ROC General Status

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Outline

- ROC status
- ROC development updates
- RPW operation activities
- Validation test activities
- Documentation status

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- **Change in the ROC team at LESIA**
  - Aichatou Aboubacar Amadou, in charge of the ROC operation tools development has left the project on mid-October 2018
  - ROC is looking for a new developer to carry on the operation tools development

ROC activity road map for 2019

• RCS integration	Feb-June 2019
• ROC-MOC I/F implementation	March-May 2019
• SVT1-a test	2 or 3 May 2019
• E2E-1 test	June 2019
• RCS "ready-for-flight" version release	June 2019
• ROC V4 pre-release ("RSS4")	July 2019
• SVT1-b test	End of July 2019
• ROC Validation Campaign #4 (RSS4VC)	Sept. 2019 (TBC)
• ROC "Acceptance Review"	Nov. 2019 (TBC)
• ROC V4 final release ("RSS4")	Dec. 2019 (TBC)

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SOLO RPW data products

- Compliance of L1/L1R/L2 master CDF with Solar Orbiter (SOLO) science data standards [SOL-SGS-TN-0009 V2.3] is now automatically checked and fixed by ROC.
- Expected CDF attributes/variables related to the coordinate systems are still missing.
- Need to detail the input required by calibration software to compute L2 data vectors in the RTN frame (in addition to instrument frame). Agreement on "transformation matrix"-like CDF, generated by ROC from SOC-provided ancillary data (SPICE kernels).
- Need to "freeze" a first list of QUALITY_BITMASK values to be implemented (available here)
- Need to finalize BIAS L1 sweeping and current master CDF description and decide the expected production cadence.
- Updating RPW L1 BP1/BP2 CDF is "in progress"

ROC-SGSE data products

- ROC-SGSE data conventions have been updated in [ROC-TST-GSE-NTT-00017-LES V2.2] (draft).
- Alignment with SOLO RPW data products. Use a single set of master CDFs for ROC-SGSE and SolO RPW L1/HK data. Can we do the same for ROC-SGSE L1R/L2 datasets?
- Data from ground calibration campaign with new conventions should be made available for mid-April on the ROC Web site (restricted area)
- RPW data from S/C EMC campaign on May 2019 will be available as ROC-SGSE data files from the ROC Web site (restricted area)

SOLO RPW Operation and Data Pipeline

- **New capabilities have been implemented into the RODP:**
  - *MOC-provided RPW telemetry data file parsing and analyzing, IDB transfer functions loading, MIB RPW data loading (only sequence), MEB GSE test log and ADS GSE format exporting, calibration software calling interface compliant with latest RCS ICD 1.2, …*

- **Main feature implementations until the ROC V4 release:**
  - Producing examples of SolO RPW LZ/L0/L1/HK/L1R/L2 data files. RPW telemetry data from ground calibration campaigns will be used as input samples. Need to check if it cover all the RPW data production use cases?
  - Processing HFR List mode and providing engineering values in HK/L1 CDF
  - Producing quicklooks and monitoring reports, as defined in [ROC-GEN-OTH-SPC-00064-LES]
  - Processing SOC-provided ancillary data (SPICE kernels) for OBT-UTC conversion and providing "transformation matrix" inputs for the RPW L2 calibration software. Need to check if we have a self-consistent set of inputs data.
  - Finalizing the MIB loading and fixing PALISADE versus MIB IDB discrepancy conflicts
  - Requesting RPW-related data from MOC

RPW Calibration Software status (1/2)

- RCS software and data processing status (see teams' presentations)
- Integrating RCS into ROC pipelines has started.
- Main objectives are:
  - Ensuring that the ROC pipelines can execute the RCS using the interface specified in the RCS ICD 1.2
  - Ensuring that the ROC pipelines can run the complete workflow "TM /LZ —> L1 —> (L1R) —> L2" for all the RPW science data production use cases
  - Implementing procedures defined in [ROC-GEN-SYS-NTT-00019-LES]
  - Be ready to perform both data and software validation tests during the RSS4VC campaign on Sept. 2019.

RPW Calibration Software status (1/2)

RCS	Integration status	Deadline
THR_CALBAR	Compliant with RCS ICD 1.2 Successfully tested on ROC-SGSE	End of April 2019
LFR_CALBUT	Normalization with RCS ICD 1.2 in progress	End of April 2019
TDS_CALBA	Normalization with RCS ICD 1.2 in progress	End of April 2019
SCMCAL	To be started	End of June 2019
BICAS	To be started	End of June 2019

RPW Low Latency data processing

- **RPW Low Latency Virtual Machine (LLVM)**
  - Full functional version of the LLVM - To be delivered to SOC on mid-April 2019
  - BIAS (sweeping) LL01 data made by ROC at LESIA, as L1 data product
  - Add COARSE_TIME_ONLY_FLAG and POWER_MEDIAN_1MHZ variables in RPW LL01 TNR data product

- **SolO LL02/LL03 data processing done by SOC (implementation in progress)**

- **SolO LL01/LL02/LL03 data will be distributed by SOC via a dedicated LL Web page**

ROC instrument operations tools status (1/2)

- **RPW command sequence editor (FIGARO)**
  - First prototype up-and-running (see with Sonny Lion for demo). Exporting/ Importing sequences in the MOC and MEB GSE TC script formats is functional.
  - Some painful use cases to be improved (cross-checking with resulting MIB sequences!)
- **RPW operation request editor (FAUST)**
  - First prototype up-and-running (see with Sonny Lion for demo)
  - Need to improve the tool capability to support ROC operators when preparing operation requests. Should rely on the exploitation of SOC-provided operation data (i.e., SOOPKitchen export, TM corridor, E-FECS) as well as data supplied by Bias and LFR teams

ROC instrument operations tools status (2/2)

- **RPW data visualization interface (TV)**
  - Development will restart asap (hiring developer in progress). Baseline is [ROC-GEN-OTH-SPC-00064-LES]
  - Will be accessible to the RPW teams from the LESIA Intranet
- **RPW SBM1/SBM2 event selection tool (SISSI)**
  - First prototype is currently planned for the ROC V5 ("RSS5") Release at end of the commissioning phase
  - Required discussions with SOC about interface specification and high-level procedures
- **The need of a RPW Operation Planning tool (OPERA) has to be re-considered, since current user requirements are quite similar to what the SOC SOOPKitchen tool actually does**

ROC interfaces with MOC and SOC

- **ROC-SOC interface status**
  - Generic File Transfer System (GFTS) node is up and running
  - Used for file exchange with SOC during end-to-end tests (E2E-0, E2E-1)
- **ROC-MOC interface status**
  - MOC Solar Orbiter Data Dissemination System (DDS) and GFTS implementation has just started
  - ROC will use the DDS client developed by SPICE team at IAS (Orsay, France) to request RPW-related data from MOC
  - On-going discussions with MOC team about using its interfaces at ESOC site during the antenna/i-boom deployment operation

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RPW commanding/configuring

- RPW will be nominally operated in-flight using a set of pre-defined "instrument configurations"
- First baseline of instrument configurations are listed into the RPW Flight Configurations Description Document (FCDD) [ROC-OPS-SYS-NTT-00074-LES]:
  - "default science", "galaxy", "low rate 1/2" + commissioning and cruise phase specific configurations.
- Covers commissioning and cruise phase operation planning
- Fit with RPW Instrument State Model [ROC-OPS-SYS-NTT-00056-LES] and the RPW Observation definitions for the SOC science operation planning tool (SOOPKitchen)
- Corresponding command sequences execution will be tested during the System Validation Test #1 (SVT1) campaign
- Instrument configurations might be refined/added during mission, from first in-flight experience feedbacks. But keep in mind that the process is not straight forward! (Requires iterations between ROC, SOC and MOC)

RPW operations activities

- RPW commissioning specific activities presented in the presentation by E.Lorfevre.
- RPW Cruise/Nominal Phases science operations presented in the presentation by J.Soucek

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System Validation Test 1 (1/3)

- **SVT-1 overall context**
  - Validation of the MOC - Spacecraft/Payload (FM) commanding interface
  - Driven by MOC from ESOC site using instrument team inputs
- **RPW-specific objectives**
  - First test of the instrument commanding interfaces with MOC in near-real conditions: execution on PFM of instrument command sequences defined for commissioning and cruise phases, use of direct and memory operation request files (MDOR, PDOR)
  - Perform a first run of the RPW antenna/I-boom deployment scenario in terms of instrument commanding
  - Perform upgrades of the RPW DAS and LFR software using MDOR
- **All RPW commands will be tested**
- **This is not a test to validate science operations nor instrument setting**

System Validation Test 1 (2/3)

- **2 sessions are planned:**
  - SVT1-A: RPW scheduled on May 2, 2019 (8-hours slot)
  - SVT1-B : End of July 2019 : Test plan to be detailed
- **SVT1-A - RPW commanding interface test**
  - First RPW allocated 4 hours slot is dedicated to test every commands within sequences (even isolated commands).
  - Timeline includes tests on prime DPU, redundant DPU and run of ANT/I-BOOM deployment scenario. Delivered as PDOR.
  - RPW SVT1-A sequence timeline has been run on the MEB EM1 at LESIA for verifications

System Validation Test 1 (3/3)

- **SVT1-A - RPW DAS and LFR software upgrades**
  - Performed during the last RPW allocated 4 hours slot
  - DAS upgrades to version 3.6.1.0
  - LFR upgrades to version 3.2.0.24
  - MDOR format files will be used to upgrade the software.
  - DPU Prime EEPROM1 and EEPROM2; and DPU redundant EEPROM1 will be upgraded. DPU Redundant EEPROM2 will be upgraded during SVT1-B or in flight (TBD).
  - "Light" SFT run is requested just after the upgrades for quick post-mortem verifications.
  - Full SFT will be performed during EMC test at the end of May 2019.

Solar Orbiter ground segment end-to-end 1 Test

- Instrument operation request mechanism between ROC and SOC will be, among other, tested on June 2019
- Partial loop test, only ROC->SOC->MOC uplink data flow (no telemetry)
- Request for around two weeks of science operations during the Nominal Phase. Based on the SOWG#13 LTP12 exercise scenario
- For these two weeks:
  - RPW acquires data in the science default configuration
  - Following routine operations are planned: BIAS sweeping and current setting, THR/LFR internal calibrations, TDS TSWF dump (time for other? LFR K-coeff/ bin updates?)
- **ROC team is preparing the associated Short Term Planning Instrument Operation Request files (IOR) for RPW. Preliminary versions to be delivered to SOC by end of April. Final version on May 10, 2019.**

ROC software system validation campaigns (1/2)

- Internal test campaigns to validate ROC infrastructure and data products w.r.t. requirements.
- A first "rehearsal" of test campaign (RSS3VC) has been run by ROC team on December 2018. Main objective was to validate the concept. It was performed on software components of the ROC V3 Release (RSS3)
- Final issue of the RSS3VC test campaign is expected for mid-April 2019 (Test report/plan)
- Test campaign to validate last ROC V4 Release will be planned on Sept. 2019.
- Final verification of the RPW data products and ROC-RCS interface before launch will be performed during this campaign, relying on [ROC-GEN-SCI-PLN-00077-LES]

ROC software system validation campaigns (2/2)

- **Limitations:**
  - No formal validation of the interfaces with Solar Orbiter MOC and SOC during these campaigns. Done during specific tests driven by ESA, such as SVT1 or E2E.
  - Instrument commanding and data processing test cases might be run separately
  - Having representative enough and self-consistent input data to test some processes might be tricky or time consuming (TBC). E.g. Exhaustive test of L1/L2 CDF data production requires a set of RPW telemetry raw data, the executed commands and associated SOC-provided data (E-FECS, ancillary SPICE kernels)

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Documentation status (1/2)

- Content of ROC requirements and CIRD documents is now quite stable
- ROC User Requirements, Software System Specification and ROC Validation and Verification Plan, as well as related traceability matrix, need updates — To be done for mid-April 2019
- First draft of RPW science Data Validation and Verification Document (DVVP) has been submitted to Lead CoI teams
- First draft of test plan for RSS4VC is planned for June 2019
- First draft of the "RPW Data Product Description Document" (DPDD) has been delivered to SOC on January 2019. SolO L1/L2 master CDF used as inputs to generate the document. "Internal" data products (LZ, HK, L1R) are not described in the DPDD.
- Finalizing BIAS operation ICD issue 1 is "in progress"
- Need to write a "LFR operation ICD" (discussion is on-going)

Documentation status (2/2)

- **Need to finalize ROC management operation plan [ROC-GEN-MGT-PLN-00041-LES]:**
  - Routine operation planning and expected activities on-ground
  - Organization relative to anomaly investigations
- **ROC User Manual - 2 parts:**
  - ROC software user guide (in progress)
  - ROC exploitation guide. **Need to include inputs for the RPW monitoring at LESIA with clear instructions to be performed by the ROC operator**
  - RPW User Manual needs updates (RPW monitoring by MOC operator and related actions, RPW commanding high level procedures with related sequences)