SUBJECT: **TC History Interface Control Document**

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Change Record

ISSUE	DATE	
0.1 draft	September 2001	Original version
0.2 draft	30 October 2001	Comments from SPIRE, ESTEC incorporated
0.3 draft	25 January 2002	Updated references, file naming
1.0	30 October 2002	First released version

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Glossary

1. INTRODUCTION

1.1 Purpose

This document specifies the structure and contents of the TC History File (THF) 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#5 in the list of ICDs [**RD5**].
The ICD is applicable to all phases of the Herschel mission: all of ILT, IST and Ops.
This ICD defines the TCH 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 ICD#8 [**RD7**] and ingestion into the HCSS by the TCH TN [**RD2**].

1.3 Applicable Documents

AD1	FIRST Common Science System: Use Case Definitions	FIRST/FSC/DOC/0158	Issue 1.0	7 November 2000
AD2	Herschel Ground Segment Design Description Document	FIRST/FSC/DOC/0146	1.1	10 December 2001
AD3	Herschel Ground Segment IRD	FIRST/FSC/DOC/0117	2.0	6 December 2001

1.4 Reference Documents

RD1	HCSS User Requirements Document	FIRST/FSC/DOC/0115	Issue 2.0	3 May 2001
RD2	TC History Technical Note	SPIRE-ICS-NOT-000899	0.1	7 September 2001
RD3	INTEGRAL TC History File ICD	11775/96/D/IM	Issue A.1	11 December 2000
RD4	SCOS-2000 Command History Data Provision Services ICD	S2K-MCS-ICD-0008-TOS-GCI	Issue 1.2	7 August 2000
RD5	Ground Segment List of ICDs	FIRST/FSC/DOC/0150	1.0	24 November 2000
RD6	Trading-off technical solutions for Relating TC history and HCSS commanding	FSCDT/TN/014	0.1 draft	14 February 2001
RD7	ICD#8	SPIRE-ICS-DOC-	0.1 draft	25 January 2002

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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
HTTP	Hypertext Transfer Protocol
IA	Interactive Analysis
ICD	Interface Control Document
ILT	Instrument Level Test
IST	Instrument System Test
MOC	Mission Operations Centre
QLA	Quick Look Analysis
RD	Reference Document
RTA	Real-Time Assessment
SCOS	Spacecraft Operating System
TBC	To be confirmed
TC	Telecommand
THF	TC History File

2. OPERATIONAL ASSUMPTIONS AND CONSTRAINTS

2.1 Communications

N/A

2.2 Hardware

N/A

2.3 Software

N/A

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 [**AD2**]).

IR-3.1-300: The MOC shall make available to the HSC the TC history information for any given operational period. *The TC history information will include uplink and execution status of all the TCs uplinked for execution during the operational period. The TC history is made available to the ICCs in addition to the TC verification reports that are part of the instrument HK TM. The HSC is using this information to flag observations that were not commanded as scheduled. It will make it available to the ICCs. An ICC will use the TC history for instrument command verification purposes.*

IR-3.1-310: The TC history data shall include the necessary information for the HSC to be able to associate (when relevant) the TC to the instrument or S/C commanding requests in the corresponding observations schedule.

IR-3.1.320: The HSC shall request the MOC to make available TC history data for a given operational period.

IR-3.1.330: The HSC shall pull TC history data from the MOC.

IR-4.4-10: The RTA shall make available to the HCSS the TC history data for any given testing period.

IR-4.4-20: The TC history data shall include the necessary information for the HCSS to be able to associate (when relevant) the TC to the instrument or TE command mnemonics exported by the HCSS. *The TC history is expected to have the same format in ILT/IST as in Ops.*

IR-4.4-30: The HCSS shall pull the TC history data from the RTA.

These requirements have been extracted from the HCSS UCD (see **[AD1]**).

Func-Req-1: Ingestion of the THF involves verifying the TC history against observation executions and any inconsistencies should be detected and flagged.

3.2 On-Line Delivery Requirements

In ILT, the THF will be delivered from SCOS-2000.
In IST, the THF will be delivered from CCS in the format described in this ICD.

3.3 Off-Line Delivery Requirements

N/A

4. INTERFACE CHARACTERISTICS

4.1 Interface Location and Medium

This interface is applicable to the THF, which is generated by the EGSE-ILT/CCS/MOC and delivered to the HCSS. In all cases, the THF will be transferred as a file over a communication line (LAN for EGSE-ILT/CCS, 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, CCS for IST and MOC for Ops. The way in which the THF is retrieved from the relevant data source is outside the scope of this ICD but is covered in: ICD#8 for ILT, TBD ICD for IST and DDID for Ops.
A THF will be exported to the HCSS from the data source when requested.

4.4 Node and Device Addressing

For ILT, see ICD#8 [**RD7**]; other issues are addressed in the TN [**RD2**].

4.5 Relationship with other interfaces

For ILT, see ICD#8.

4.5.1 Database

This is outside the scope of this document (see **AD-1** and ICD#8 [**RD7**]).

5. ACCESS

5.1 Programs generating or using the Interface Data

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

5.2 Failure Protection, Detection and Recovery Procedures

Any failure in transferring the THF between the EGSE-ILT/CCS/MOC and the HCSS, e.g. timeout, will be detected when the THF is processed by the HCSS (ingested). This will terminate the current processing including database transactions (rollback might be necessary) and reinitiate a request for the THF from the EGSE-ILT/MOC (see ICD#8).

5.3 File Naming Conventions

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

THF_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 Detection Requirements

The HCSS database should have sufficient space to contain all TCs, 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 THF 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 THF by the HCSS will detect any data integrity problems.

5.7 Backup Requirements

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

5.8 Input / Output Protocols, Calling Sequence

For ILT, this will be defined in ICD#8; 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

See [**RD2**].

5.10 Error Handling

See section 5.2.

6. DETAILED INTERFACE SPECIFICATIONS

6.1 Data Structure

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

6.2 Generation Method

The THF is generated by a specific application running in the EGSE-ILT/CCS/MOC following a request from the HCSS. Information to be inserted in the THF is extracted from the TC history archives. Each file covers a specific time window reported in the file header in terms of both its start and end times and its length. The time window is configurable within the system. Note that the requirement (see 6.4) that a THF could contain all TCs from the mission lifetime imposes a constraint on the format used to express the time window: (HH:MM:SS) is insufficient as this is limits the time window that an individual THF could cover to 99:59:59 hours. The suggested format is HHHHH:MM:SS (TBC).

6.3 Data passed across the interface - direction of transfer

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

6.4 Size and Frequency of Transfers

It is envisaged that one THF per day will be produced on average in all phases.
The size of a THF can range from one TC to all TCs in the EGSE-ILT/CCS/MOC. Note that a request for **all** TCs from the start of the mission will not be supported by MOC (TBC).

7. DATA DEFINITION

This section defines the characteristics of the THF.
The THF shall be a collection of commanding data related to commanding sessions performed during a time defined in the THF header.
The information contained in the file includes for each command released by the system command characteristics and characteristics of each editable (at DB level) parameter associated to the command (if any).
TC history fields identified for ILT will be maintained for Ops but new fields could be added for Ops. The expected introduction of XML in 2002/03 is also expected to have an impact on the format of the THF.

7.1 File characteristics

The THF is an ASCII file consisting of a header record and a variable number of data records, each with a fixed format and length. Each record is terminated by a new-line character but field delimiters are not present within a record. All record fields have a fixed length, are left justified and blank padded.

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 - THF Header Record Structure

No.	Field Title	Field Offset	Field Length	Description
0	File Name	0	40	The name of the file (this field might vanish in subsequent versions)
1	1st TC time	40	21	Release time of the first command included in the file (YYYY.DDD.HH.MM.SS.SSS)
2	Last TC time	61	21	Release time of the last command inserted in the file (YYYY.DDD.HH.MM.SS.SSS)
3	Time window	82	11	Time window covered in the file. Format: HHHHH:MM:SS
	Total Length		93	

7.3 Data Records

For each command released within the time window covered by the file, there is at least a record reporting the characteristics of the command, a record encoding the command bit pattern and (optionally depending on the command) a number of records reporting the characteristics and value of all the editable parameters associated with the command.
There are three possible types of data record:

1. Command data record
   This describes the characteristics of the command.
2. Bit pattern record
   This encodes the bit pattern of the command.

3. Parameter data record
   This describes the characteristics of an editable command parameter.

The first field (a character) of a data record identities the type of record.

7.3.1 Command Data Record

A command data record is followed by a bit pattern record and then by 0 or *n* parameter data records.
The first data record of the file (after the header) is always a command data record.
A command data record consists of a description of the command characteristics and has the following structure and information:

Table 2 - THF Command Data Record Structure

No.	Field Title	Field Offset	Field Length	Description
0	Record Type	0	1	Type of data record within the THF: '**C**' => command data record
1	HCSS TCID	1	32	TC ID of command (unsigned 32-bit integer)
2	Name	33	11	Name of the command
3	Description	44	25	Description of the command
4	Sequence	69	9	Name of the originating parent sequence (if applicable)
5	Release Time	78	21	Time of command release (YYYY.DDD.HH.MM.SS.SSS)
6	Execution Time	99	22	Predicted time of command execution. For immediate commands this field shows the actual uplink time (based on packet TC responses from the station equipment) plus the propagation delay. For execution time-tagged commands, this field shows the execution time-tag.
7	Static PTV check	121	2	Static PTV Check State (**E** ⇒ **E**nabled, **D** ⇒ **D**isabled or **O** ⇒ **O**verridden)
8	Dynamic PTV check	123	2	Dynamic PTV Check State (**E** ⇒ **E**nabled, **D** ⇒ **D**isabled or **O** ⇒ **O**verridden)
9	CEV check	125	2	CEV Check State (**E** ⇒ **E**nabled or **D** ⇒ **D**isabled)
10	Group	127	2	Group flag value (**G** ⇒ in a group, **E** ⇒ last in a group or **blank**⇒ not in group (TBC))
11	Block	129	2	Block flag value (**B** ⇒ in a block, **E** ⇒ last in a block or **blank**⇒ not in block (TBC))
12	IL	131	3	Interlock Status, two characters, the first is the interlock type, the second, the interlock stage type. Interlock Type: 1. **L**⇒Local 2. **G**⇒Global 3. **S**⇒Subsystem local Interlock Stage Type: 1. **R**⇒Release from SCOS-2000 2. **G**⇒Ground Station reception acceptance 3. **T**⇒Uplink, a.k.a radiation 4. **O**⇒On-board reception acceptance, a.k.a. transfer 5. **A**⇒On-board application acceptance 6. **S**⇒Start of execution 7. **0,1,2,3,4,5,6,7,8,9**⇒Execution step 'n'

				8. **C**⇒Execution completion

No.	Field Title	Field Offset	Field Length	Description
13	Source Type	134	3	Source Type (**MS**⇒Manual Stack, **AS**⇒Auto Stack, **EX**⇒External Source)
14	Source	137	9	Source workstation ID, name or mnemonic
15	Update Time	146	22	Time the interlock/verification (TBC) status was last updated.
16	Verification Status	168	19	Verification status of the different verification stages for the command. A command may have up to 17 different verification types defined: 1. Release from SCOS-2000 2. Ground Station reception acceptance 3. Uplink, a.k.a radiation 4. On-board reception acceptance, a.k.a. transfer 5. On-board application acceptance 6. Start of execution 7. Execution step 0 8. Execution step 1 9. Execution step 2 10. Execution step 3 11. Execution step 4 12. Execution step 5 13. Execution step 6 14. Execution step 7 15. Execution step 8 16. Execution step 9 17. Execution completion Each verification stage may have one of the following statuses: **F**⇒Fail **S**⇒Success **P**⇒Pending **I**⇒Idle **T**⇒Time-out **U**⇒Unverified **X**⇒Unknown **blank**⇒N/A Each verification stage status is indicated by a single character in the field in the position corresponding to its verification type, i.e. release from SCOS-2000 status is the first character of the field, Ground Station reception acceptance is the second, etc.
	Total Length		187	

7.3.2 Bit Pattern Record

A bit pattern record contains a hex encoding of the TC bit pattern associated with the command and has the following structure and information:

Table 3 - THF Bit Pattern Record Structure

No.	Field Title	Field Offset	Field Length	Description
0	Record Type	0	1	Type of data record with the THF: '**B**' ⇒ bit pattern record
1	Bit pattern	1	512	Hex encoding of 256 octet (1 octet = 8 bits) TC bit pattern
		Total Length	513	

The TC bit pattern in the THF is not applicable to ILT (available via SCOS-2000 during ILT).

7.3.3 Parameter Data Record

A parameter data record has the following structure and information:

Table 4 - THF Parameter Data Record Structure

No.	Field Title	Field Offset	Field Length	Description
0	Record Type	0	1	Type of data record within the THF: '**P**'⇒parameter data record
1	Name	1	11	Name of the command parameter
2	Description	12	25	Description of command parameter. Currently not available, i.e. this field is blank.
3	Value Representation	37	9	Parameter value representation, i.e. whether the value shown in field no. 5 is a raw or engineering value (**Eng**⇒Engineering, **Raw**⇒Raw)
4	Radix	46	19	Value radix. Only applicable for unsigned integer raw values. (**Dec**⇒Decimal, **Hex**⇒Hexadecimal, **Oct**⇒Octal)
5	Value	65	88	Parameter value in representation specified in field no.3 and radix specified in field no. 4 (if applicable)
			Total Length	153