500 kSPS. LFR redundancy module	IAP
Thermal Noise and High Frequency Receivers	TNR-HFR	Electron measurements at the local plasma frequency and remote detection of radio emissions. TNR-HFR will provide electric power spectral densities from 4 kHz up to 16 MHz and magnetic power spectral densities from 10 kHz up to 500 kHz.	LESIA
Low Frequency Receiver	LFR	LFR covering both in-situ electric and magnetic measurements from DC to about	LPP

		10 kHz. LFR will provide both waveform and power spectral densities in this frequency range.	
Biasing unit	BIAS	BIAS will allow DC electric measurements. The BIAS drive a constant current to the electric antennas allowing reliable DC/LF electric field and satellite potential measurements.	IRF/KTH
Digital Process Unit	DPU	DPU will handle commands, data and communication with S/C.	LESIA, IWF
Low Voltage Power Supply - Power Distribution Unit	LVPS-PDU	Since the LVPS unit produces the secondary voltages, the PDU distributes the output voltages toward the various RPW subunits.	AsI
Search Coil Magnetometer	SCM	The SCM is an inductive magnetic sensor. It is made of a core in a high permeability material (ferrite or perm-alloy) on which are wound a main coil with several thousand turns and a secondary coil with a few turns.	LPC2E
Electrical antennas, Pre-Amplifiers	ANT, PA	Each ANT monopole serves as a simple voltage sensor. At low frequencies, an antenna is coupled to the local plasma potential through a photoelectron sheath. Successful measurement of DC/low frequency plasma electric fields requires that the antenna be biased (as described below). At sufficiently high (radio) frequencies, an antenna behaves as if in a vacuum. Each monopole is connected to the inputs of both: A low frequency and high frequency preamplifiers.	CNES, SSL

Table 1. RPW sub-systems.

4 RPW OPERATION CENTRE (ROC) CONCEPT

4.1 General

The ROC is in charge of the RPW ground segment (RGS) activities. It ensures the two functions of operation and data centres for the RPW instrument.

The ROC is located at the "Laboratoire d'Etudes Spatiales et d'Instrumentation en Astrophysique" (LESIA) at Meudon (France), which is the RPW PI-ship laboratory.

The centre is under the responsibility of the RPW Principal Investigator (PI) and the RPW Ground Segment Project Manager.

4.2 Main Objectives

According to the science and operation requirements at Solar Orbiter and RPW levels [AD1, AD2, AD3, AD6, AD7], the ROC main objectives are to:

- Support the definition of the science operations.
- Provide inputs for the definition and implementation of the science operation planning, data handling and archiving concepts.
- Supervise the preparation of the instrument operation timelines
- Support the definition and implementation of the Solar Orbiter scientific data archive, as part of the pre-launch tasks.
- Agree on a long-term science activity plan and define the scientific priorities of scientific goals.
- Monitor and analyze instrument behaviour
- Optimize instrument performances and science data return
- Deliver calibrated and high level processing data, including relevant calibration products, to the Solar Orbiter scientific archive.
- Provide to ESA unlimited access to all processed and analysed data for public relation purposes during the 3-months proprietary period.
- Provide summaries of the main scientific results at regular intervals
- Maintain the instrument flight software

Most of the ROC tasks are carried out in close collaboration with the other parties who have delegated responsibilities for the ground segment and operations.

In the framework of the RPW EM and PFM ground calibration campaigns, the ROC shall also develop, deliver and maintain a SGSE dedicated to post-mortem analysis of data [AD4]. The so-called ROC SGSE shall support calibration validation, but also be a milestone in the development of ROC infrastructure for in-flight RPW data processing as well as monitoring.

4.3 Involved Institutes

The institutes involved in the RGS are given in the following table.

Institute	Function
CNES	- RPW project manager (until the end of commissioning phase only)
ESAC	- Solar Orbiter Science Operation Centre (SSOC)
ESOC	- Solar Orbiter Mission Operation Centre (SMOC)
IAP	- TDS Lead CoI-ship laboratory
IRF-U	- Bias Lead CoI-ship laboratory

IWF	- Antennas calibrations (rheometry)
LESIA	- RPW PI-ship laboratory - ROC host - RPW MEB / PA manager - DPU & Flight S/W manager - TNR-HFR Lead CoI-ship laboratory - In-flight effective antennas calibration
LPC2E	- SCM Lead CoI-ship laboratory
LPP	- LFR Lead CoI-ship laboratory

Table 2. Institutes involved in the RPW Ground Segment.

4.4 Key personnel and teams

Figure below presents the organization of the key personnel and teams involved in the ROC and RGS. The names in bold correspond to the entities that have an effective and continuous participation to the ROC activities. Other entities are in support for specific phases of the mission and/or are involved in the anomaly isolation and recovery procedures.

The responsibilities of the ROC key personnel are given in the section 7.

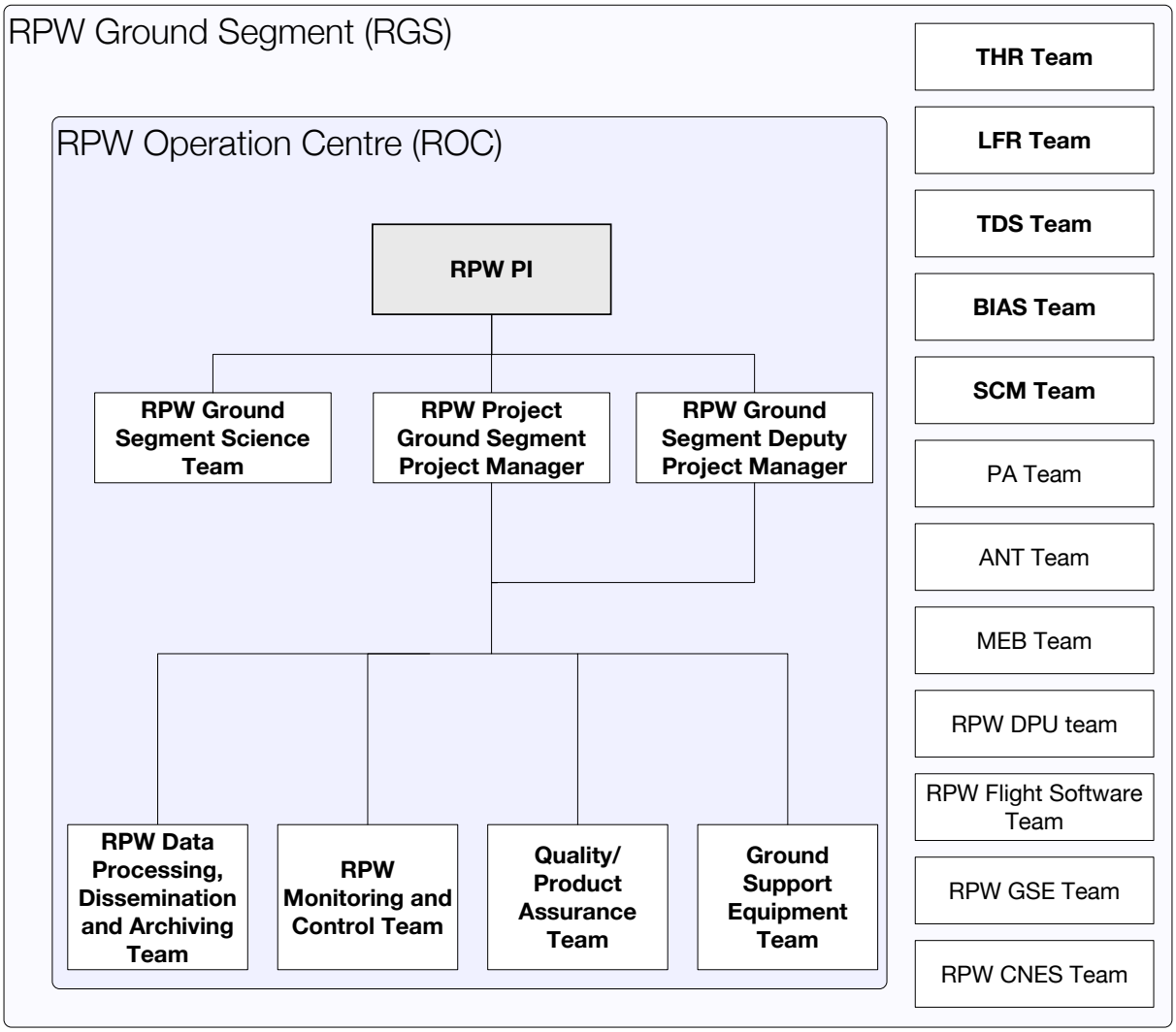

Figure 1. ROC key personnel and teams.

5 ROC SCIENCE AND OPERATIONS ACTIVITIES IMPLEMENTATION REQUIREMENTS

5.1 ROC general science activities implementation requirements

The ROC shall support the following science activities:

- Preparing and updating the RPW science activity plan and the resulting operations planning in accordance with the Solar Orbiter mission science and operations plans.
- Producing RPW science data compliant with the data formats defined in [RD6].
- Ensuring the validation and the quality assessment of the RPW science data products.
- Providing full access to the RPW science data products to the RPW Consortium and the SSOC.
- Delivering the required RPW science data products at the ESAC data archive and the Centre de Données de Physique des Plasmas (CDPP).
- Ensuring the long-term storage of the RPW science data products archived at the LESIA.
- Ensuring that the documentation related to the science activities at the ROC is up-to-date and available.

5.2 ROC general operations activities implementation requirements

As soon as the on-board RPW instrument is swichted-on, the ROC shall ensure the sustainability of the following routine operations activities at the LESIA:

- Monitoring the instrument health and performance.
- Optimizing the instrument performances and science data returns.
- In agreement with the mission operation planning and constraints at the Solar Orbiter level:
    - Preparing and commanding the RPW flight operating modes
    - Controlling the RPW on-board data storage and power consumption
    - Controlling the RPW TM/TC data rate.
- Maintaining the on-board DPU software
- Controling the on-board BIAS current
- Managing the SBM event data selection and downlink
- Monitoring the instrument science and engineering data validatity and consistency
- Providing full access to its instrument science and engineering data archive to the RPW Consortium and the SSOC/SMOC.
- Being the main interlocutor with the SSOC/SMOC in case of non-routine procedures (e.g., anomalies, flight software updates).
- Supervizing the instrument anomaly activities at the instrument level.
- Ensuring that the documentation related to the RPW instrument operations activities at the ROC is up-to-date and available.

5.3 Specific science and operations activities implementation requirements related to the Solar Orbiter mission timeline

Figure 2 indicates the timeline of the different phases of the Solar Orbiter mission and the corresponding operations planned after the launch.

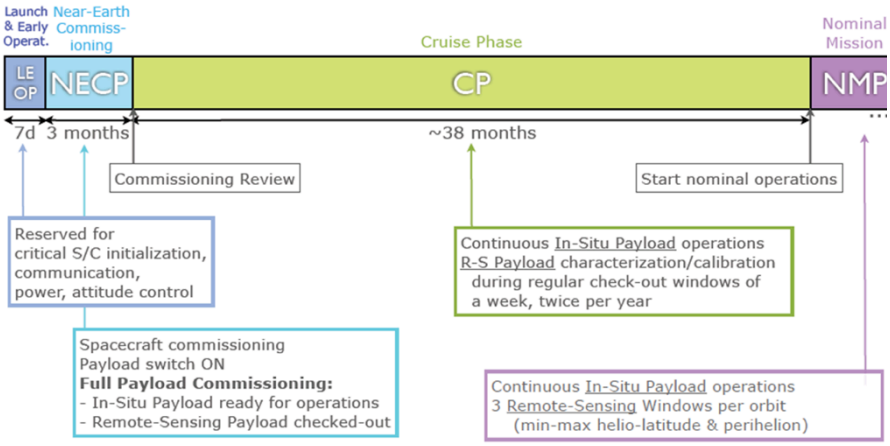

Figure 2. Solar Orbiter operation phases timeline

The RPW Ground Segment Project Manager and PI shall define a specific RPW operation planning in agreement with this mission timeline.

5.3.1 ROC specific activities implementation requirements before the launch

Before the launch, the ROC shall:

- Develop, test, validate and deliver to the CNES and LESIA AIT/AIV teams a SGSE in support to the RPW ground calibration validations. The ROC shall also ensure the maintenance and the possible upgrades of this SGSE.
- Develop, test, validate, deliver and run software tools to support the RPW flight software team in the validation of the SBM1/SBM2 detection algorithms. The ROC shall also ensure the maintenance and possible upgrades of these tools after the launch.
- Support the definition of data formats for the science products (contributor in the Modeling and Data Analysis Working Group for Solar Orbiter)
- Define, prepare and validate the RPW science and operations data products.
- Define, prepare and validate the RPW operation planning concept for the different phases of the mission. This task shall be done in agreement with the Solar Orbiter mission planning.
- Prepare the RPW commissing and cruise phase activities and dedicated support software and data, including dedicated RPW flight procedures (RFP).
- Specify, design, develop, test, validate, deliver and run facilities related to the RPW operation planning, the instrument monitoring and commanding, and the data processing. These tools shall be fully operationnal at the launch. The maintenance and the possible upgrades are under the responsibility of the ROC.
- Design, develop, test, validate and deliver to the SSOC, a Low Latency Virtual Machine (LLVM) for RPW, according to the SSOC delivery planning.
- Participate to the writing of the RPW user manual to be delivered by the CNES to the SMOC before the launch.
- Participate to the System Validation Tests (SVT) and System Operation Validation (SOV) campaigns at the SMOC/SSOC levels.
- Participate to the Low latency test schedule of the SSOC.

- Retrieve, implement and run the RPW subsystems calibration software that will be developed in the Lead CoI institutes. It concerns more specifically the following sub-systems:
  - ANT Estimation of Leff in BF (SPIS simulation,E=-VXB), estimation of Leff in HF (CNES& Austrian simulations, use of Rolls)
  - SCM Transfer functions & calibrations, merging with MAG data
  - LFR Transfer functions & calibrations
  - BIAS Determination of BIAS current depending on R
  - TDS Transfer functions & calibrations
  - TNR-HFR Transfer functions & calibrations

5.3.2 ROC specific activities implementation requirements during the Launch and Early Operation Phase (LEOP)

No activity is planned by the ROC during the Launch and Early Operation Phase (LEOP) since RPW is switched-off.

5.3.3 ROC specific activities implementation requirement during the Near Earth Commissioning Phase (NECP)

The RPW instrument will be switched-on during the Near-Earth Commissioning Phase (NECP), which will begin seven days after the launch.

The following operations shall be realized during this phase by the SMOC, with the ROC and CNES support [AD4, AD5]:

- RPW switching-on
- ANT deployment
- SCM boom deployment
- Interference campaign

For each of these critical operations, the ROC team with the support of the CNES and the SMOC shall:

- Prepare and deliver specific RFP to be run.
- Define an exhaustive list of instrument key-parameters to be monitored.
- Plan the procedures to be applied in case of instrument operation failures.
- Ensure that all of the engineering and human support resources are fully validated and trained respectively.
- Ensure that all of the engineering and human support resources are fully operationnal and available respectively.

The end of this phase shall lead to the writing of a specific RPW NECP operations report document.

5.3.4 ROC specific activities implementation requirements during the Cruise Phase (CP)

During the Cruise Phase (CP), the ROC shall perform the following specific tasks:

- Evaluating, validating and optimizing the RPW on-board data storage, power consumption and TM/TC data rate. This task will be done in collaboration with the

SSOC team, which in charge of providing to Instrument Team (IT) periodic information about available data rates (e.g, "corridor" data).
- Evaluating, validating and optimizing the instrument scientific return
- Evaluating, validating and optimizing the on-board SBM1/SBM2 detection algorithms and the SBM1/SBM2 events data downlink management
- Evaluating, validating and optimizing the BIAS current calibration
- Participating to the ANT calibration rolls and to the analysis of the resulting data. The roll campaigns shall lead to the delivery of direction and length parameters of the flight effective ANT vectors.

5.3.5 ROC activities implementation requirements during the Nominal Mission Phase (NMP)

During the Nominal Mission Phase (NMP) and the Extended Mission Phase (EMP), the ROC team shall ensure the standard operations as defined in the sections 5.1 and 5.2.

In addition, scientific cooperation with other mission teams (e.g. FIELDS/Solar Probe Plus) needs to be reinforced.

5.3.6 ROC activities implementation requirement during the Post-Operation Phase

At the end of the mission, the ROC shall:
- Finalize the science data processing and archiving for all of the mission phases.
- Maintain the data access interface for ESAC, CDPP and RPW Consortium users and provide a helpdesk to support solving problems related to (a) the usage of the data retrieval system and (b) retrieving actual data.

6 ROC SOFTWARE SYSTEM CAPABILITIES IMPLEMENTATION REQUIREMENTS

The ROC Software System (RSS) definition encompasses all of the software sub-systems and equipement that the ROC must host and use to perform the ground segment activities.

6.1 General capabilities implementation requirements

In agreement with the ROC science and operation activities requirements, the RSS shall supply the following main functionalities:
- Prompt visualization of the RPW vital parameters for instrument performance monitoring
- High control of the RPW flight operating mode preparation in order to manage: (i) the on-board data storage. (ii) The BIAS current. (iii) The power consumption. (iv) The TM/TC data rate, which shall be compatible with the TM corridors (TMC) and SMOC pass planning respectively.
- RPW operation planning
- RPW operation requests preparation and validation
- RPW science data processing, calibration and validation
- RPW science data dissemination and archiving
- RPW low latency data management
- Visualization and analysis of the RPW data produced during the ground calibration campaigns at system level

All of these tasks shall be as much as possible automated and easily monitored using dedicated interfaces and watchdog systems.

6.2 Data processing specific capabilities implementation requirements

The RSS shall supply the following specific functionalities about the RPW data processing:

- Promptly requesting, retrieving and processing RPW TM packet data as provided by the SSOC/SMOC during all phases of the mission
- Promptly requesting, retrieving and processing Solar Orbiter ancillary data and quicklook (e.g., orbit/attitude SPICE kernels) as provided by the SSOCS/SMOC during the whole mission
- Producing, evaluating the quality and validating the RPW calibrated science data and higher levels products of scientific interests.
- ROC data processing facilities shall ensure reception and translation of quicklook and auxiliary data from SSOC.
- ROC data processing facilities shall ensure engineering and HK product control tool.
- Delivery of all RPW data products to SSOC within 3 months.
- ROC data processing facilities shall support minimal human intervention
- ROC data processing facilities shall ensure processing time
- ROC data processing facilities shall support science data quality assessment
- ROC data processing facilities shall support science data validation
- ROC data processing facilities shall support data traceability and annotation ability
- Calibration product access
- Calibration product viewer
- Engineering and HK product access
- Engineering and HK product viewer
- Display status of data production flow at ROC
- ROC data processing facilities shall ensure access to science models

6.3 Instrument monitoring specific capabilities implementation requirements

The RSS shall supply the following specific RPW instrument monitoring functionalities:

- Monitoring the RPW performance during all phases of the mission.
- Displaying ROC system status
- Controlling the RPW on-board data storage and power, as well as the TM/TC data rates.
- Managing the SBM selection and downlink.
- Optimizing the SBM detection rates by assessing the on-board algorithm parameters.
- Controlling the BIAS current to be applied on-board.
- Displaying instrument status timeline
- Fully operational interfaces and logistics with the SMOC/SSOC/CNES/RPW teams in case of RPW failure/anomalie detection.

6.4 Instrument commanding specific capabilities implementation requirements

The ROC shall supply the following specific RPW instrument commanding functionalities:

- Logistical support for preparing the RPW operation planning

- Instrument operation tools, which shall contain the following features:
  - Tool and interface to view and plan the instrument operations
  - Specific tool and notebook for the commissioning planner
  - Tool for approval or rejection of the operation planning
  - Instrument operation simulator to test and validate the Instrument Operation Request (IOR) execution
  - Instrument operation generator to edit and validate the IOR set using the data format and procedures as defined by the SSOC
  - Instrument operation generator to edit and validate the Payload Direct Operation Requets (PDOR) and the Memory Direct Operation Requests (MDOR) sets using the data format and procedures as defined by the SMOC
  - Tool to monitor and select the SBM event data to downlink
  - Tool to help ROC team in the RFP edition and validation

6.5 RPW low latency data processing specific capabilities implementation requirements

Concerning the low latency data, the RSS shall be able to:

- Promptly deliver a fully operational and up-to-date LLVM to the SSOC
- Ensure that the LLVM delivery, deployment and application are compliant with the SSOC specification requirements
- Ensure the LLVM interfaces are compliant with the SSOC specification requirements
- Ensure the LLVM data products are compliant with the SSOC specification requirements

6.6 Data dissemination and archiving specific capabilities implementation requirements

The RSS shall:

- Ensure that RPW data required for operations and instrument monitoring are promptly available to the RPW, SSOC and SMOC teams.
- Archive all of the RPW data produced at the LESIA for all phases of the mission
- Deliver to the ESAC data archive centre, the RPW data products compliant with the Solar Orbiter data format and metadata definition.
- Distribute the RPW data products to be archived at ESAC in priority within 3 months.
- Ensure that the ROC interfaces with the ESAC data archive centre are compliant with the SSOC specification requirements.
- Prepare a data archiving plan of the RPW data products at the Centre de Physique des Plasmas (CDPP) at Toulouse.
- Provide public information about the instrument status and the data availability.
- Make available to external users software libraries to analyse RPW data.

6.7 ROC Ground Support Equipment (GSE) specific capabilities implementation requirements

During the ground calibration tests at system level, the ROC team shall:

- Provide to the CNES and LESIA AIT/AIV teams a tool dedicated to process and to analyse the RPW data but also the EGSE stimuli data.
- Deliver the processed data to the RPW consortium teams.

- Provide to the Lead CoI teams software support allowing to analyse calibration test data.

In support to the SBM1/SBM2 detection algorithms by the RPW flight software team, the ROC team shall:

- Develop, test, validate and run tools to simulate the SBM detections. The resulting data shall serve as inputs for the validation at the DPU level.
- Maximize the re-use of these tools for the in-flight validation of the SBM detection algorithms during the CP.

7 RESPONSABILITIES

7.1 RPW Principal Investigator responsibilities

In the framework of the RPW ground segment, the RPW PI is in charge of:

- Supporting the Solar Orbiter science operation definition.
- Defining the RPW science operation planning for all phases of the mission in accordance with the Solar Orbiter mission planning.
- Approving the ROC CIRD and Project Management Plan (PMP).
- Approving the financial and technical proposal document
- Validating RPW science data calibrations.
- Assuming overall responsibility about the RPW science data in terms of quality, dissemination and archiving.
- Share overall responsibility with the RPW Project Manager at the CNES for the definition and execution of the RPW operations during the NECP.
- Assume overall responsibility for the definition and execution of the RPW operations during the CP, the NMP and the EMP.
- Supervising the selection of SBM event data to be downlinked from the SSMM. This activity shall be performed in collaboration with other instrument PIs involved.
- Being the main interlocutor between the RPW ground segment and the Solar Orbiter consortium concerning RPW science operation planning at S/C level.
- Liasing with the science community concerning the RPW science data exploitation.
- Liaising with the NASA Solar Probe Plus FIELDS PI team in common development and data processing.

7.2 RPW Ground Segment Project Manager responsibilites

The RPW Ground Segment Project Manager is responsible of supervising the RPW ground segment activities.

Specificaly:

- Establish the overall RPW ground segment activities and RSS capabilities implementation requirements.
- Establish the concepts to ensure compatibility, commonality, and maximum re-use of hardware and software between all phases of the project.
- Assume overall coordination for the definition and implementation of the elements of the ROC.
- Establish the ROC PMP.
- Establish the technical and financial proposal document (PTF).

- Assume overall responsibility for the ROC infrastructure availability during all phases of the mission
- Assume overall responsibility for the RPW ground segment configuration and documentation management, in terms of consistency and accessibility policy.
- Generate the CIRD, update as required.
- Approve all changes of the RPW Software Development Plan (SDP).
- Ensure the instrument operations comply the science and operation planning at both payload and S/C levels.
- Supervise the RFP preparation, validation and delivery.
- Assume overall responsibility for the remote control of the RPW operational modes. It includes the SOOP to IOR/PDOR/MDOR translation as well as the IOR/PDOR/MDOR preparation, validation and transmission to the SSOC/SMOC.
- Coordinate the RPW routine and anomaly operations.
- Assume overall responsibility for the RPW performances during all in-flight phases of the mission.
- Ensure the monitoring of the RPW performance as well as on-board data storage and power management.
- Coordinate the instrument failure and anomaly operation management.
- Establish and maintain the overall RPW ground segment development and sustainability.
- Act as the main interface with the RPW Lead CoI ground segment teams.
- Act as the main interface with the SMOC and SSOC about RPW operation, data processing and archiving technical issues.

7.3 RPW Ground Segment Deputy Project Manager responsibilities

The RPW Ground Segment Deputy Project Manager is in charge of:

- Supervising and participating to the RSS development and validation, more particularly the ROC SGSE, RPW science operation planning tools, data processing pipelines, instrument monitoring tools as well as the software interfaces with the SMOC/SSOC.
- Ensuring the sustainability, the availability and the maintenance of the RSS during all phases of the mission.
- Establishing the ROC SDP, the ROC Software System Specification (SSS), the Software Design Documents (SDD) and Interface Control Documents (ICD) concerning the RSS.
- Coordinating the writing and delivery of Software User Manuals (SUM) for the RSS.
- Establishing guidelines about RPW ground segment engineering development, including procedures for testing, validating, delivering, executing and maintaining applications to be run by the ROC.
- Being the main interlocutor between the ROC and the LESIA in terms of hardware/software logistic support.
- Ensuring the archiving and accessibility of the RPW ground segment documentation
- Liaising with the RPW Lead CoI ground segment teams about RPW sub-system science data processing software and data to be implemented in the RSS.

7.4 RPW Ground Segment Scientist Team responsibilites

The RPW Ground Segment scientits are in charge of supporting the RPW science activities in the ROC, and maximazing the scientific return of the instrument. Their main tasks consist of:

- Ensuring the RPW performance fulfilled the science requirements [AD6].
- Participating of the RPW science data format definition.
- Supervising the validation of the RPW science data calibrations.
- Optimizing and validating the SBM detection algorithms.
- Ensuring the quality of RPW science data produced during the mission.
- Participating to the preparation of the science operations for RPW.
- Participating to the discussions concerning the RPW science in the dedicated working groups (e.g., Modelling And Data Analysis Working Group, MADAWG)

7.5 RPW Lead Co-Investigator teams

In the framework of the RGS, the Lead Co-I team shall:

- Ensure the calibration of its RPW sub-system.
- Support the RPW sub-system data product definition
- Support the validation of its RPW sub-system science data.
- Ensure the quality of its RPW sub-system calibrated science data.
- Provide expertise support in case of failure or anomalies involving its RPW sub-system.
- Assume the development, test, validation, delivery and maintenance of the software that produce science data for their RPW sub-system. These software shall be designed to be runnable in the RSS.
- Participate to the preparation of the RPW operations.

8 REQUIREMENT SUMMARY

8.1 ROC science and operations activities implementation requirements

Requirement Number	Description
General science and operations activities implementation requirements	
REQ-ROC-CIRD-0001	The ROC shall monitor and optimize the RPW performance. [REQ-PI-SIRD-0006]
REQ-ROC-CIRD-0002	The ROC shall optimize the RPW science returns
REQ-ROC-CIRD-0003	The ROC shall ensure the preparation and commanding of the RPW flight operating modes, in agreement with the instrument and Solar Orbiter operation planning.
REQ-ROC-CIRD-0004	The ROC shall maintain the RPW flight software. [REQ-PI-SIRD-0010]
REQ-ROC-CIRD-0005	The ROC shall maintain the RPW User Manual.
REQ-ROC-CIRD-0006	The ROC shall control the RPW on-board data storage.
REQ-ROC-CIRD-0007	The ROC shall control the RPW on-board power consumption.
REQ-ROC-CIRD-0008	The ROC shall maintain the RPW TM data rate within the TMC limits defined by the SSOC.
REQ-ROC-CIRD-0009	The ROC shall ensure the RPW TC data rate within the constraints defined by the SMOC (150 TCs per day for IOR).
REQ-ROC-CIRD-0010	The ROC shall produce RPW science data compliant with data formats defined at Solar Orbiter level [RD6].
REQ-ROC-CIRD-0011	The ROC shall deliver calibrated and high level data, including relevant calibration products, to the Solar Orbiter scientific archive. [REQ-PI-SIRD-0007]
REQ-ROC-CIRD-0012	The ROC shall provide a full access to its science data archive to the RPW Consortium and SSOC.
REQ-ROC-CIRD-0013	The ROC shall provide to ESA unlimited access to all processed and analysed data for public relation purposes during the 3-months proprietary period. [REQ-PI-SIRD-0008]
REQ-ROC-CIRD-0014	The ROC in collaboration with the RPW science teams (PI, lead CoIs, CoIs) shall provide summaries of the main scientific results at regular intervals. [REQ-PI-SIRD-0009]
REQ-ROC-CIRD-0015	The ROC shall ensure its archiving data format and the

	corresponding interface facilities comply the SSOC specification requirements.
REQ-ROC-CIRD-0016	The ROC shall perform the data processing of the ancillary data (S/C attitude, orbitography, time cofficients) delivered by the SMOC/SSOC data for its needs and those of the RPW consortium
REQ-ROC-CIRD-0017	The ROC shall supervize and perform the selection of SBM event data to be downlinked
REQ-ROC-CIRD-0018	The ROC shall control the BIAS current applied on-board.
REQ-ROC-CIRD-0019	The ROC shall support the preparation of the instrument operation timelines. Especially, the ROC team in collaboration with the RPW PI shall define and supervise a RPW operation planning compliant with the Solar Orbiter mission planning. [REQ-PI-SIRD-0003]
REQ-ROC-CIRD-0020	The ROC shall maintain fully operational software and interfaces with the SMOC/SSOC, especially in case of RPW failure/anomaly.
Pre-launch activites implementation requirements	
REQ-ROC-CIRD-0021	The ROC shall support the definition of the science operations. [REQ-PI-SIRD-0001]
REQ-ROC-CIRD-0022	The ROC shall provide inputs for the definition and implementation of the science operations planning, data handling and archiving concepts. [REQ-PI-SIRD-0002]
REQ-ROC-CIRD-0023	The ROC shall support the definition and implementation of the Solar Orbiter scientific data archive, as part of the pre-launch tasks. [REQ-PI-SIRD-0004]
REQ-ROC-CIRD-0024	The ROC shall agree on a long-term science activity plan and define the science priorities of scientific goals. [REQ-PI-SIRD-0005]
REQ-ROC-CIRD-0025	The ROC team shall support the definition of data formats for the science products. Espectially, it shall chose a contributor to be in the Modeling and Data Analysis Working Group for Solar Orbiter)
REQ-ROC-CIRD-0026	The ROC shall develop, test, validate and deliver a ROC SGSE as a support to the RPW ground calibration validations.

REQ-ROC-CIRD-0027	The ROC shall develop, test, validate and deliver tools related to the RPW operation preparation, instrument monitoring and data processing, dissemination and archiving . These tools shall be fully operationnal at launch.
REQ-ROC-CIRD-0028	The ROC shall prepare, verifify and supply to the SMOC the RPW user manual. This task shall be completed in collaboration with RPW team at CNES.
REQ-ROC-CIRD-0029	The ROC shall define the RPW science operation planning for the different phases of the mission. This task shall be done in accordance with the Solar Orbiter mission planning.
REQ-ROC-CIRD-0030	The ROC shall define, prepare, test, validate and deliver to the SMOC a as much as possible exhaustive list of Flight Operation Procedures (FOP) for RPW. A specific tool should be developed to help ROC team in the FOP preparation and validation.
REQ-ROC-CIRD-0031	The ROC shall supervise the delivery, integration, validation and execution processes concerning the RPW subsystems calibration software that will be developped in the Lead CoI institutes. It concerns more specifically the following sub-systems: • ANT Estimation of Leff in BF (SPIS simulation,E=-VXB), estimation of Leff in HF (CNES& Austrian simulations, use of Rolls) • SCM Transfer functions & calibrations, merging with MAG data • LFR Transfer functions & calibrations • BIAS Determination of BIAS current depending on R • TDS Transfer functions & calibrations • TNR-HFR Transfer functions & calibrations
REQ-ROC-CIRD-0032	The ROC shall prepare a data archiving plan of the RPW data products at the Centre de Physique des Plasmas (CDPP) at Toulouse.
Near Earth commissioning phase activities implementation requirements	
REQ-ROC-CIRD-0033	The following operations shall be realized during the NECP by the SMOC in collaboration with the ROC and RPW CNES teams [AD4, RD3]: • RPW switching-on • ANT deployment

	• SCM deployment • ANT calibration rolls • Interference campaign An exhaustive list of instrument key-parameters to be monitored shall be defined for each of these critical operations.
REQ-ROC-CIRD-0034	The ROC shall supply all engineering support required to succeed the NECP RPW operations. Especially, the ROC team shall ensure that the critical facilities are always fully operationnal and can be deployed and run at the SMOC site during specific phases.
Cruise phase activities implementation requirements	
REQ-ROC-CIRD-0035	The ROC shall evaluate, validate and optimize the RPW on-board data storage during the CP. This task will be done in collaboration with the SSOC team, which in charge of providing to IT periodic information about available data rates (e.g, “corridor” data).
REQ-ROC-CIRD-0036	The ROC shall evaluate, validate and optimize the RPW on-board power consumption during the CP. This task will be done in collaboration with the SSOC team, which in charge of providing to IT periodic information about available data rates (e.g, “power” data).
REQ-ROC-CIRD-0037	The ROC shall evaluate, validate and optimize the RPW science performance during the CP.
REQ-ROC-CIRD-0038	The ROC shall evaluate, validate and optimize the on-board SBM detection algorithms and the SBM event data downlink-cycle procedures during the CP.
REQ-ROC-CIRD-0039	The ROC shall evaluate, validate and optimize the BIAS current calibration procedures during the CP.
REQ-ROC-CIRD-0040	The ROC shall participate to the ANT calibration rolls and to the analysis of the resulting data. The roll campaigns shall lead to the delivery of direction and length parameters of the flight effective ANT vectors.
Nominal and Extended phases activities implementation requirements	
REQ-ROC-CIRD-0041	During the nominal phase, the ROC shall ensure the standard operations (REQ-ROC-CIRD-0001 to REQ-ROC-CIRD-0017)

REQ-ROC-CIRD-0042	The ROC and the RPW science teams shall maintain scientific cooperations with other mission teams, and more particularly the FIELDS/Solar Probe Plus team
Post-Operation Phase activities implementation requirements	
REQ-ROC-CIRD-0043	During the post-operation phase, the ROC shall finalize the science data processing and archiving for all of the mission phases.
REQ-ROC-CIRD-0044	During the post-operation phase, the ROC shall maintain the data access interface for external users and provide a helpdesk to support solving problems related to (a) the usage of the data retrieval system and (b) retrieving actual data.

8.2 ROC software system capabilities implementation requirements

Requirement Number	Description
General capabilities implementation requirements	
REQ-ROC-CIRD-0045	The ROC software system shall support prompt visualization of the RPW vital parameters for instrument performance monitoring
REQ-ROC-CIRD-0046	The ROC software system shall be able to control the RPW on-board operating modes, TM/TC data rates, RPW on-board data storage, BIAS current, and power.
REQ-ROC-CIRD-0047	The ROC software system shall permit to define and apply the RPW science operation planning
REQ-ROC-CIRD-0048	The ROC software system shall ensure the RPW operation requests preparation and validation
REQ-ROC-CIRD-0049	The ROC software system shall ensure the RPW science data processing, calibration and validation
REQ-ROC-CIRD-0050	The ROC software system shall ensure the RPW science data dissemination and archiving for the data stored at the LESIA site.

REQ-ROC-CIRD-0051	The ROC software system shall ensure the RPW low latency data processing and the validation and delivery of the RPW Low Latency data pipeline instance to the SMOC.
REQ-ROC-CIRD-0052	The ROC software system shall support post-mortem visualization and analysis of the RPW data produced during the calibration tests at system level
Data processing specific capabilities implementation requirements	
REQ-ROC-CIRD-0053	The ROC software system shall be able to promptly request, retrieve and process RPW TM packet data as returned by the SMOC/SSOC interfaces during all of the phases of the mission
REQ-ROC-CIRD-0054	The ROC software system shall be able to promptly request, retrieve and process RPW TC report data as returned by the SMOC/SSOC interfaces during all of the phases of the mission
REQ-ROC-CIRD-0055	The ROC software system shall be able to promptly request, retrieve and process Solar Orbiter ancillary data (e.g., orbit/attitude/time SPICE kernels) as returned by the SSOC/SMOC interfaces during the whole mission
REQ-ROC-CIRD-0056	The ROC software system shall permit to produce, to evaluate the quality and to validate the RPW calibrated science data and higher levels products of scientific interests.
REQ-ROC-CIRD-0057	The ROC software system shall support automated routine from anomaly event reporting during processes.
REQ-ROC-CIRD-0058	The ROC software system shall support fast executive summary and delivery of major anomalous events.
REQ-ROC-CIRD-0059	The ROC software system shall support delivery of all RPW science data products to the ESA data archive centre within 3 months.

REQ-ROC-CIRD-0060	The ROC software system shall ensure reception and conversion of quicklooks and ancillary data retrieved from the SSOC.
REQ-ROC-CIRD-0061	The ROC software system shall supply engineering and HK product control tool
REQ-ROC-CIRD-0062	The ROC software system shall support minimal human intervention
REQ-ROC-CIRD-0063	The ROC software system shall ensure time processing
REQ-ROC-CIRD-0064	The ROC software system shall support science data quality assessment
REQ-ROC-CIRD-0065	The ROC software system shall support science data validation
REQ-ROC-CIRD-0066	The ROC software system shall support the data identification and annotation ability
REQ-ROC-CIRD-0067	The ROC software system shall ensure calibration product archiving and dissemination to the ESA and RPW consortium teams.
REQ-ROC-CIRD-0068	The ROC software system shall provide calibration product viewer
REQ-ROC-CIRD-0069	The ROC software system shall ensure engineering and HK product access
REQ-ROC-CIRD-0070	The ROC software system shall provide engineering and HK product viewer
REQ-ROC-CIRD-0071	The ROC software system shall support displaying status of data products

REQ-ROC-CIRD-0072	The ROC software system shall ensure access to science models
REQ-ROC-CIRD-0073	The ROC software system shall support promptly delivering of a fully operational and up-to-date RPW LLVM to the SSOC
REQ-ROC-CIRD-0074	The ROC software system shall supply LLVM delivery and installation compliant with the SSOC requirements
REQ-ROC-CIRD-0075	The ROC software system shall supply LLVM interfaces compliant with the SSOC requirements
REQ-ROC-CIRD-0076	The ROC software system shall supply LLVM data products compliant with the SSOC definition.
Instrument monitoring specific capabilities implementation requirements	
REQ-ROC-CIRD-0077	The ROC software system shall supply tools to analyse the RPW engineering and science performances during the whole mission
REQ-ROC-CIRD-0078	The ROC software system shall supply tools to analyse the RPW on-board data storage and power consumption, as well as the TM/TC data rates.
REQ-ROC-CIRD-0079	The ROC software system shall supply tools to monitor the on-board storage of the SBM data
REQ-ROC-CIRD-0080	The ROC software system shall support optimizing the SBM detection rates by assessing the on-board algorithm parameters.
REQ-ROC-CIRD-0081	The ROC software system shall support controlling the BIAS current to be applied on-board
REQ-ROC-CIRD-0082	The ROC software system shall support displaying instrument sub-systems status timeline
REQ-ROC-CIRD-0083	The ROC software system shall support displaying RPW TM event report history, TC history and TM/TC statistics.
Instrument commanding specific capabilities implementation requirements	
REQ-ROC-CIRD-0084	The ROC software system shall provide logistical support for preparing the RPW operation planning (e.g., visiocon. system)
REQ-ROC-CIRD-0085	The ROC software system shall provide promtping tool and notebook for the commissioning planner
REQ-ROC-CIRD-0086	The ROC software system shall support approval or rejection of the operation plans before submission to the SSOC/SMOC

REQ-ROC-CIRD-0087	The ROC software system shall provide tools to generate/edit the IOR/PDOR/MDOR
REQ-ROC-CIRD-0088	The ROC software system shall provide tools to generate/edit the RFP.
REQ-ROC-CIRD-0089	The ROC software system shall supply graphical user interfaces for the IOR/PDOR/MDOR editor, the RFP editor, the instrument operation planner and the SBM event selection tool.
REQ-ROC-CIRD-0090	The ROC software system shall permit to test and validate the IOR/MDOR/PDOR execution. This task can be done using interfaces with external tools (e.g., MEB GSE)
REQ-ROC-CIRD-0091	The ROC software system shall implement SMOC/SSOC compliant interfaces to submit RPW operation requests.
REQ-ROC-CIRD-0092	The ROC software system shall implement SMOC/SSOC compliant interfaces to retrieve input files needed to prepare the operation requests (TMC, E-FECS, etc.).
Data dissemination and archiving specific capability implementation requirements	
REQ-ROC-CIRD-0093	The ROC software system shall permit that RPW data required for operations and instrument monitoring are promptly available to the RPW, SSOC and SMOC teams.
REQ-ROC-CIRD-0094	The ROC software system shall permit archiving all of the RPW data produced at the LESIA for all phases of the mission
REQ-ROC-CIRD-0095	The ROC software system shall allow the ROC team to deliver to the SSOC data archive centre, RPW data products compliant with the SSOC data format and metadata definition.
REQ-ROC-CIRD-0096	The ROC software system shall permit to distribute the RPW data products to be archived at SSOC in priority within 3 months.
REQ-ROC-CIRD-0097	The ROC software system shall contain interfaces compliant with the SSOC data archive interface specifications [RD6].
REQ-ROC-CIRD-0098	The ROC software system shall offer capabilities to inform users about the instrument status and data availability
REQ-ROC-CIRD-0099	The ROC team shall maximize the re-use of routines

	from the ROC software system, in order to make available to external users software libraries to analyse RPW data.
Ground Support Equipment implementation requirements	
REQ-ROC-CIRD-0100	The ROC software system shall include a dedicated post-mortem visualization tool to allow the AIT/AIV teams to view and analyse RPW data, but also RPW EGSE stimuli data.
REQ-ROC-CIRD-0101	The ROC software system shall include software support to the Lead CoI teams, allowing to retrieve and analyse calibration test data.
REQ-ROC-CIRD-0102	The ROC software system shall contain programs to simulate and optimize the SBM1/SBM2 event detection as planned on-board. These programs shall be designed to support the flight software team during the SBM algorithm validation tests.

9 COMPLIANCE MATRICES

9.1 Compliance to SIRD

According to SIRD, for the implementation of the SGS, the PI teams are expected to:

- Support the definition of the science operations.
- Provide inputs for the definition and implementation of the science operations planning, data handling and archiving concepts.
- Support the preparation of the instrument operation timelines.
- Support the definition and implementation of the Solar Orbiter scientific data archive, as part of the pre-launch tasks).
- Agree on a long-term science activity plan and define the scientific priorities of scientific goals.
- Monitor and optimise instrument performance.
- Deliver calibrated and high level data, including relevant calibration products, to the Solar Orbiter scientific archive).
- Provide to ESA unlimited access to all processed and analysed data for public relation purposes during the 3-months proprietary period).
- Provide summaries of the main scientific results at regular intervals.
- Maintain the instrument flight software.

9.2 Compliance to EID-A

The EID-A requirements below are of concern to the RPW operations. At this stage of the project we have taken note of them. The RPW compliance to these requirements will be described in the next issue of this document and certainly before the Instrument Critical Design Review.

EIDA R-365 The PI shall ensure that the use of instrument autonomy complies with the requirements specified in the Solar Orbiter Operation Requirements Document [NR-27] Section 2.2 and the referenced documents.

EIDA R-366 The PI shall comply with the relevant requirements specified in the Solar Orbiter Operation Requirements Document [NR-27] on Spacecraft Control (Section 2.1.4); on the Spacecraft Users Manual (Section 4.1) and referenced documents therein.

EIDA R-371 The PI shall issue instrument operations reports after each in-flight phase.

EIDA R-372 The PI shall make available the necessary resources during NECP for the installation of instrument EGSE equipment at the SMOC to monitor the operations execution in near-real time and to support GO/NOGO decisions at predefined steps in the procedures.

EIDA R-373 The PI shall submit operations requests to the SSOC.

EIDA R-375 The PI shall comply with the requirements specified in the Solar Orbiter Operation Requirements Document [NR-27] for Onboard Processors and Software (Section 2.3.2); Memory Management Service (Section 3.6) and referenced documents therein.

EIDA R-376 The PI shall maintain the instrument on-board software throughout the mission.

EIDA R-380 The PI shall be responsible for the verification of correct loading of the instrument software updates, since science telemetry processing will not be performed at the SMOC.

EIDA R-381 The PI shall support the preparation of the Solar Orbiter Mission Planning, including exchange of files between the SSOC and SMOC in line with the requirements set out in the SGS-OGS ICD [NR-TBD).”

EIDA R-382 The PI shall provide inputs to the SSOC for the requested science operations for integration in the mission planning products.

EIDA R-389 The PI shall make available the necessary resources to support the procedure definition, the procedure approval, the text execution, the results analysis and the anomaly investigation/resolution for the Data Disposition System Interface Test (DDSIT).

10 LIST OF TBC/TBD/TBWS

TBC/TBD/TBW			
Reference/Page/Location	Description	Type	Status

11 DISTRIBUTION LIST

LISTS See Contents lists in "Baghera Web": Project's informations / Project's actors / RPW_actors.xls and tab with the name of the list or NAMES below		Tech_LESIA
		Tech_MEB
		Tech_RPW
		[Lead-]CoIs
		Science-CoIs

INTERNAL

LESIA CNRS		

LESIA CNRS		

EXTERNAL (To modify if necessary)

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