



Project Document

**Operational Day Logging Tools
Requirements**

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Page: 1 of 9



SUBJECT: **Operational Day Logging Tools Requirements**

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CHANGE RECORD

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TABLE OF CONTENTS

TABLE OF CONTENTS2

1. INTRODUCTION3

1.1 SCOPE3

1.2 STRUCTURE OF DOCUMENT.....3

2. MAIN AIMS3

3. THE HEALTH MONITOR REPORT LOGS AND SUMMARY3

3.1 THE GENERAL EVENTS LOGS4

3.2 THE PROBLEMATIC EVENTS LOGS.....4

3.3 THE OUT-OF-LIMITS LOG4

3.4 THE TRANSPARENT PACKETS LOG4

3.5 THE COMMAND VERIFICATION REPORT LOG5

3.6 THE COMMAND VERIFICATION FAILURE LOG5

3.7 THE SUMMARY LOG5

4. THE OBSERVATION LOG6

4.1 SOURCE PARAMETERS6

4.2 OBSERVING MODE PARAMETERS.....6

4.3 DETECTOR PARAMETERS.....7

4.4 STATUS FLAGS7

4.5 COMMENTS7

5. OUTPUT FORMAT.....7

6. CALLING PROCEDURE8

7. CONNECTIONS AMONG LOGS8

8. EXAMPLE FORMAT FOR THE OBSERVATION LOG.....9



INTRODUCTION

1.1 Scope

This document describes the requirements for health monitoring and operational day logging tools to be run during SPIRE operations. The contents of the log and output are defined.

1.2 Structure of Document

First the main aims are presented, and then the requirements for health monitoring and operational day logging. Finally, the output format and calling procedure are defined and also some desirable connections between logs detailed.

2. MAIN AIMS

We need to produce a log of each operational day during the mission to enable people within the ICC to determine what observations were performed, at what times and with what parameters, and also when errors and anomalies occurred.

This will enable the ICC to

- Quickly determine what happened in each operational day
- Understand the sequence of observations performed
- Check parameters and positions of observations
- Easily find relevant data for processing/analysis
- Quickly find all observations made using the same mode
- Identify observations with errors and events

This will be achieved by writing 3 logging reports:

- Health monitor logs (containing details of errors and anomalies)
- A health summary report for each day (summarising the above logs)
- An observation log (similar to that used for PFM testing)

The output format should initially be a simple ascii file produced for each operational day. These should be combined into an overall log. They could also be entered into a database with user interface for queries – web interface? SQL, Microsoft Access. The logs should also be saved as Products within the database.

3. THE HEALTH MONITOR REPORT LOGS AND SUMMARY

This log will provide information on aspects related to instrument health, including:

- Events;
- Out-of-limits occurrences;
- Transparent packets;
- Command execution failures.

The software producing the log will analyse telemetry data from SPIRE to create the following output files:

- 3.1 One log with all events, including step reports and signalling and clearing of error conditions;
- 3.2 One log including only “problematic” events, i.e. signalling and clearing of error conditions;
- 3.3 One log with all out-of-limits occurrences;
- 3.4 One log with any “transparent packets” events;
- 3.5 One log with all command verification reports (type 1, any subtype);



- 3.6 One log with only command verification acceptance/execution failures (type 1, subtype 2, 8);
- 3.7 A summary report giving how many anomalies of each kind were registered in the time interval considered. There will be a grand total for the whole interval and then a list of values per operational day.

The columns inside each log are described in the sections below.

3.1 The general events logs

- Event identification (made by hex event ID and SID, structure ID);
- Brief event name (taken from OBS manual)
- Date
- Time
- OBSID
- BBID
- Parameters (list of hex values)

3.2 The problematic events logs

- Event identification (made by hex event ID and SID, structure ID);
- Brief event name (taken from OBS manual)
- Date
- Time
- OBSID
- BBID
- Parameters (list of hex values)

3.3 The out-of-limits log

- Date
- Time
- OBSID
- BBID
- Parameter name
- Type of event (one character, O for a value going out of limits, B for a value coming back into limits)
- Type of limit (one character, S for soft and H for hard limit)

To be determined: do we also give a difference between the actual parameter and the limit? If yes, how do we measure it? Do we give the max/mean/median value over the out-of-limit time period?

3.4 The transparent packets log

The DPU receives science data frames from the DCU (detectors), MCU (mechanisms) and SCU (subsystems). Each data frame specifies its length and frame ID in its first few parameters. However, if a data frame gets corrupted for some reason and there is a mismatch in the length/ID, the DPU dumps the entire frame into a "transparent packet" (without further processing).

- Date
- Time
- OBSID
- BBID
- Type of packet (MCU, DCU or SCU)



3.5 The command verification report log

- Date
- Time
- OBSID
- BBID
- Command report type and subtype
- Command name
- Command parameters? How should they be stored in the log?

3.6 The command verification failure log

- Date
- Time
- OBSID
- BBID
- Command report type and subtype
- Command name
- Command parameters? How should they be stored in the log?

3.7 The summary log

This log will have, for the operational day selected (or any custom time interval) the form of a table with the following columns:

- Start date
- Start time
- End date
- End time
- Total number of events
- Number of events of type (5, 1)
- Number of events of type (5, 2)
- Number of events of type (5, 4)
- Total number of out-of-limits occurrences
- Number of “hard” out-of-limits
- Number of “soft” out-of-limits
- Total number of transparent packets received
- Number of MCU transparent packets
- Number of DCU transparent packets
- Number of SCU transparent packets
- Number of command failures

When the time interval covers more than one operational day, the first row will display a grand total for the whole period, while the following rows will have data for each operational day (or fraction of day). This will also be the format of the overall log.

To be determined:

- Do we include back-into-limits events as well?
- Does the overall log need more summary rows, i.e. for a whole week or month?
- Does the overall log need *finer* summary rows, e.g. per OBSID?



4. THE OBSERVATION LOG

This log will report the parameters of each observation performed, recording information about:

- Source parameters
- Observing mode parameters
- Detector parameters
- Status flags
- Comments

These parameters will allow members of the ICC to determine all necessary information about what has been observed. They will also allow searches for certain observations if the log is imported into some kind of database. When a parameter is not constant through an observation (e.g. bias for a load curve, or position for a Solar System Object) the value will be set to “var”. When a column is not applicable, the value will be set to “N/A”.

4.1 Source Parameters

- Source Name (as entered by the observer)
- Position/pointing

Source Positions

We need to give the position of the observation on the sky. There are several choices of position that could be given:

- The position of the source from the catalogue – problem is that not all observations will have a source defined (PCAL) and some observations may have an offset from the source position and so not actually be observed at these coordinates.
- The actual position used for the centre of the observation (e.g. centre of map for scan map).
- The first pointing position used in the observation. This would give the actual pointing at the start of each observation and would not depend on the observing mode or if a source had been defined.

4.2 Observing Mode Parameters

- OBSID (in hex)
- Date (dd-mm-yyyy)
- Start Time (UTC)
- End Time (UTC)
- Observation Mode (POF1, POF2 etc..)
- Number of Repetitions requested in HSpot (ie. a measure of on-source time)
- Size of map (if mapping AOT, e.g. “4’x7’”, otherwise “single” for pointed observations or “small” for 64 point jiggle)
- Spectrometer specific parameters
 - Spectral resolution (L, M, H or L+H)
 - Spatial sampling (S, I or F)
- Photometer specific parameters
 - Scan speed (nominal, fast, or exact value)

Additional parameters that may be needed are SCAL temperature, SMEC start and end positions, SMEC speed and whether photometer cross scanning was used. These could be added in a Comments field.



4.3 Detector Parameters

- Bias Amplitude (4 columns: SW, MW, LW, TC – for the spectrometer the MW and TC columns will be “N/A”)
- Bias Frequency (one value for all arrays)
- Sampling Rate (one value for all arrays)
- Phase (4 columns: SW, MW, LW, TC – for the spectrometer the MW and TC columns will be “N/A”)
- Vss (may be removed later in routine phase when its value is fixed)

4.4 Status flags

- Observation status (completed or aborted)
- Quality Control status (an indication of quality control information – may not be possible if the log is generated before data have been processed through the pipeline)
- Error status (reflection of events and errors derived from the Health Monitor log)

4.5 Comments

These could include any extra parameters that are not already included in columns. For example scan start/end and scan speed for spectrometer, SCAL temperature, or “cross scanning” (or not) for photometer.

Most of the information to fill the observation log is recorded in the Housekeeping. The remaining information comes from what the Observer entered into HSpot. The Science data is not required. Therefore, the log can be created as soon as all ordered housekeeping telemetry for the observational day has been ingested into the database at RAL.

The housekeeping values required should have been converted into physical units. This should be done using the QLA conversion tables.

The additional data that is not in housekeeping (e.g. observational mode parameters) will be read from the HSpot input information – there will be a way to read this information for the pipeline. The same method should be used for this log.

5. OUTPUT FORMAT

- 5.1 The output format of the health monitor logs and observation log will be comma separated variable (CSV) ascii files with fixed width columns. This will enable them to be both human readable and easily imported into Excel or a database.
- 5.2 A separate file for each day will be produced. These will be combined into an overall log file containing a much longer timescale. If necessary, the combined log could be separated into several sections if it would be too large a file with the entire mission in.
- 5.3 Each log should also be formatted as a TableDataset and saved as a Product. This will enable it to be read and queried within the HCSS using the Product Access Layer.



6. CALLING PROCEDURE

- 6.1 Scripts to produce the health and observation logs will be called to run on each operational day after all of the relevant data has been received for that day. They will run by querying the database at RAL. They are required to work under Linux so that they can reside as a process on one of the database machines.
- 6.2 Due to the uncertainty in length of the operational day, the scripts cannot be run automatically as CRON jobs at the same time every day. Either they must be started by the operator, or involve some kind of listener to only start once the data have been successfully received into the RAL database.
- 6.3 It should also be possible to start the script with a manually specified time range.
- 6.4 When running automatically, each log script should check that it does not write the same information multiple times in the overall combined log. This means that if it was run twice for the same day, it would not add the results of the second time to the combined log.

7. CONNECTIONS AMONG LOGS

- 7.1 The contents of the main observation log should be easily cross checked with the contents of the Health Monitor Report logs and any other daily logs. Therefore at least one of the columns will need to be reproduced in all logs, e.g. OBSID, time.
- 7.2 If possible, there should be a common logging toolbox of methods that are needed for the main log and also the Health Monitor Report logs and other logs. For example the script to combine daily logs into a single overall log could be used by both.
- 7.3 If possible, methods and classes developed for trend analysis should be used for querying and retrieving data from the database.



8. EXAMPLE FORMAT FOR THE OBSERVATION LOG

| Status | OBSID | ObsMode | Rep | Source | RA | Dec | date | startTime | endTime | BiasAmp ,SW | BiasAmp ,MW | BiasAmp ,LW | BiasAmp ,TC |
|--------|------------|------------|--------|----------------|---------------|---------------|-------------|-----------|-----------|----------------|----------------|----------------|----------------|
| 1 | ,0x0000001 | ,SOF1 | ,100 | ,Neptune | ,var | ,var | ,22-11-2007 | ,00:00:00 | ,04:00:39 | ,31 | ,N/A | ,31 | ,N/A |
| 1 | ,0x0000002 | ,SOF1 | ,240 | ,Titan | ,var | ,var | ,22-11-2007 | ,00:00:00 | ,09:20:39 | ,31 | ,N/A | ,31 | ,N/A |
| 1 | ,0x0000003 | ,SOF1 | ,2H;2L | ,IC59-S5 | ,0h57m24.00s | ,+61d09m30.0s | ,22-11-2007 | ,00:00:00 | ,00:10:13 | ,31 | ,N/A | ,31 | ,N/A |
| 1 | ,0x0000004 | ,SOF1 | ,4H;9L | ,IRAS04191_int | ,4h22m03.47s | ,+15d42m51.0s | ,22-11-2007 | ,00:00:00 | ,00:16:27 | ,31 | ,N/A | ,31 | ,N/A |
| 1 | ,0x0000005 | ,SOF2 | ,3 | ,Cas A | ,23h23m24.00s | ,+58d44m54.0s | ,22-11-2007 | ,00:00:00 | ,05:09:43 | ,31 | ,N/A | ,31 | ,N/A |
| 1 | ,0x0000006 | ,SOF1 | ,2 | ,Sh241MHII | ,6h04m00.00s | ,+30d15m00.0s | ,22-11-2007 | ,00:00:00 | ,00:09:22 | ,31 | ,N/A | ,31 | ,N/A |
| 1 | ,0x0000007 | ,POF2 | ,1 | ,Wild 2 | ,var | ,var | ,22-11-2007 | ,00:00:00 | ,00:09:36 | ,31 | ,31 | ,31 | ,31 |
| 1 | ,0x0000008 | ,POF3 | ,15 | ,NGC 3640 | ,11h21m06.85s | ,+31d4m05.4s | ,22-11-2007 | ,00:00:00 | ,01:56:24 | ,31 | ,31 | ,31 | ,31 |
| 1 | ,0x0000009 | ,POF5 | ,40 | ,A1835 | ,14h01m02.00s | ,+25d1m30.0s | ,22-11-2007 | ,00:00:00 | ,03:43:12 | ,31 | ,31 | ,31 | ,31 |
| 1 | ,0x000000A | ,POF5 | ,2 | ,Lockman-SWIRE | ,10h45m00.00s | ,+58d00m00.0s | ,22-11-2007 | ,00:00:00 | ,06:39:00 | ,31 | ,31 | ,31 | ,31 |
| 1 | ,0x000000B | ,POF5 | ,2 | ,Lockman-SWIRE | ,10h45m00.00s | ,+58d00m00.0s | ,22-11-2007 | ,00:00:00 | ,06:39:00 | ,31 | ,31 | ,31 | ,31 |
| 1 | ,0x000000C | ,LoadCurve | ,1 | ,BlankSky01 | ,14h01m02.00s | ,+25d1m30.0s | ,22-11-2007 | ,00:00:00 | ,00:20:00 | ,var | ,var | ,var | ,var |

| BiasFrg | sample | Phase ,SW | Phase ,MW | Phase ,LW | Phase ,TC | Vss | Map ,Size | Spec ,Res | Spec ,Sampl | Phot ,scan speed | QC | Comments |
|---------|--------|--------------|--------------|--------------|--------------|------|--------------|--------------|----------------|---------------------|----|--|
| 161 | ,81 | ,185 | ,N/A | ,190 | ,N/A | ,2.0 | ,single | ,H | ,S | ,N/A | ,0 | ,start=0.2 mm; end=15.5 mm; Spd=0.4 mm/s |
| 161 | ,81 | ,185 | ,N/A | ,190 | ,N/A | ,2.0 | ,single | ,H | ,S | ,N/A | ,0 | |
| 161 | ,81 | ,185 | ,N/A | ,190 | ,N/A | ,2.0 | ,single | ,H+L | ,S | ,N/A | ,0 | |
| 161 | ,81 | ,185 | ,N/A | ,190 | ,N/A | ,2.0 | ,single | ,H+L | ,S | ,N/A | ,0 | |
| 161 | ,81 | ,185 | ,N/A | ,190 | ,N/A | ,2.0 | ,8"x8" | ,M | ,I | ,N/A | ,0 | ,SCAL2T=4.8 K; SCAL4T=4.8 K |
| 161 | ,81 | ,185 | ,N/A | ,190 | ,N/A | ,2.0 | ,single | ,H | ,S | ,N/A | ,0 | |
| 131 | ,19 | ,182 | ,183 | ,183 | ,183 | ,2.0 | ,single | ,N/A | ,N/A | ,N/A | ,0 | |
| 131 | ,19 | ,182 | ,183 | ,183 | ,183 | ,2.0 | ,small | ,N/A | ,N/A | ,N/A | ,0 | |
| 131 | ,19 | ,182 | ,183 | ,183 | ,183 | ,2.0 | ,4"x4" | ,N/A | ,N/A | ,nominal | ,0 | |
| 131 | ,19 | ,182 | ,183 | ,183 | ,183 | ,2.0 | ,180"x120" | ,N/A | ,N/A | ,0 | ,0 | |
| 131 | ,19 | ,182 | ,183 | ,183 | ,183 | ,2.0 | ,180"x120" | ,N/A | ,55"/s | ,0 | ,0 | |
| 131 | ,19 | ,182 | ,183 | ,183 | ,183 | ,2.0 | ,single | ,N/A | ,N/A | ,N/A | ,0 | |