SUBJECT: **OOL Data**
Interface Control Document

PREPARED BY: M. J. Graham

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APPROVED BY: ……. **Date:** …….

Agreed By		**Date**
HIFI EGSE Manager	L. Dubbeldam	
HIFI ICC Manager	P. Roelfsema	
PACS EGSE Manager	E. Wiezorrek	
PACS ICC Manager	O. Bauer	
SPIRE EGSE Manager	J. Payne	
SPIRE ICC Manager	K. King	
ESA HSC Manager	J. Riedinger	
ESA AIV Manager	TBS	

Distribution

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Change Record

ISSUE	DATE	
0.1 draft	24 November 2001	Original version
0.2 draft	25 January 2002	Incorporated comments from SPIRE, HIFI, PACS and ESTEC regarding: IST generation, time formats, offline delivery, XML, file naming.
0.3 draft	26 February 2002	Slight changes to lengths of fields for compatibility with Logica development
1.0	30 October 2002	First official release

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Glossary

1. INTRODUCTION

1.1 Purpose

This document specifies the structure and contents of Out Of Limits (OOL) record file (ORF) as expected by the Herschel Common Science System (HCSS) in all mission phases: ILT, IST and Ops.

1.2 Scope

This document corresponds to ICD#3 in the list of ICDs [**RD3**].
This ICD is applicable to all phases of the Herschel missions: all of ILT, IST and Ops.
This ICD defines the ORF file format only and does not cover the control aspects related to the file generation or ingestion into the HCSS: file generation in ILT is covered by [**RD7**].

1.3 Applicable Documents

AD1	Herschel Ground Segment Design Description Document	FIRST/FSC/DOC/0146	1.1	10 December 2001
AD2	Herschel Ground Segment IRD	FIRST/FSC/DOC/0117	2.0	6 December 2001

1.4 Reference Documents

RD 1	HCSS User Requirements Document	FIRST/FSC/DOC/0115	2.0	3 May 2001
RD 2	FIRST Common Science System: Use Case Definitions	FIRST/FSC/DOC/0158	1.0	7 November 2000
RD 3	Ground Segment List of ICDs	FIRST/FSC/DOC/0150	1.0	24 November 2000
RD 4	SCOS-2000 Out of Limits Display Operator User Manual	S2K-MCS-SUM-2220 -TOS-GCI	1.1	17 July 2000
RD 5	IMCS MADDS-A/MADDS-B Interface Control Document	IMCS-MADDSA-MADDSB-ICD-001	Draft	10 May 2000
RD 6	MIB Format Interface Control Document	SPIRE-MCS-ICD-0001 -TOS-GCI	4.2	1 December 2000
RD 7	HCSS-RTA Interface Interface Control Document	SPIRE-ICS-DOC-000975	1.0	30 October 2002

1.5 List of Acronyms

AD	Applicable Document
CCS	Central Checkout System
DDID	Data Delivery System ICD
EGSE	Electrical Ground Segment Engineering
HCSS	Herschel Common Science System
IA	Interactive Analysis
ICD	Interface Control Document
ILT	Instrument Level Test
IST	Instrument System Test
MIB	Mission Information Base
MOC	Mission Operations Centre
OOL	Out Of Limits
ORF	OOL Record File
QLA	Quick Look Analysis
RD	Reference Document
RTA	Real-Time Assessment
SCOS	Spacecraft Operating System
TBC	To be confirmed
TBW	To be written
TC	Telecommand
TM	Telemetry

2. OPERATIONAL ASSUMPTIONS AND CONSTRAINTS

2.1 Communications

N/A

2.2 Hardware

N/A

2.3 Software

The expected introduction of XML in 2002/03 is not anticipated to have any impact on binary format data such as that covered in this ICD.

2.4 User

N/A

2.5 Timing

N/A

3. REQUIREMENTS

3.1 Functional Requirements

These requirements have been extracted from the Ground Segment IRD (see [**AD1**]).

IR-3.1-470: The MOC shall make available the instruments parameters OOL information for a given operation period. *The HSC may be using this data for the purpose of observation quality control. It will make it available to the ICCs. An ICC will use OOL information for monitoring their instruments. The MOC will make available the list of instrument parameters out of limits (soft & hard) for a given operation period. OOL data are only relevant for HK TM parameters including derived parameters.*

IR-3.1-475: The HSC shall pull OOL data from the MOC. *The OOL data will be delivered with the flow of consolidated TM as separate packets.*

IR-3.1-480: The MOC shall make available to the HSC the instrument parameters OOL for a given operational period at the same time as the instrument consolidated HK TM for this period.

IR-4.4-40: The RTA shall make available to the HCSS its logs for any given testing period.

IR-4.4-50: The HCSS shall pull the RTA logs data from the RTA.

3.2 On-Line Delivery Requirements

In ILT and IST, the ORF will be delivered from SCOS-2000.
In Ops, the ORF will be retrieved from the DDS by HSC.

3.3 Off-Line Delivery Requirements

N/A

4. INTERFACE CHARACTERISTICS

4.1 Interface Location and Medium

This interface is applicable to the ORF, which is generated by the EGSE-ILT/MOC and delivered to the HCSS. In all cases, the ORF will be transferred as a file over a communication line (LAN for EGSE-ILT, WAN for Ops).

4.2 Hardware Characteristics and Limitations

N/A

4.3 Data Source, Destination and Transfer Mechanism

The data sources for the three mission phases are EGSE-ILT for ILT and IST (in the latter phase, the data will be produced by replaying the TM data to RTA/SCOS-2000 [**AD1**, **AD2** 4.4.2]) and MOC for Ops. The way in which the ORF is retrieved from the relevant data source is outside the scope of this ICD but is covered in [**RD7**] for ILT, TBD ICD for IST and DDID for Ops. An ORF will be exported to the HCSS from the data source when requested.

4.4 Node and Device Addressing

For ILT, see [**RD7**].

4.5 Relationship with other interfaces

For ILT, see [**RD7**].

5. ACCESS

5.1 Programs generating or using the Interface Data

The main program using the ORF is the HCSS OOLIngestor; however, there are no restrictions on other programs using it.

5.2 Failure Protection, Detection and Recovery Procedures

Any failure in transferring the ORF between the EGSE-ILT/MOC and the HCSS, e.g. timeout, will be detected when the ORF is processed by the HCSS (ingested). This will terminate the current processing including database transactions (rollback might be necessary) and reinitiate a for the ORF from the EGSE-ILT/MOC (see [**RD7**]).

5.3 File Naming Conventions

Although the ORF is a transient file, a naming convention is required to ensure that ORFs are not overwritten on the data source side by successive ORFs before they have been transferred to the HCSS (this applies primarily to ILT using HCSS v0.1). The following file naming convention will be applied to the ORF:

ORF_yymmdd_cccc.DAT

- yy is the year in which the data in the file start
- mm is the month in which the data in the file start
- dd is the day of the month on which the data in the file start
- cccc is a cyclic counter relating to files generated on the same day

5.4 Storage and File Deletion Requirements

The HCSS database should be sufficient space to contain all OOL data, i.e. for the entire mission.

5.5 Security Requirements

Servers must be kept up-to-date with the latest security patches, especially if not protected by a firewall. An unauthorised user must not be able to modify the ORF in any way (checksumming could aid in detecting this). Note that ftp is not a secure method of data transfer.

5.6 Data Integrity Checks

As mentioned in section 5.2, processing of the ORF by the HCSS will detect any data integrity problems.

5.7 Backup Requirements

Once ingested, OOL data are backed up as part of the HCSS database nominal back-up.
An ORF can be reconstructed from EGSE-ILT/CCS/MOC but this will certainly be limited in time.
This constrains the HCSS to ingest all OOL data.

5.8 Input / Output Protocols, Calling Sequence

For ILT, this will be defined in [**RD7**]; for IST, this is defined as part of a TBD ICD; and for Ops, this will be defined as part of the DDID.

5.9 Synchronisation Requirements

- A locking mechanism must be used to prevent data being extracted from the database whilst it is in the process of being written or modified to prevent a partially written ORF being transferred to the HCSS (see [**RD7**]).

5.10 Error Handling

See section 5.2.

6. DETAILED INTERFACE SPECIFICATION

6.1 Data Structure

The data passed via the ORF interface is all file-based.

6.2 Generation Method

The ORF is generated by a specific application running in the EGSE-ILT/MOC following a request from the HCSS. Each file covers a specific time window reported in the file header in terms of both its start and end timestamps.

6.3 Data passed across the interface – direction of transfer

This ICD deals solely with the data passed from the EGSE-ILT/MOC to the HCSS. The data passed is made up of the ORFs.

6.4 Size and Frequency of Transfers

It is envisaged that one ORF per operation period will be produced Ops; during ILT and IST, this might not be the case.

7. DATA DEFINITION

This section defines the characteristics of the ORF.
The ORF shall be a collection of OOL event packets generated for each state transition during a time defined in the ORF header.
The MIB version used to generate a particular OOL event packet can be retrieved from the HCSS based on the release time in the ORF header record.

7.1 File characteristics

The ORF is a binary file consisting of a header record and a variable number of OOL event packets, each of which consists of a list of records, arranged in time ascending order. Network-order byte ordering (MSB first) is to be used.

7.2 Header Record

The header record reports general information about the contents of the file and is stored at the beginning of the file. The header has the following structure and information:

Table 1 – ORF Header Record Structure

No.	Field Title	Octet	Type	Description
0	1st OOL packet time	0-7	Time format	Release time of the first OOL event packet included in the file
1	Last OOL packet time	8-15	Time format	Release time of the last OOL event packet included in the file
2	Number of OOL packets	16-19	32 bit integer	Number of OOL event packets in the ORF
	Total Length	20		

7.2.1 Time Format

The time format used is the Sun MJT, as standard on Sun Solaris UNIX platforms. The format is two 32 bit integers. The first contains the number of seconds since 00:00, 1st January 1970 and the second integer the number of microseconds:

Octet	Type	Description
0-3	32 bit integer	Seconds since epoch (00:00, 1st January 1970)
4-7	32 bit integer	Additional microseconds from seconds in first field

7.3 OOL Packet

OOL event packets are generated for each state transition within the time window covered by the file. If the limit checker is configured to generate an updated OOL packet, when any of the parameters

have a value changed, then there are additional OOL packets generated with a minimum time of difference.
An OOL packet contains a list of records and has the following structure:

Table 3 – OOL Packet Structure

No.	Field Title	Octet	Type	Description
0	Number of records	0-1	16 bit integer	The number of records in the OOL packet
1	Spacecraft	2-3	Characters	Spacecraft
2	Record 1	4-?	Record	1st record
3	Record 2	?	Record	2nd record
…	Record …	?	Record	…th record
n+1	Record n	?	Record	nth record
	Total Length			

Each record can be a:
- Limit record
- Status Consistency record (the parameter has not changed unless as a result of a TC)
- State record (the parameter is constant all the time)

7.3.1 Limit record

This record is built for the parameters with parameter limit values and has the following structure:

Table 4 – Limit Record Structure

No.	Field Title	Octet	Type	Description
0	Type	0	8 bit integer	Record type (0)
1	OOL time	1-8	Time format	The time when the parameter was found to be out of limits
2	Value time	9-16	Time format	Time of value
3	Name	17-24	Characters	Name of the parameter as appearing in the MIB
4	Behaviour number	25-28	32 bit integer	Behaviour in BEHV subsystem
5	Parameter state	29-30	16 bit integer	Parameter state in BEHV subsystem (0 = nominal, 1 = warning, 2 = out of limits, 3 = SCC)
6	String state	31-32	16 bit integer	String state in BEHV subsystem
7	State	33-41	Characters	Description of parameter state (“LOW LOW”, “LOW”, “HIGH”, “HIGH HIGH”)
8	Value	42-55	Value	Parameter value

9	Low limit	56-69	Value	Low limit of parameter
10	Upper limit	70-83	Value	Upper limit of parameter
	Total Length	84		

The reference file is BEHVoolLimitRecord in the BEHV subsystem (from [**RD5**]).

7.3.2 Status Consistency record

This record is built for the parameters where the status consistency checking is defined and has the following structure:

Table 4 – Status Consistency Record Structure

No.	Field Title	Octet	Type	Description
0	Type	0	8 bit integer	Record type (1)
1	OOL time	1-8	Time format	The time when the parameter was found to be out of limits
2	Value time	9-16	Time format	Time of value
3	Name	17-24	Characters	Name of the parameter as appearing in the MIB
4	Behaviour number	25-28	32 bit integer	Behaviour in BEHV subsystem
5	Parameter state	29-30	16 bit integer	Parameter state in BEHV subsystem (0 = nominal, 1 = warning, 2 = OOL, 3 = SCC)
6	String state	31-32	16 bit integer	String state in BEHV subsystem
7	State	33-41	Characters	Description of parameter state (“LOW LOW”, “LOW”, “HIGH”, “HIGH HIGH”)
8	Value engineer	42-55	Value	Parameter engineering value
9	Low limit engineer	56-69	Value	Low limit of parameter (engineering value)
10	Upper limit engineer	70-83	Value	Upper limit of parameter (engineering value)
	Total Length	84		

The reference file is BEHVoolLimitRecord in the BEHV subsystem (taken from [**RD5**]).

7.3.3 State record

This record is built for the parameters with a list of defined states and has the following structure:

Table 5 – State Record Structure

No.	Field Title	Octet	Type	Description

0	Type	0	8 bit integer	Record type (2)
1	OOL time	1-8	Time format	The time when the parameter was found to be out of limits
2	Value time	9-16	Time format	Time of value
3	Name	17-24	Characters	Name of the parameter as appearing in the MIB
4	Behaviour number	25-28	32 bit integer	Behaviour in BEHV subsystem
5	Number of values	29-30	16 bit integer	Number of values
6	Parameter state	31-32	16 bit integer	Parameter state in BEHV subsystem (0 = nominal, 1 = warning, 2 = OOL, 3 = SCC)
7	Value	33-46	Value	Parameter value
	Total Length	47		

The reference file is BEHVoolStatusRecord in the BEHV subsystem (taken from [**RD5**]).

7.3.4 Value format

Values are specified as Char(14) [**RD6**] as they can be raw integer, engineering values, or strings depending on context.