SPIRE ICC

User Requirements Document
for the
Common Uplink System (CUS)

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1.1 Purpose & Scope

This document defines those requirements put on the ICC by the need to be able to send commands to the instrument to carry out scientific, calibration and engineering observations. The Common Uplink System (CUS) is expected to provide the required functionality during all phases: from instrument testing on the ground through to the commissioning and routine phases. The CUS is a component of the Herschel Common Science System (HCSS). A more detailed description is given in Section 1.4.

1.2 Definitions of Terms and Acronyms

Listing of acronyms that are "unusual" to this URD

AIV	Assembly Integration and Verification
BB	Building Block
BBID	Building Block Identifier
DB	DataBase
CCS	Central Checkout System
EGSE	Electrical Ground Support Equipment
HGS	Herschel Ground Segment
HSC	Herschel Science Centre
HCSS	Herschel Common Science System
HCSSDT	HCSS Development Team (ESA +ICC's)
HSCDT	HSC Development Team (ESA)
ICC	Instrument Control Centre
ILT	Instrument Level Test
IST	Integrated System Test
MIB	Mission Information Base
OBS	On Board Software
OBSID	Observation Identifier
PV	Performance Verification
SCOS	Spacecraft Control Operations System
SPIRE	The Spectral and Photometric Imaging REceiver for Herschel
TC	TeleCommand
TM	TeleMetry
URD	User Requirement Document

In addition two web pages are available describing terms applicable to SPIRE
http://www.ssd.rl.ac.uk/spire/consortium/information/FIRSTacronyms.shtm
http://www.ssd.rl.ac.uk/spire/consortium/information/FIRSTdefinitions.asp
which are to be updated.

1.3 Related Documents

1.3.1 Applicable Documents

AD-1	SIRD (Herschel Science Operations Implementation Requirements Document)

1.3.2 Reference Documents

RD-1	HGSDD Herschel Ground Segment Design Description (FIRST/FSC/DOC/0146)
RD-2	SPIRE ICC URD Scope Document
RD-3	HCSS URD
RD-4	Herschel-HSC Actor list

RD-5 Technical Note on Observation and Building Block Identifiers for Herschel (ICC/2001-001)

1.4 Overview

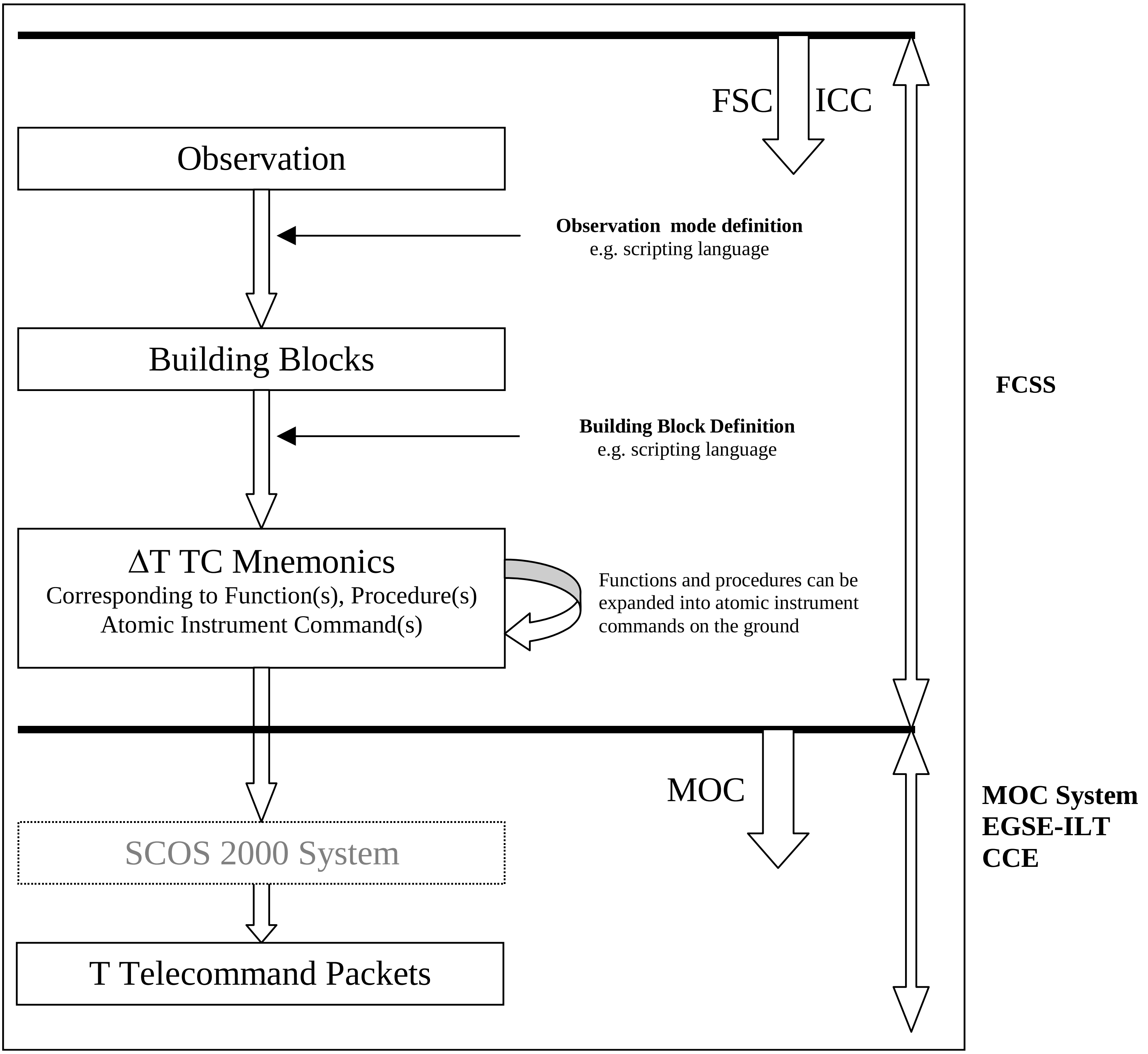
The Common Uplink System (CUS) allows the user to enter details of an observation to be performed (viz. an observation request) by the instrument and translates them into instrument commands which eventually get executed by the instrument. The CUS will use the same mechanism to define observation modes and building blocks (see definitions given below) for all types of observations. It could be an observation request originating from an astronomer, or it could be a calibration or an engineering observation request (e.g. instrument characterisation) from an instrument engineer or a calibration scientist. A scripting language will be used for this purpose.

The CUS component is expected to be identical for all three instruments on Herschel (apart from the actual contents of the CUS database of course). It will be developed jointly by the HSCDT and the ICC's for the HCSS (hereafter referred to as the HCSSDT).

Figure 1 shows the four abstraction levels of the CUS (see the HGSDD (RD-1) for further details). At the highest level is the *observation,* which could be a scientific, calibration or an engineering observation. The next level refers to *Building Blocks* (*BB's*), which are essentially a high level description of the *observation* in the user domain (e.g. perform_calibration, perform_scan, etc). The *BB's* themselves are scripted in the same language as an *observation.* The relative time-tagged *TC mnemonics*, occurring at the third abstraction level, are instrument commands. These first three levels of the CUS abstraction are within the scope of the overall HCSS. At the fourth level of abstraction, the TC mnemonics are translated into TC packets by SCOS 2000. This translation itself is achieved by referring to the MIB instrument database in ILT, IST and operations using the EGSE-ILT, CCS and MOC systems respectively. The TC packets, which are tagged with absolute times by SCOS-2000, can be executed by the OBS without any further expansion. It is important to note that during ILT the CUS will be used to generate instrument test sequences, calibration measurements and instrument characterisation measurements for input to the EGSE Test Facility Control System. For IST these test sequences and measurements will be supplied to the CCS without any interactive facility for modifications.

The CUS is therefore responsible for generating TC mnemonics for observations. It knows about the structure of an observation and how to break it down into a set of TC mnemonics.

Figure 1: The abstraction levels of the CUS



2 User Characteristics

The users of the CUS have been identified with the actor definitions given in the HCSS. These have been described elsewhere but their roles in the context of the CUS are briefly outlined below:

2.1 Instrument Engineer

The Instrument Engineer will provide the CUS database and generate observation modes.

2.2 Calibration Scientist

The Calibration Scientist will use the CUS to generate observation requests for calibrating the instrument**.**

2.3 Configuration Controller

The Configuration Controller will keep track of the various CUS databases and their status.

2.4 Astronomer

The Astronomer will use the CUS indirectly via the Proposal Handling System (PHS) to generate observation requests in astronomically meaningful terms (e.g. given signal-to-noise, integration times, etc).

3 Requirements

This section describes the actual requirements on the ICC by the CUS.

3.1 UR-CUS-100: Instrument Information

UR-CUS-110: Provision Of CUS DB Information

UR-CUS-110: It shall be possible to provide to the HSC all instrument information needed for the CUS.

Instrument information includes operating mode definitions, building block definitions, TC mnemonics, translation of TC's, sequences of commands for manual commanding by the MOC. The actual mechanism and data format of delivery to the HSC is TBD but is expected to vary depending on the information.

For manual commanding the sequences of commands will be delivered to the MOC via the FSC.

- **Source** [SIRD requirements: ICCF-050, 055, 060, 065]
- **Importance/Priority** [High]
- **Risk** [High]
- **Phase** [Mid ILT/Operations]

UR-CUS-120: CUS and Instrument Command Database

UR-CUS-120: It shall be possible to associate CUS commands with the low level instrument commands via a database.

CUS commands are uplinked to the instrument via the S/C CDMS which passes them on to the DPU. On receptiom the DPU OBS transmits these commands to the appropriate instrument sub-system. Within a sub-system each such command corresponds to low level commands which are executed sequentially to carry out the instrument operations. The required database associates these low level commands with the CUS commands.

- **Source** [SDS]
- **Importance/Priority** [High]
- **Risk** [High]
- **Phase** [Mid ILT/Operations]

UR-CUS-130: Telemetry Contents

UR-CUS-130: All the uplink TC information needed to associate it with the downlinked TM should be present within the TM itself.

The HGS design provides the concept of Observation Identifiers (OBSID's) and Building Block Identifiers (BBID's). The OBSID uniquely identifies an observation execution during all phases of the mission while the BBID divides up an individual observation execution into its key components. The HK and science TM packets form an observation will be tagged with these identifiers enabling packages such as IA and QLA to process the data easily. It is therefore important that the BB's in observations are defined to make the TM processing tasks as smooth and as self-reliant as possible. This requirement puts an explicit requirement on the instrument team.

- **Source** [SIRD requirement: ICCF-080]
- **Importance/Priority** [High]
- **Risk** [High]
- **Phase** [Mid ILT/Operations]

UR-CUS-140: Configuration Control

UR-CUS-140: It shall be possible to keep all the instrument information relevant to the CUS under configuration control.

The CUS DB needs to be kept under configuration control locally at the ICC as well as at the HSC.

- **Source** [SDS]
- **Importance/Priority** [Medium]
- **Risk** [Medium]
- **Phase** [Mid ILT/Operations]

3.2 UR-CUS-200: Installation and Testing

UR-CUS-210: Installation

UR-CUS-210: It shall be possible to install the CUS after delivery from the HCSS on a local system.

Resources will be available locally to take delivery, install and run the CUS component in the overall HCSS release. The most likely scenario is that the entire HCSS will be delivered to the ICC by the HCSSDT, including the CUS.

- **Source** [SDS]

- **Importance/Priority** [High]
- **Risk** [High]
- **Phase** [Mid ILT/Operations]

UR-CUS-220: Test facility for the CUS

UR-CUS-220: A test facility shall be available at the ICC to ensure that the CUS does not have any adverse effects on the instrument.

This test facility will perform preliminary checks on the CUS before being used on the instrument to carry out ground tests, calibrations and observations. Note that this requirement puts explicit requirements on the AIV programme and facility.

- **Source** [SDS]
- **Importance/Priority** [High]
- **Risk** [High]
- **Phase** [Mid ILT/Operations]

UR-CUS-230: Testing of observation modes

UR-CUS-230: It shall be possible to test and check an observation mode to ensure that it does not compromise the safety of the instrument.

An observation mode consists of a series of BB's. The ICC must test and validate these modes in such a way that the execution of one BB does not leave the instrument in a state in which the following BB cannot be executed. This could happen, for example, because either the instrument is not in the correct mode to continue observing or it has failed in some way.

To perform this task the CUS implementation at the ICC will need to support several CUS DB's.

- **Source** [SDS]
- **Importance/Priority** [High]
- **Risk** [High]
- **Phase** [Mid ILT/Operations]

3.3 UR-CUS-300: Problem reporting

UR-CUS-310: Problem reporting

UR-CUS-310: It shall be possible to send CUS problem reports to the CUS developers in the HCSSDT.

The ICC would need to communicate with the overall HCSSDT to ensure that all problems encountered are effectively reported. It is expected that this process will be handled seamlessly in the HCSS.

- **Source** [SDS]
- **Importance/Priority** [Medium]
- **Risk** [Medium]
- **Phase** [Early ILT/Operations]

3.4 UR-CUS-400: Access to the HSC system

UR-CUS-410: Access to the HSC system

UR-CUS-410: It shall be possible to access the HSC CUS system.

The ICC should have full network access to the HSC system to use the CUS implementation in the officially released CUS DB.

- **Source** [SDS]
- **Importance/Priority** [Medium]
- **Risk** [Medium]
- **Phase** [Early ILT/Operations]