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JUNO

JIRAM Uplink Downlink Procedures

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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
2.0	XX/XX/XX	Pg. 11. Paragraph (2.3)	Typo in JRCE
2.0		Pg. 13. Paragraph (2.4)	Typo in JRCE

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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>

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 commands, and be able to process the data received from the instrument into the appropriate science data set within the time frame allocated in the Level-3 processes.

In the uplink side, this involves being able to support the Science Planning Working Group (SPWG) in the planning of science activities, and being able to generate all the JIRAM commands that support the science plan.

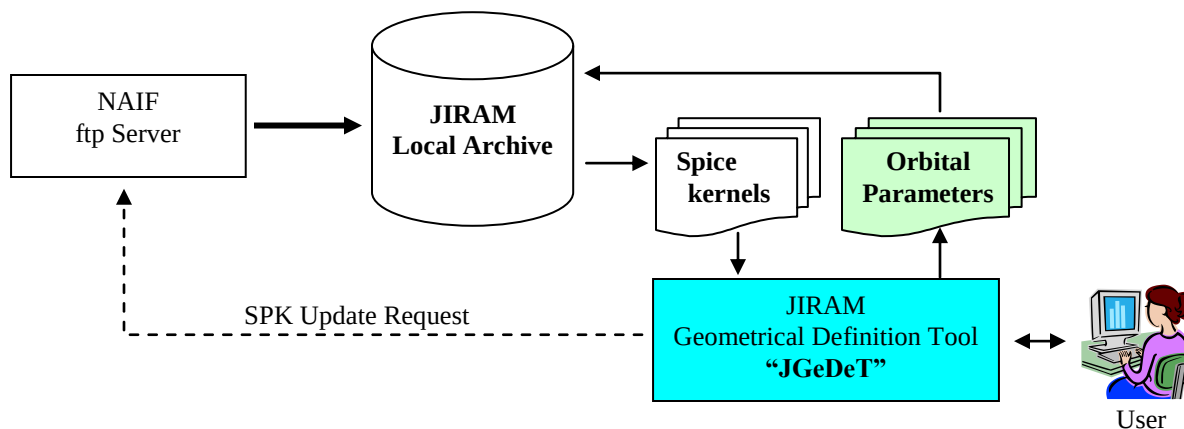
The downlink phase concentrates in being able to obtain/access the JIRAM instrument compressed level-2 science data from the File Exchange Interface (FEI) server, decompressing or expanding the data, calibrating the data (generating the level-3 science data), and producing the final higher-level science data products.

The JIRAM routine uplink and downlink operations are implemented via seven plan levels.

2 UPLINK PROCEDURES

2.1 GENERATION OF THE MAIN ORBITAL PARAMETERS PROCEDURES

First step of the Commanding Chain is the generation of the spacecraft orbit and attitude information (Sub SC longitude, Sub SC latitude, SC altitude,...) that will be extracted by the Juno SPK and handled by the “*JIRAM Geometrical Definition Tool*”. The orbital parameters are stored in the “*JIRAM Local Archive*” to be available to the entire Commanding Chain.



Support Tool: JIRAM Geometrical Definition Tool (JGeDeT)

Support Documents:

Detailed Check List:

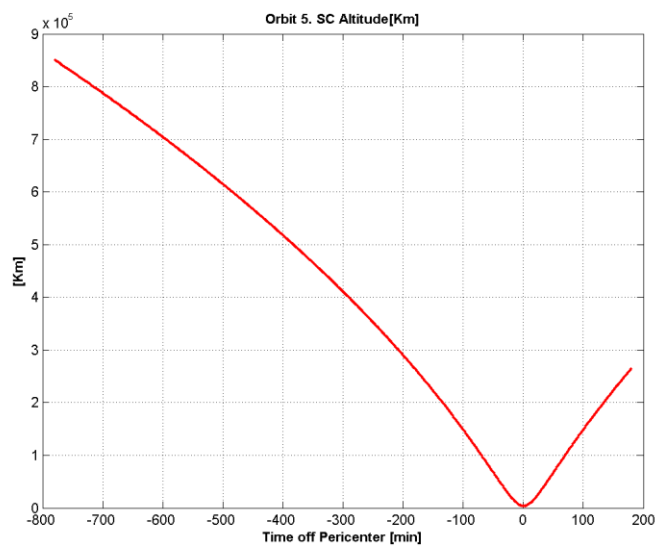
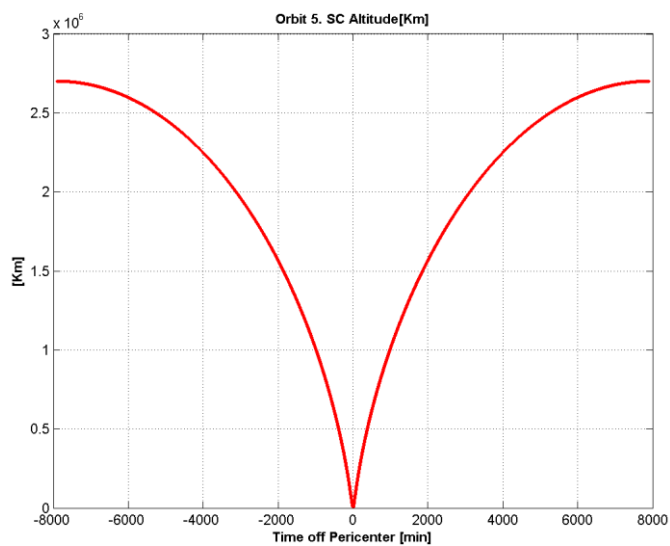
1. Login to JIRAM Ground Segment (Sign in using personal User_Id and Password)
2. Run JGeDeT tool.
3. Check the latest available Juno SPK products from (<http://naif.jpl.nasa.gov/pub/naif/JUNO/>)
4. Update SPK products into JIRAM local archive.
5. Software Environment Configuration:
 - a. Selection of the orbits of interest.
 - b. Definition of the Orbit Sampling Factor.
6. Selection of the orbital parameters:
 - a. All available orbital parameters.
 - b. Limited branch of orbital parameters.
7. Storage of the Output File into the JIRAM Local Archive.
8. Graphical Visualization of the calculated orbital parameters.



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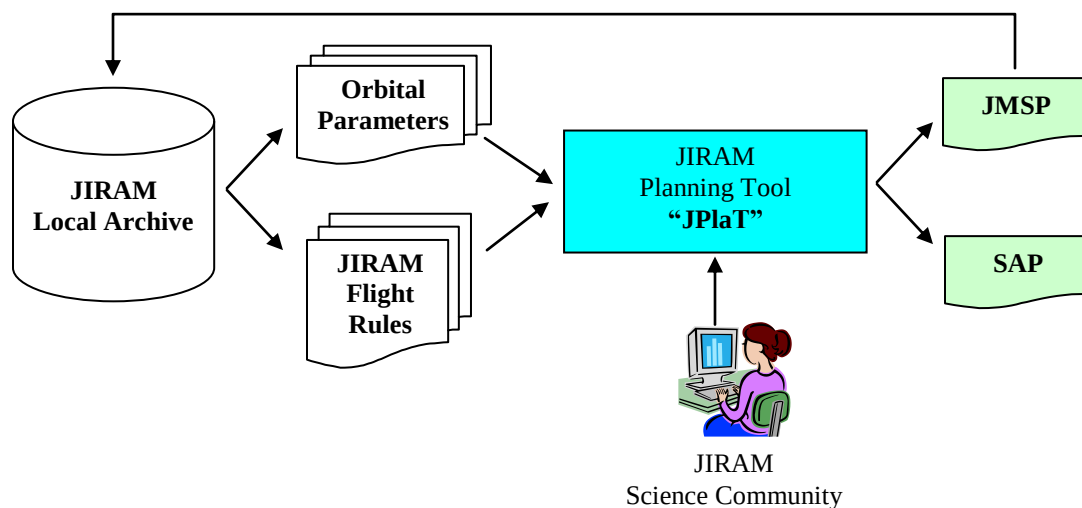
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Examples of Graphical Output



2.2 SCIENCE TIMELINE IMPLEMENTATION PROCEDURES

The Science Timeline Implementation process culminates in the generation of the Science Activity Plan (SAP). An internal version of the SAP file is the JIRAM Master Science Plan (**JMSP**) is available to the JIRAM team through the JIRAM local archive. The **JMSP** nominally contains the selection of science observation periods in term of Scientific Operative Sequences imposed by the mission goals, mission conditions and constraints (Data Volume, Power budget,...).



Support Tool: JIRAM Planning Tool (**JPlat**)

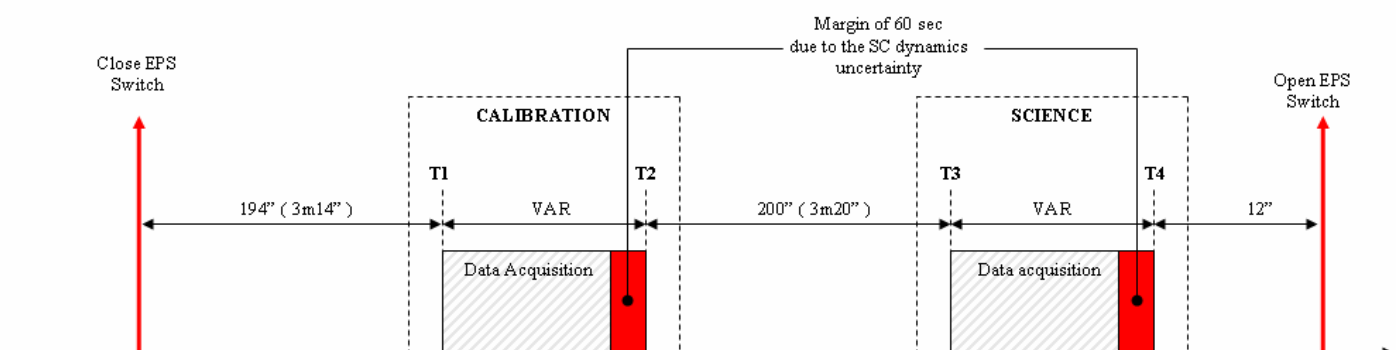
Support Documents: [RD-01]

Detailed Check List:

1. Login to JIRAM Ground Segment (Sign in using personal User_Id and Password)
2. Run **JPlat** tool.
3. Export Orbital Parameters and Flight Rules to the local workstation.
4. Identification of all the science areas interested by the selected flyby (orbit)
5. Prioritization of the science areas (High Medium Low).
6. Analysis and validation of the achievable Science Goals, provided by the JIRAM Science Community, over the prioritized science targets.
7. Modelling of the Jupiter Radiation Environment for the identification of the no working regions.

8. The Planning Tool has been also designed to access different kind of information related to the mission and display them in a different format, with intensive graphical outputs. The aim of the application is the data merging (fusion utilities) to optimize the planning process and the scientific exploitation phase. The design modularity should allow the addition of future functionalities.
9. Implementation of the JIRAM Master Science Plan (**JMSP**) with the implementation of the Science Operative Blocks, necessities to achieve the designed Science Goals previously defined.
10. Computation of the Data Volume, Power profile and SC pointing attitude, requested by the **JMSP**.
11. Resolution of the overall mission conflicts, if any, in term of:
 - a. Data Volume overflow
 - b. Power Overflow.
 - c. Violation of the SC and instrument flight Rules.
12. The original JMSP, will be reshaped in case of conflicts.
13. Estimation of the Global Coverage achievable with the harmonized **JMSP**.
14. The harmonized **JMSP** will be stored into the JIRAM local archive and then converted into SAP format.
15. Login to JSOC using the correct IP address (<https://jsoc.swri.edu/jsoc>)
16. Sign in using personal JSOC user name and corresponding password.
17. Upload of the SAP activities.

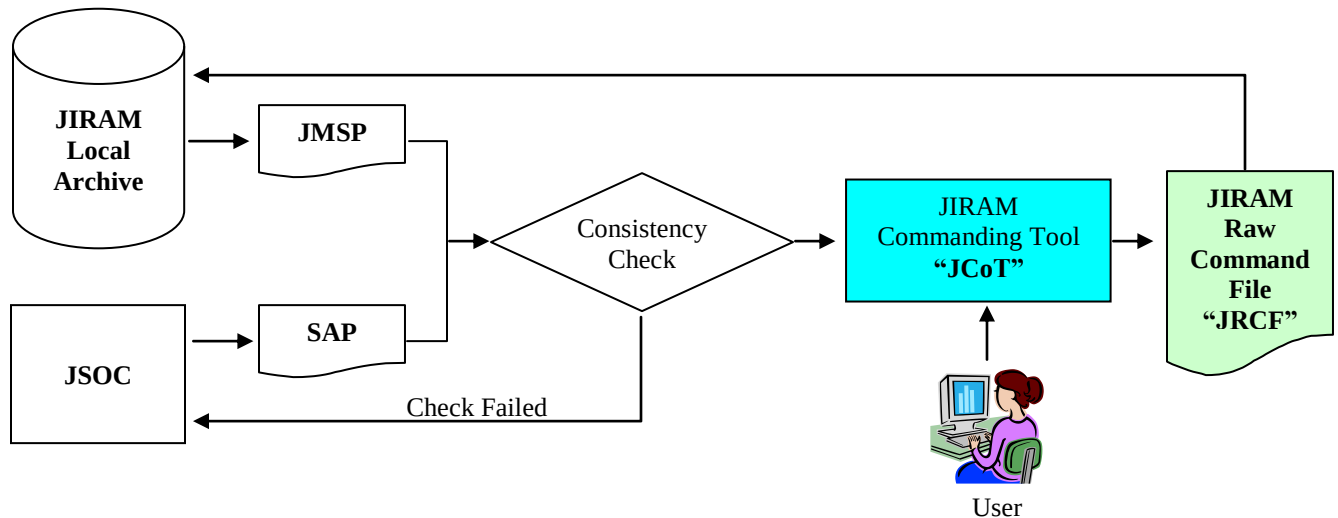
JMSP Graphical Visualization



In the JMSP timeline contain just Science Activities (Calibration block, Science block, ...). The timeline will be completed by the Jiram Commanding Tool, adding the technical blocks (SAFE, STB ecc).

2.3 RAW COMMANDS GENERATION

Once the Planning Cycle has been harmonized (all conflicts solved) the next phase is the generation of the hardware Tele-Commands and parameters.



Support Tool: JIRAM Commanding Tool (JCoT)

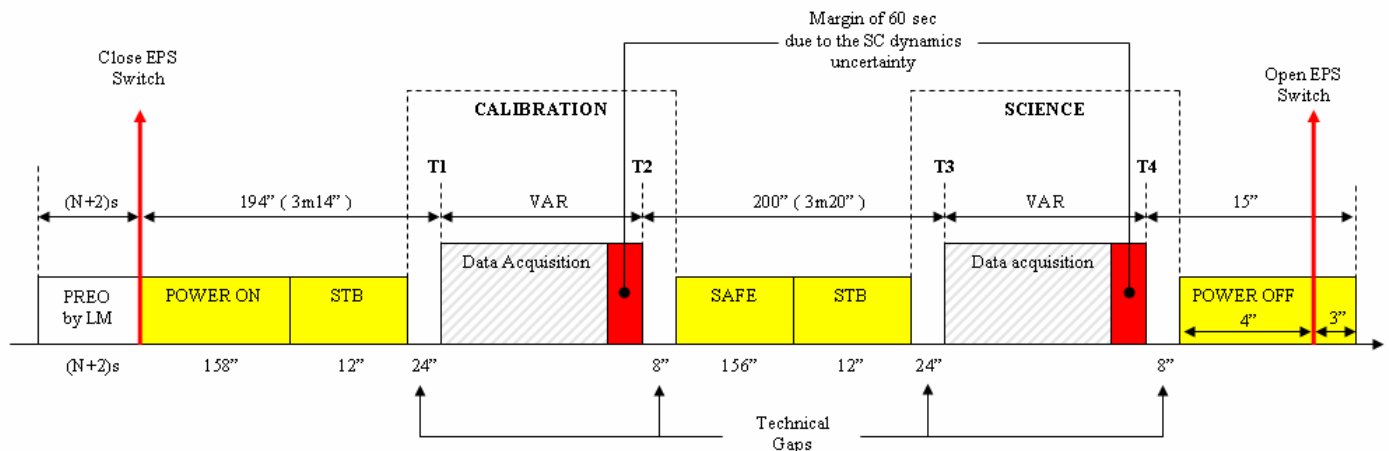
Support Documents: [RD-01], [RD-02], [RD-03], [RD-04]

Detailed Check List:

1. Login to JSOC using the correct IP address (<https://jsoc.swri.edu/jsoc>).
2. Sign in using personal JSOC user name and corresponding password.
3. Select the Science Activity Plan (SAP) under consideration.
4. Export the SAP to the local workstation.
5. Login to JIRAM Ground Segment (Sign in using personal User_Id and Password)
6. Select and export to the local workstation the harmonized JMSP (under consideration) from the local archive.
7. Verify the consistency between SAP and JMSP.
8. In case of discrepancies (JMSP not in line with SAP) then contact JSOC.
19. Definition of the *Atomic Sequences* in term of Tele-Commands and Settable Parameters. Items fully described in [RD-01].
20. Definition of the *Timing* (relative and absolute) and *Duration* of the Atomic blocks.

21. Data Volume and Power Consumption will be finalized in this phase (possible reduction of resources, declared in the **SAP**).
22. All the Tele Commands and Settable Parameters will be checked by the **JCoT** itself, in term of:
 - a. Data Production Rate.
 - b. Instantaneous Consumed Power.
 - c. Tele-Commands fields “Consistency Check”.
 - d. Detection and warning message display of the risk parameters and Tele-Command (if any), see [RD-01] Chapter 6.
23. Generation and storage into local archive, of the JIRAM Raw Command File (**JRCF**) to be converted into SASF format

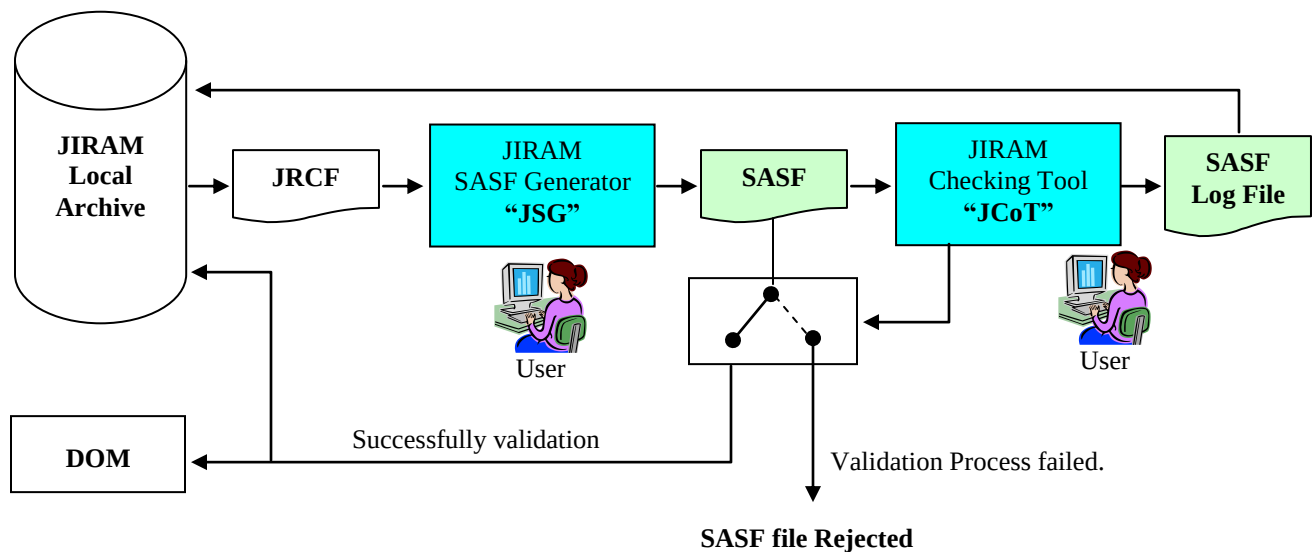
JRFC Graphical Visualization



In yellow are highlighted the blocks added by the JIRAM Commanding Tool

2.4 SASF GENERATION PROCEDURES

Accordingly to the JIRAM Raw Command Files (**JRCF**), generated by the (**JCoT**), the raw sequences are then converted into SASF format and finally checked by the JIRAM Testing Tool before the delivery to the DOM client.



Support Tool: JIRAM SASF Generator (**JSG**). JIRAM Checking Tool (**JCT**)

Support Documents: NA

Main Items List:

1. Login to the JIRAM Ground Segment (Sign in using personal User_Id and Password)
2. Run **JSG** tool.
3. Select the JIRAM Raw Command File (**JRFC**) under consideration.
4. Export the JRFC to the local workstation.
5. Definition of the SASF timing format (relative or absolute time).
6. Translation of the Raw Commands and Parameters syntax into SASF format.
7. Generation of the SASF file.

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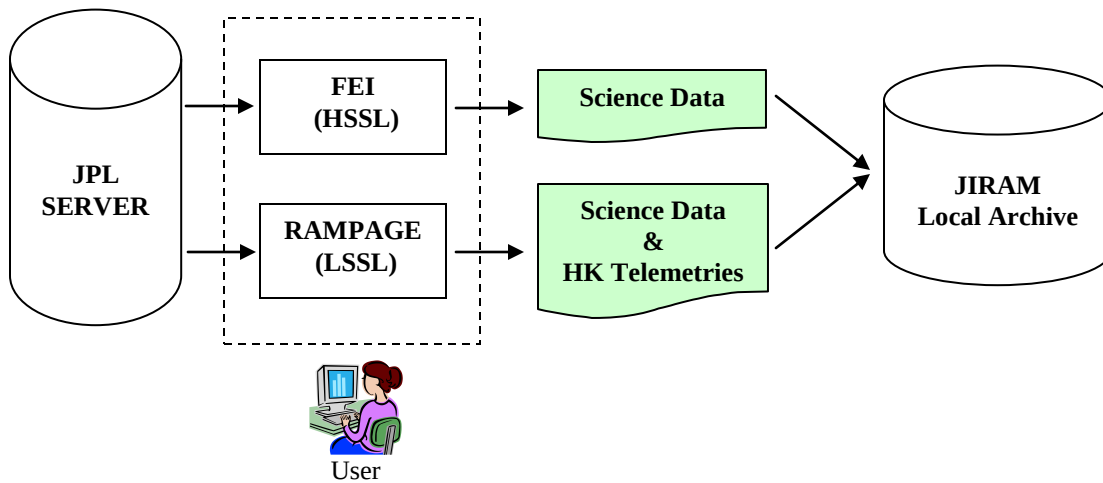
JIRAM Checking Tool Phase

8. Import the SASF file into the local directory of the JIRAM Checking Tool (**JCT**)
9. Risk Parameters and Tele-Commands Identification (if any).
10. Calculation of Power consumption and Data Volume Profiles.
11. Verification of the instrument Hardware Performances.
12. Verification of the instrument Science Performances.
13. Verification of the instrument Flight Rules.
14. Verification of the overall SASF timing.
15. SASF Syntax Check
16. Storage of the approved SASF file into the JIRAM local Archive.
17. Login to the JPL DOM server (Sign in using personal User_Id and Password)
18. Publish of the SASF file into the DOM server.

3 DOWNLINK PROCEDURES

The downlink procedures involve JIRAM Science and Engineering Telemetries, as well as JUNO spacecraft housekeeping telemetries and SPICE kernels products. JIRAM is able transfer the collected data through two dedicated bus: HSSL and LSSL. Depending on the selected BUS, data products are respectively retrieved by the File Exchange Interface (FEI) for HSSL and RAMPAGE for LSSL .

3.1 DATA DOWNLINK PROCEDURES



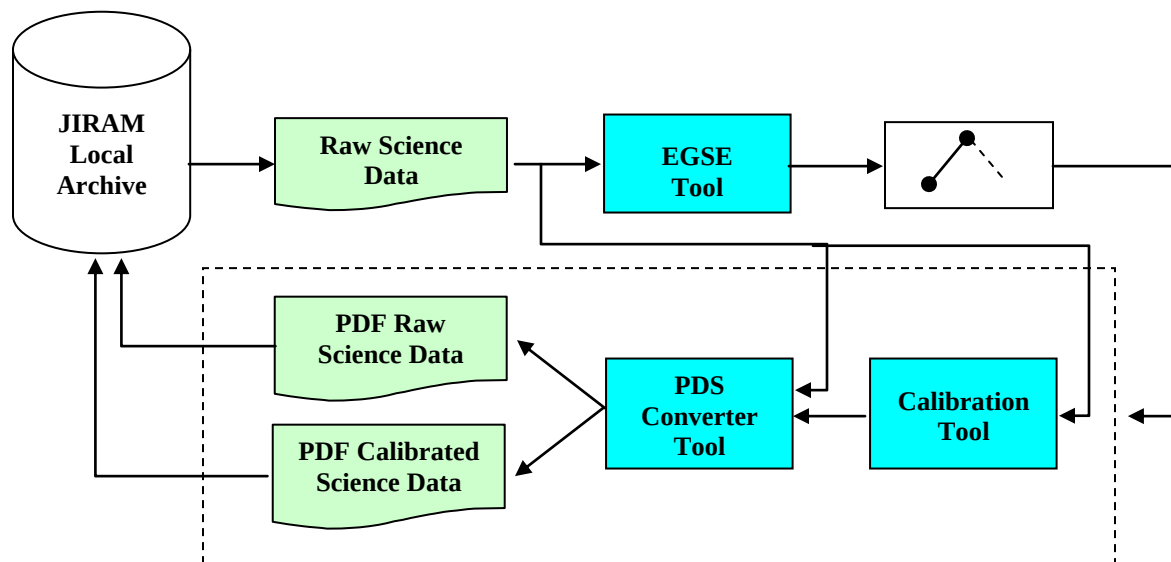
Support Tools: FEI, RAMPAGE (delivered by JPL)

Support Documents: [RD-06], [RD-07]

Main Items List:

1. Login to FEI
2. Sign in using JIRAM team name and corresponding password.
3. Selection of the server of interest (ATLO, STL, TEST,...) from which to download the files.
4. Selection of the Science Data Download utility (HSSL) in the temporal range of interest.
5. Export the files to the JIRAM local Archive.
6. Access the Rampage web page (<https://jnorampage.fltops.jpl.nasa.gov>).
7. Sign in using personal User_Id and Password.
8. Selection of the server of interest (ATLO, STL, TEST,...).
9. Selection of the available Query forms (Channel Query form or APID Query form)
10. Population of the Query Time Parameters.
11. Selection of the Items to be downloaded.
12. Storage of the Data into the JIRAM local Archive.

3.2 DATA PROCESSING PROCEDURES



Support Tools: EGSE (delivered by GA). PDS Converter. Calibration Tool

Support Documents: [RD-06], [RD-09]

Main Items List:

1. Run and login the EGSE tool (Sign in using personal User_Id and Password)
2. Access the data to be processed from the JIRAM Local Archive.
3. Definition of the Checks to be performed:
 - a. Quality verification of JIRAM HK and SCIENCE telemetry
 - b. Check of the Executed Commands.
 - c. Reconciliation of the executed commands by JIRAM with the command contained in the SASF file.
4. Check of the log file generated by EGSE with the Checks Results (previous bullet 3.)
5. Execution of the DPS conversion and Storage into the JIRAM Local Archive (data not yet processed).
6. Calibration and Processing of the PDS raw products (data processed).
7. Storage of the processed PDS products into the JIRAM local archive.

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3.3 PDS DELIVERY PROCEDURES

Support Tool: NA

Support Documents: NA

Main Items List:

1. Login to **JSOC Staging Server** (<https://jsocstg1.swri.edu>)
2. Sign in using personal JSOC user name and corresponding password.
3. Login to JIRAM Local Archive and select the PDS products to be delivered.
4. Upload of the PDS files into the JSOC server.
5. Collecting (via e-mail) the Validation Results.