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JUNO

JIRAM Operation Procedure

“Uplink”

OLD CATALOGUE:

JIR-IFSI-SY-002-2011/ INAF/IAPS-2014-04/ ISSUE 2 / REVISION 0

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ACRONYM & ABBREVIATION LIST

| | |
|--------|---|
| ASI | Agenzia Spaziale Italiana |
| DOM | Distributed Object Manager |
| EGSE | Electrical Ground Support Equipment |
| FEI | File Exchange Interface |
| GA | Galileo Avionica |
| HEX | Hexadecimal format |
| HK | Housekeeping |
| HW | Hardware |
| HSSL | High Speed Serial Link |
| INAF | Istituto Nazionale di Astrofisica |
| JSOC | Juno Science Operations Centre (at SwRI, Texas) |
| JCoT | Jiram Commanding Tool |
| JGeDeT | Jiram Geometrical Definition Tool |
| JMSP | Jiram Master Science Plan |
| JPLaT | Jiram Planning Tool |
| JPL | Jet Propulsion Laboratory |
| JIRAM | Jovian Infrared Auroral Mapper |
| JRCF | Jiram Raw Command File |
| JSG | Jiram SASF Generator |
| LM | Lockheed Martin |
| LSSL | Low Speed Serial Link |
| NA | Not Applicable |
| NASA | National Aeronautics and Space Administration |
| PI | Principal Investigator |
| PDS | Planetary Data System |
| PJ | Peri Jove |
| RD | Reference Document |
| SASF | SC Activity Sequence File |
| SAP | Science Activity Plan |
| SC | Spacecraft |
| SPWG | Science Planning Working Group |

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DOCUMENT CHANGE LOG

| Issue | Date | Pages/Paragraphs affected | Changes Description |
|-------|------|---------------------------|---------------------|
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APPLICABLE DOCUMENTS

The following documents at the latest issue in effect shall apply. These documents are herein referred as [AD-XX].

| <i>Id</i> | <i>Document Number</i> | <i>Description</i> |
|-----------|------------------------|--------------------|
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REFERENCE DOCUMENTS

The following documents shall be used as reference background and support information. These documents are herein referred as [RD-XX].

| <i>Id</i> | <i>Document Number</i> | <i>Description</i> |
|-----------|---------------------------|---|
| [RD-01] | JIR-IFSI-UR-002-2010 | JIRAM_Operations_Interface_Control_Document_Issue_05 |
| [RD-02] | JIRAM-GAF-IC-001 | JIRAM-GAF-IC-001_rev6_CICD.pdf |
| [RD-03] | JIRAM-GAF-TN-027 | JIRAM-GAF-TN-027_rev10.pdf |
| [RD-04] | JIRAM-GAF-RP-011 | JIRAM-GAF-RP-011_rev0(CalibrationDataRecord).pdf |
| [RD-05] | JIR/IFSI/PN/001/2011 | JIRAM Contingency Plan |
| [RD-06] | Version 5. Release 2.0.4b | FEI Client Installation Guide |
| [RD-07] | Version 5. Release 2.0.4b | FEI User Guide |
| [RD-08] | Revision AA02 | JIRAM_EGSE_USER_MANUAL |
| [RD-09] | JIR-IFSI-UR-001-2010 | EGSE & PDS Converter Software Requirements Specifications |

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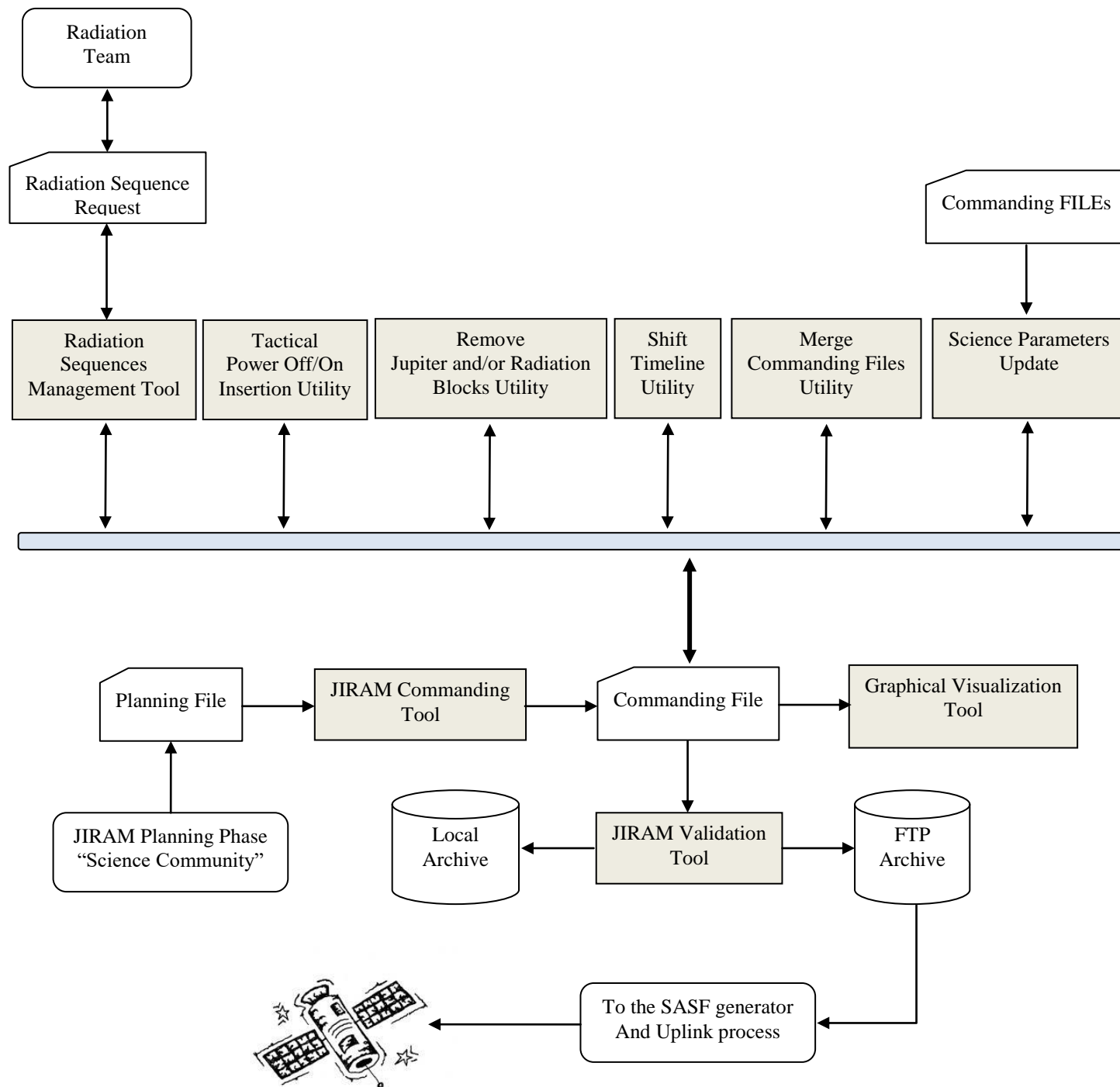
1 PURPOSE OF THIS DOCUMENT

The aim of the JIRAM Operation Procedures is to give flexibility to the JIRAM Science Community, in finalizing the science requests into instrument Tele-Commands and to give to the Operation Team the steps to follow for a correct implementation of Commanding products to be exchanged with the project.

The JIRAM ground segment has been updated several times during the last two years (2014-2015) in order to automatically manage all the Operation Procedures by Software and Utilities, The architecture is shown in Fig 1.1.

The Operation Procedure Structure can be applied indifferently to the various level of the JUNO-JIRAM operation chain (PASS1, PASS2 and TACTICAL). All the operation products are automatically managed by SW, with the super vision of the experts that will guide the various steps to be executed for a correct implementation of observation plan.

The final files, after the validation of the “Validation/Simulation Tool”, will be posted into the local archive and into the FTP archive. An automatic e-mail will inform all the JIRAM team of new available file in the FTP.



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2.1 JIRAM PLANNING PHASE

In the JIRAM Planning Phase the Scientists will decide, with the support of the Science Simulation Tool, the objectives to be achieved for a certain period of operation (es. jm0203). This task will culminate in the generation of the Planning File that will be posted into the FTP archive, that are for example:

ORBIT 02: JIRAM_PLAN_ORBIT2_PJ-06h_PJ+18h_(merged).jir
ORBIT 03: JIRAM_PLAN_ORBIT3_PJ-05h_PJ+12h_(merged).jir

The planning product is a binary Matlab file and the science observation is organize by samples, where each sample represent a nadir observation on the planet. The information available for each sample are:

UTC_Time,
Scet_time,
Operative_Mode,
Sp_Nadir_Offset_2,
Sp_Nadir_Delta,
Imager_Exposure_Time,
Spectrometer_Exposure_Time,
Science_Name_Block

FTP ARCHIVE

<ftp.sic.rm.cnr.i>

Utente = junouser
Password = 729331821

Folders:

/1. Jiram Routine Opeations/JM_002_003/1. PJ_002_Preliminary/1. Planning Files
/1. Jiram Routine Opeations/JM_002_003/2. PJ_003_Preliminary/1. Planning Files

LOCAL ARCHIEVE

C:\JIRAM LOCAL ARCHIEVE\JIRAM\1. Jiram Operations\1. Jiram Routine Opeations\JM_002_003\
1. PJ_002_Preliminary

C:\JIRAM LOCAL ARCHIEVE\JIRAM\1. Jiram Operations\1. Jiram Routine Opeations\JM_002_003\
1. PJ_003_Preliminary

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2.2 JIRAM COMMANDING TOOL

The JIRAM Commanding Tool implements procedures, algorithms and data formats in such a way to permit a user to perform tasks related to the Planning activities of the instrument mission. This activity leads to the generation of parameter values to be used, in automated processes, to command the instrument.

Nominal input to the Commanding Tool are instrument Timelines generated by the JIRAM Science Simulation Tool, validated within the Science Activity Plan file “SAP”. Alternatively, timelines can be manually defined or command parameters can be, again manually, selected.

Outputs of the Commanding Tool are a set of commands rows and a set of SP values to be used for instrument programming and formalized in the JIRAM Raw Command File. The JIRAM raw command file (Commanding File) will be translated into SASF format (JPL requirement) with the SASF Generator Tool.

The JIRAM Commanding Tool functional architecture can be partitioned in modules. Basic Commanding Tool usage foresees the user to manage the task of “commanding” the instrument in different ways.

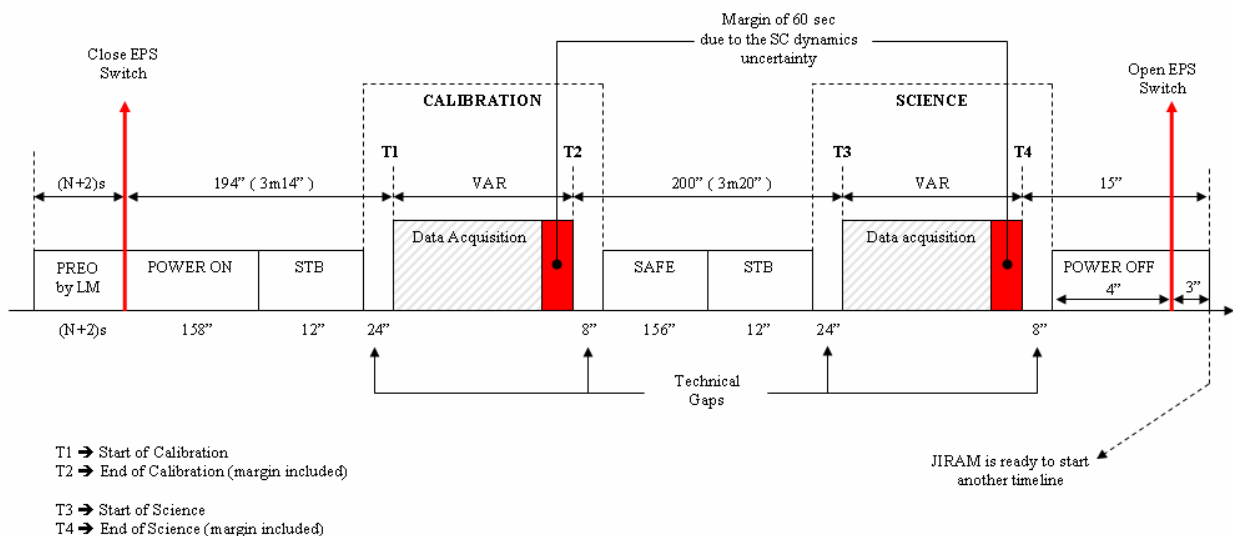
The main option is that to select one, timeline from the Planning schema (these timelines are a product of the JIRAM Simulation Tool) and commit them for a standard processing. As an alternative the user may bypass the standard generation process and perform an assisted manual input of Operative Sequences.

SW Configuration Inputs:

- ✓ Output file name. Default value is “JRM_CMD_000_000_V01”
- ✓ Raw Memory Free Buffer Margin [%]. Default value is “2%”
- ✓ BKG Repetition Rate[%]. Default value is “0%”
- ✓ Imager Compression State. Default value is “NO-COMPRESSION”
- ✓ BKG subtraction . Default vale is “SUBTRACTION-ENABLED”
- ✓ Target in the first acquisition. Default value is “DARK”
- ✓ Motor Mode in the first acquisition. Default value is “POINT”
- ✓ Motor Mode in the second acquisition. Default value is “SPIN”

SW Tasks

- ✓ Output and FTP directories definition
- ✓ Load Planning File in MATLAB format (MATLAB_TABLE)
- ✓ Identification of the Jupiter observation blocks in (NADIR_DELTA_TRANSITION)
- ✓ For each Science block of NADIR_DELTA_TRANSITION the following steps will be executed:
- ✓ RAW memory check. If the block could not be stored into the empty RAW partition, the block will be cut in sub blocks.
- ✓ If the sub block cannot be stored into the RAW partition, due to other data in the memory, the RAW will be empty before the acquisition of the new sub block.
- ✓ Generation of Tele-Commands and parameters for the implementation of the Sub Block.
- ✓ RAW memory content will be updated with the new data generated by the actual Sub Block
- ✓ Insertion of the Standard calibration blocks at the beginning and at the end of the timeline
- ✓ Insertion of the Power On and Power Off blocks
- ✓ Insertion of the Heater activities before the Power on block and after the power off block
- ✓ Dynamic content of the RAW and SOFT memory within the timeline.



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Fig 2.2.2 shows a graphical representation of a generic operative timeline. The Commanding Tool will add to the final timeline.

Jiram Raw Command File (**JRCF**), the technical sequences necessary for the operation of the instrument, like for example: “POWER ON” , “STB”, “SAFE” and “POWER OFF”.

The Commanding Tool will also calculate the overall timing in different format and the internal timing of each single Sequence.

FTP ARCHIVE

<ftp.sic.rm.cnr.i>

Utente = junouser

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Folders:

/1. Jiram Routine Operations/JM_002_003/1. PJ_002_Preliminary/1. Planning Files

/1. Jiram Routine Operations/JM_002_003/2. PJ_003_Preliminary/1. Planning Files

LOCAL ARCHIEVE

/1. Jiram Routine Operations/JM_002_003/3. PASS1/2. Commanding Files

/1. Jiram Routine Operations/JM_002_003/3. PASS1/3. Validation Files

C:\JIRAM LOCAL ARCHIEVE\JIRAM\1. Jiram Operations\1. Jiram Routine Opeations\JM_002_003\
1. PJ_003_Preliminary

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2.3 RADIATION SEQUENCE MANAGEMENT TOOL

The inputs of the Radiation Sequence Management Tool are: the “Commanding File” generated by the JIRAM Commanding Tool and the “Radiation Sequence File” generated and distributed by the “Radiation Team”. The output is the editing of the “Radiation Sequence File” in case it is necessary to take out, from the original “Radiation Sequence File”, one or more blocks because in conflicts with the Jupiter’s observation sequences. This tool can also edit the original “Commanding File” in case it is necessary to anticipate the Power on blocks to fit the within the timeline, the radiation blocks.

SW Tasks

- ✓ Compare the “Commanding File” and the “Radiation File” and visualize eventually overlapping of the sequences.
- ✓ In case of overlapping of the sequences, the user can decide with block to take out from the current plan, that could be the radiation sequence or the Jupiter sequence.

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2.4 TACTICAL POWER CYCLES (OFF/ON) INSERTION UTILITY

The input of the Tool is the “Commanding File”, the output of the tool is the “edited Commanding File”. The aim of this SW is the insertion of the Power Cycle blocks (on-off) between the science blocks when there is a GAP in time between the blocks greater than 2 Hr in order to reset the instrument and to avoid errors that could be generated by the radiation environment of Jupiter.

SW Tasks

- ✓ If the technical gap between the science blocks is greater than 2Hr and less than 3Hr, the power cycle will be set at the end of the technical gap and it consists of:

Power Off

Power On

Standby

- ✓ If the technical gap between the science blocks is greater than 2Hr and less than 6Hr, the power cycle will be split as following:

Standard Calibration at the beginning of the technical GAP

Power Off after the Calibration

Power On at the end of the technical GAP

Standby after the Power On

Standard Calibration after the Standby

- ✓ If the technical gap between the science blocks is greater than 6Hr, the power cycle will be defined as following described:

Standard Calibration at the beginning of the technical GAP

Power Off after the Calibration

Heater Operation Disable after the Calibration

Heater Operation Enable at the end of the technical GAP

Power On after the Heater Operation

Standby after the Power On

Standard Calibration after the Standby

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2.5 JIRAM VALIDATION TOOL

The JIRAM Validation Tool is the most important tool of the JIRAM commanding chain. This SW is able to test both the “Commanding File” and the “SASF File”. If the checked file is approved the SW will automatically push the File into the FTP archive and an automatic e-mail will inform the users of the approved file.

SW Tasks

- ✓ Generation of the Readable File with the list of Tele-Commands and Parameters in UTC format
- ✓ Check of the minimum safe time of 2sec between Tele-Commands
- ✓ Check of the timing of the particular Tele-Commands that require more than 2sec for the execution.
- ✓ Check of the correct allocation of the two acquisitions within the cycle duration that could be set to a fix value of 30s or synchronized with the SC dynamics, if available.
- ✓ Flight Rules Verification:
 - Spectrometer Compression Check
 - JRM_SAFE Tele-Command Check
 - JRM_RESET Tele-Command Check
 - Check: The calibration parameters
 - Check: The Standby block is configuration
 - Check: The exposure times settings that must be compliant with the designed OPM
 - Check: The Detectors Gains must have default values
 - Check: BKG_REPETITION must set to “0” is the double science is enabled
 - Check: Double science is not allowed if summed science is enabled
 - Check: That the values of the Tc’s parameters are within the working ranges
 - Check: if LSSL is enabled only a restricted set of operative modes are allowed
 - Risk Parameters and Tele-Commands Identification (if any)
 - Calculation of Power consumption and Data Volume Profiles
 - Verification of the instrument Hardware Performances.
 - Verification of the instrument Science Performances.
 - Syntax Check
 - RAW and SOFT dynamic simulation