HERSCHEL

SGS-MOC Operations Interactions Document

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Change Record

DOCUMENT STATUS SHEET			
1. DOCUMENT TITLE:			
Previous Issue	Previous issue date	New issue Date	Change Description
0.1 draft	3rd October 2006	17th May 07	Updates made to take into account actions from HGSSE : - Action 191206/13 closeout in section 4.2.2 Input email from R.Biggins10th Oct 06– section 3.2.3 Inclusion in section 3.2.1 the use of the ESOC ARTS system for S/C AR problem tracking Moved existing section 3.2.4 to 3.2.5 Created Section 3.2.4 on Radiation monitor data exchange with the ESA space weather group Update of section 3.1.2 to address rejoin commands & bus config commands. Also renamed subsection such that it is generic to commanding rather than just manual commanding. Update of section 3.1.5 to include reference to General spacecraft parameter updates & impact on the SGS
0.9 draft	17th May 07	15th Sept 08	Updates made for the ground segment readiness Review
1.0 draft	15th Sept 08	8th October 09	Full document re-write to reflect operational experience

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1 Introduction

1.1 Purpose & Scope

This document will address all nominal & contingency operational interactions between the Herschel Science Ground Segment and the MOC during the commissioning, PV & Routine phases of the mission.

It has been updated to address operational experience as well as to include various issues raised during Ground segment meetings which impact on the SGS-MOC interactions.

It is expected to be released as issue 1.0 by the start of the routine operations phase.

1.2 List of acronyms

For Acronyms used in this document, please refer to the following Wiki Address (with the standard Herschel Username/Password e.g. as used for livelink to access HGSSE documents).

http://www.herschel.be/twiki/bin/view/Hcss/HerschelAcronyms

1.3 Applicable Documents

[AD 1] Herschel Space Observatory Science Management Plan (SMP), Herschel/HSC/DOC/0019, 2.1

[AD 2] Herschel Space Observatory Operations Scenario Document, HERSCHEL/HSC/DOC/0114, 1.2

[AD 3] Herschel Ground Segment Design Description, FIRST/FSC/DOC/0146, 1.5

[AD 4] Herschel Ground Segment Interface Requirements Document, FIRST/HSC/DOC/0117, 2.5

[AD 5] Herschel Ground Segment Interface Control Document Wiki page - http://www.herschel.be/twiki/bin/view/HSC/GroundSegmentInterfaces

[AD 6] Herschel Operations Groups Organisation, HERSCHEL-HSC-DOC-1219, 1.1

1.4 Reference Documents

[RD 1] Science Ground Segment System Data Flow TN – HSCDT-TN052, 1.3

[RD 2] HSC-ICC Operations Interactions Document - HERSCHEL-HSC-DOC-1184, ISSUE 1.3

[RD 3] Mission Planning Concept Document, Issue 1.0

2 Ground Segment Co-ordination Groups – Post Launch

2.1 Introduction

[AD 6] describes the principal entities that will exist during in-orbit operations in order to maintain overall Ground Segment interrelations and coordination, in order to control the system configuration at top level, and in some cases in order to ensure that detailed tasks falling across centre boundaries are efficiently and harmoniously pursued throughout the entire SGS or the entire mission structure.

From the perspective of the SGS-MOC interactions, there are two high level management groups which include the SGS & the MOC. These are :

- Herschel Operational Ground Segment Steering Group (HOGSSG)
- Herschel Science Operations Co-ordination Group (HSOCG)

These are described in tabular form in the next two subsections.

An additional group which can include the involvement of the MOC is the Herschel Science Ground Segment Core CCB. This involvement is primarily only for HPSDB & OBSM issues thus MOC is not considered a formal member of the Core CCB but rather a participant only for these specific Ground Segment interfaces.

Finally, there is the HSC-MOC(FDS) Interactions group which consists of the HSC & the MOC Flight Dynamics Teams working together to address interface & S/C ACMS issues which affect those interfaces.

Each of the above will also be described in the coming subsections.

2.1.1 Herschel Operational Ground Segment Steering Group (HOGSSG)

Name	Herschel Operational Ground Segment Steering Group (HOGSSG)
Chair	Johannes Riedinger (Herschel Mission Manager) jriedinger@rssd.esa.int
Parent group	None
Peer groups	None
Reporting groups	HSOCG (*), HOTcore, MOC, ICCs, NHSC
Contact address	HOGSSG@sciops.esa.int
Purpose/ ToR	The HOGSSG in Operations is the Management Group for the Herschel mission in operations, and is chaired by the Herschel Mission Manager (HMM) to whom both HSC and MOC report, and who is the highest level interface to ESA for the ICC managers and the NHSC Manager. It is the forum for formal collective interactions between the HMM and the ICC, HSC, MOC and NHSC managers. The HOGSSG is the forum in which the SGS (HSC+ICCs+NHSC) and the MOC regulate activities that are not routinely handled at either HSC or MOC level or coordinate those activities that cannot adequately be addressed through the routine working-level interfaces between MOC, HSC, ICC and NHSC personnel.. (*) The coordination group for the SGS, responsible for the working interfaces between the HSC, the ICCs, the NHSC and the MOC, is the Herschel Science Operations Coordination Group (HSOCG – see Sec.3.3.2. below).
Meetings	The group meets roughly every 3 months (every month initially)
Incept date	End of Commissioning Phase
Expiry date	End of In-flight Operations.
Membership	Members: HMM: Herschel Mission Manager (HMM - Chair) Herschel Science Operations Manager (HSCOM) Deputy HSCOM and Herschel System Engineer (H. Sys. Eng.) Herschel Spacecraft Operations Manager (HSOM) DP Development Manager HIFI, PACS and SPIRE ICC Managers HIFI, PACS and SPIRE System Engineers NHSC manager Herschel Project Scientist (PS) Supporting members: Others as required by the Agenda.
Comments	Supersedes the Development Phase HSGSSG.

2.1.2 Herschel Science Operations Coordination Group (HSOCG)

Name	Herschel Science Operations Coordination Group (HSOCG)	
Chair	Leo Metcalfe (HSCOM)	Leo.metcalfe@sciops.esa.int
Parent group	HOGSSG	
Peer groups	MOC Management Group	
Reporting groups	HOTcore, ICC Management Groups, NHSC Management Group	
Contact address	HSOCG@sciops.esa.int	
Purpose/ ToR	The HSOCG is the forum for formal working interactions between the HSCOM, the ICC and NHSC managers, and the MOC). HSOCG is the coordination group for the Science Ground Segment (SGS) at working level (as distinct from the HOGSSG which is the management group for the Herschel mission). This group is concerned with coordinateing the day-to-day working interfaces among the centres and is a vehicle to enable the HSCOM to ensure the effectiveness of the HSC as the hub for the Science Ground Segment.	
Meetings	The group meets every two weeks initially (or daily, in LEOP/CoP/PV)	
Incept date	Pre-flight simulations	
Expiry date	End of Archival Phase	
Membership	HSOCG is comprised of the HSCOM and HSC System Engineer, the ICC Managers and the ICC System Engineers, the NHSC Manager and other HSC, ICC and NHSC Group Leaders as shall be necessary to conduct the business of the group. HSCOM (Chair) Deputy HSCOM & HSC System Engineer DP Development Manager NHSC manager HIFI, PACS and SPIRE ICC managers HIFI, PACS and SPIRE System Engineers Herschel Project Scientist Herschel SOM Herschel Flight Dynamics Coordinator. <u>Supporting members</u>: Others as required by the work of the Group.	
Comments	Supersedes the Development HCSSMG and the SciOpsWG.	

2.1.3 Herschel Core CCB

Name	Herschel Core Operational CCB (cCCB)	
Chair	L. Metcalfe (HSCOM)	Leo.Metcalfe@sciops.esa.int
Parent group(s)	HSOCG, HOTcore	
Peer groups	None	
Reporting groups	ICC CCBs, DPCCB, HCSS CCB, HSA CCB, MPS CCB, systemCCB	
Contact address	cCCB@sciops.esa.int	
Purpose/ ToR	The Core Operational CCB is the central CCB for the Herschel SGS. It is fed by, and interacts with, lower level feeder CCBs for complex subsystems, as described in the HSC-ICC Interactions Document [RD2]. Each feeder CCB is represented on the cCCB.	
Meetings	The group meets every two weeks initially (more often in LEOP/CoP/PV)	
Incept date	Launch-1 year	
Expiry date	End of Post-Operations Phase	
Membership	HSCOM (Chair) Quality Control Rep. (Group Secretary) HSC System Engineer NHSC manager: for the NHSC CCB HIFI System Engineer: for the HIFI ICC CCB PACS System Engineer: for the PACS ICC CCB Representative of the SPIRE ICC CCB Representative of the DPCCB Herschel Archive Scientist HSC System Architect (also representing the HCSS CCB) HSC Configuration Control Engineer Herschel Project Scientist DP Quality Control Engineer Representative of the Mission Planning and Proposal Handling CCB Instrument Calibration Scientists group leader. Supporting members: NHSC Liaison representative at HSC. Others as required by the work of the Group ***(MOC for the case of HPSDB & OBSM issues)***	
Comments	Fed by subsidiary CCBs [RD2].	

2.1.4 HSC-MOC(FDS) Interactions Group

Name	HSC-MOC(FDS) Interactions Group	
Chair	L. O'Rourke (Deputy HSCOM & System Engineer)	lorourke@esa.int
Parent group(s)	HSOCG, HOTcore	
Peer groups	None	
Reporting groups	None	
Contact address	Gottlob Gienger/esoc/ESA@ESA, Mark Tuttlebee/esoc/ESA@ESA, Michael Reichenbaecher/esoc/ESA@ESA, Frank Budnik/esoc/ESA@ESA, Rainer.Kresken@esa.int, jbrumfit@sciops.esa.int, Miguel.Sanchez@sciops.esa.int, Anthony.Marston@sciops.esa.int, hscics@sciops.esa.int, hsc_sw_maint@sciops.esa.int, lorourke@esa.int	
Purpose/ ToR	The HSC-MOC(FDS) Interactions group has been set up to address those ACMS issues which impact on the mission planning & AHF interfaces between the two centres as well as to track changes in operational ICDs & documents which affect the two centres in those areas.	
Meetings	The group meets via telecon every four weeks	
Incept date	Launch+6 months	
Expiry date	End of Post-Operations Phase	
Membership	Deputy HSCOM & System Engineer (Chair) HSC Pointing Expert HSC Instrument & Calibration Support Group Leader HSC S/W Maintenance Group Leader MOC FDS Herschel group leader MOC FDS ADC Representatives MOC FDS Orbit Representatives MOC FDS Q Representatives Supporting members: None	
Comments	None	

3 Listing the Interactions between SGS and the MOC

3.1 The main SGS-MOC transfer & data exchange mechanisms

As an introduction to the SGS-MOC operational interactions and to support the procedures & steps that are outlined in the coming pages, here is a brief overview of the transfer mechanisms supporting the exchange of different data types and information sets between the SGS and the MOC throughout the course of the mission.

(a) **Data Disposition System (DDS)[1] :** Science & HK TM Object data are retrieved by the HSC (& propagated on to the ICCs) from the DDS server which is located on the Secure Data Server machine at MOC. This DDS server accesses through the MOC firewall the Long Term Archive Additional data such as OOL and TCH data are also retrieved. The process is that Xml requests are sent by the HSC DDS client. After being processed by the DDS server, the resultant data set is placed on the HSC Interface server via FTP. This data transfer is via the lease line.

(b) **File Transfer System[2]** – The FTS server software is located on the SDS machine in the MOC. A client application is located at HSC on the interface server. The FTS software works through HTTP & FTP with continuous checks being performed of the links between the client & the server. A file being sent from the MOC e.g. FDS, is transferred by the FDS software through the firewall onto the SDS whereby it is then forwarded to the HSC. Files sent by the HSC arrive on the SDS and are then forwarded on to the relevant MOC subsystem. Examples of files that are transferred include mission planning files (POS, PSF, Orbit), OBSM images and the Attitude History file. This data transfer is via the lease line.

(c) **FTP** : Certain data is provided by Flight Dynamics via the FDS FTP site e.g. Attitude Constraint software, Slew Time & path predictor software. This data transfer is via public internet. The delivery of this data is informed to the HSC via email.

(d) **RTSI interface :** This is the interface used for the transfer of real-time telemetry packets passed from the MOC Mission Control System (MCS) to the ICC workstations located at the MOC i.e. ICC@MOC, and directly to the ICC@ICC and the HSC. .

Besides the above data interactions, there will of course be many procedural interactions related to e.g. mission planning, instrument anomalies, as well as the clear need to hold regular status meetings during the operations phase.

[1] ICC@MOC may also retrieve data from the DDS.
[2] ICC@MOC is envisaged to use FTS for the transfer of locally generated TPFs to the MOC & HSC

3.2 Overview of the SGS-MOC data types being exchanged

The following interfaces listed in the tables below have been identified between Herschel Science Centre and the three Instrument Control Centres. The contents of the tables below have been extracted from [AD 2] with definition of data type contents described in the specific ICDs listed in the ground segment list of ICDs document [AD 5].

Note that the mechanism on how MOC data is provided to the ICCs from the HSC to the ICCs as well as the reception of ICC data at the HSC is described in the HSC-ICC Operations Interactions Document [RD 2] and shall not be repeated here.

Data being transferred	Data Type Description	Generation Details	Transfer Mechanism
S/C TM Pkts	Spacecraft HK TM packets	Generated on the S/C	DDS
HK TM Pkts	Instrument HK TM packets	Generated on the S/C	DDS
SCIENCE TM Pkts	Instrument Science TM packets	Generated on the S/C	DDS
OOL	Out of Limit data	MOC MCS generated data	DDS
TCH	Telecommand History data	MOC MCS generated data	DDS
TCO	Time Correlation packets	MOC MCS generated data	DDS
OBSM packets	Instrument Image dump TM packets	Generated on the S/C	DDS
OBSM/IOBS	OBSM dump file	MOC OBSM generated data	FTS
Orbit file	Long Term & Short Term orbit files	FDS generated data	FTS
PSF	Planning Skeleton file	FDS generated data	FTS
TSF	Timeline Summary file	MOC MCS generated data	FTS
EPOS	Enhanced POS File	FDS generated data	FTS
AHF	Attitude History File	FDS generated data	FTS
HPSDB/MIB	Spacecraft DB / MIB files	MOC (DB) generated data	FTS
OEF	Orbit Events File	FDS generated data	FTS
STPF	Slew Time Predictor File	FDS generated data	FTS
OBDB	On Board DB file	FDS generated data	FTS

Table 1 Data to be transferred from MOC to HSC directly

Data being transferred	Data Type Description	Generation Details	Transfer Mechanism
S/C TM Pkts	Spacecraft HK TM packets	Generated on the S/C	RTSI
HK TM Pkts	Instrument HK TM packets	Generated on the S/C	RTSI
SCIENCE TM Pkts	Instrument Science TM packets	Generated on the S/C	RTSI

Table 2 Data to be transferred from MOC to ICC@MOC, ICCs & HSC directly

Data being transferred	Data Type Description	Generation Details	Transfer Mechanism
TPF	Task Parameter Files	Generated locally at ICC@MOC	FTS

Table 3 Data to be transferred from ICC@MOC to the MOC(MCS) and HSC directly

Files being transferred	File Description	Generation Details	Transfer Mechanism
SIAM	Spacecraft Misalignment Matrix	Generated at HSC	FTS
POS	Preferred Observation Sequence	Generated at HSC	FTS
SSO	SSO Ephemerides file	Generated at HSC	FTS
IOBS	Instrument OBSM Image File	Generated at ICCs	FTS
TPF	Task Parameter File	Generated at ICCs	FTS

Table 4 Data to be transferred from the SGS to the MOC (via the HSC)[3]

Files being transferred	File Description	Generation Details	Transfer Mechanism
MIB	Instrument DB updates	Generated at ICCs	Email

Table 5 Data to be transferred directlyfrom the ICC to the MOC

[3] The reception of this data at the HSC from the ICCs is covered in [RD 2]. The ICC MIBs are transferred directly to the MOC via email with the HSC in copy.

3.3 Summary of the main interactions between the SGS & the MOC

The HSC & the ICCs shall have the following main operational interactions with the MOC :

Ground Segment Configuration Control Board Interactions

- Configuration Control board for the Commissioning, PV & Routine phase

Mission Planning Interactions (POS/ICP file updates)

- Mission Planning interactions – during the commissioning phase
- Mission Planning Interactions – during the PV phase
- Mission Planning Interactions – during the Routine phase

ICC@MOC Operational Interactions

- RTSI interactions – during the commissioning (& PV) phase
- TPF interactions – during the commissioning (& PV) phase

Specific Operational Interactions

- Spacecraft Anomalies & notification of problems
- Instrument Anomalies & notification of problems
- OBSM Interactions
- HPSDB & MIB Interactions

Operational Data Transfers with the MOC - Interactions

- FTS provided data
- DDS provided data
- RTSI provided data

4 Interactions & Data Transfers Pertaining to the Planning Cycle

4.1 Data Transfers relevant to the Planning Cycle

The following files are exchanged between the HSC & the MOC in the Mission Planning process :

Data being transferred	Data Type Description	Subsystem Generating it	Transfer Mechanism	Nominal delivery Frequency
Orbit file	Long Term & Short Term orbit files	FDS	FTS	Once weekly
PSF	Planning Skeleton file	FDS	FTS	(7 files) 3 weeks before 1st DTCP
EPOS	Enhanced POS File	FDS	FTS	(7 files) 1.5 weeks before 1st DTCP
HPSDB/MIB	Spacecraft DB / MIB files	MOC (DB)	FTS	Asynchronous
OEF	Orbit Events File	FDS	FTS	Once weekly

Table 6 Data to be transferred from MOC to HSC for MPS

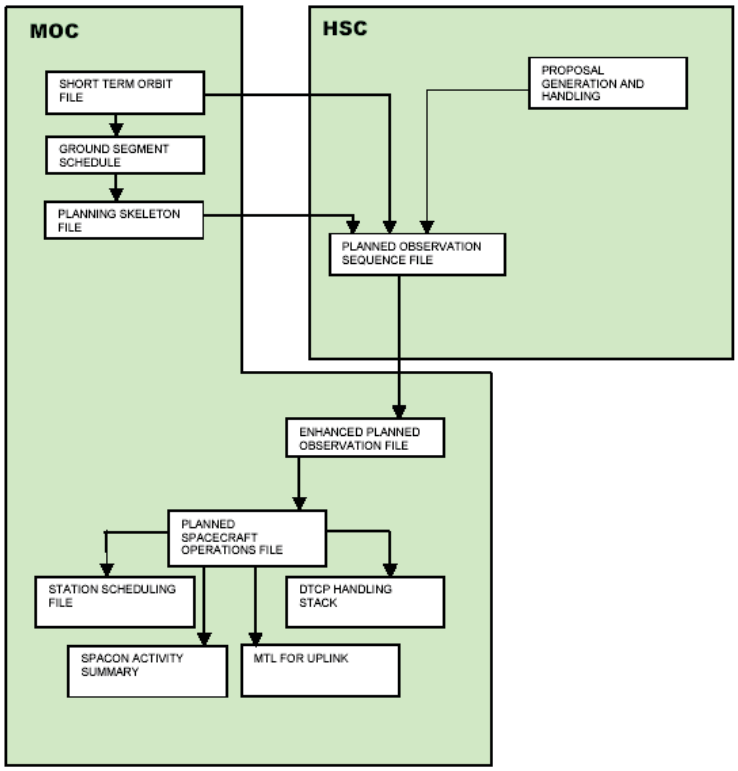
Data being transferred	Data Type Description	Subsystem Generating it	Transfer Mechanism	Nominal delivery Frequency
SIAM	Spacecraft Misalignment Matrix	HCSS	FTS	Asynchronous
POS	Preferred Observation Sequence	MPS	FTS	7 POS files (1st POS file = 2 weeks before DTCP, 7th POS file = 3 weeks before DTCP)
SSO	SSO Ephemerides file	MPS	FTS	Asynchronous
MIB	Instrument DB updates	ICC MIB S/w	FTS	Asynchronous

Table 7 Data to be transferred from HSC to MOC for MPS

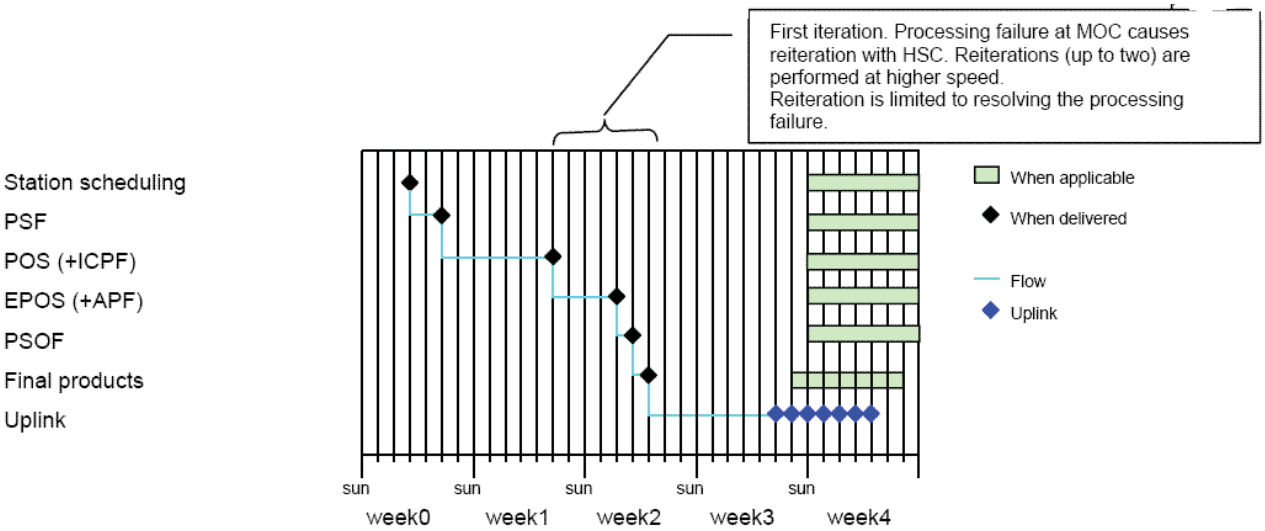
4.2 The Nominal Planning Cycle

4.2.1 The Data Flow in the planning Cycle – who does what

RD 3 provides an overview of the data flow that is expected to take place in ground segment for the Mission Planning chain. The drawing below is extracted from that document:



In addition to this drawing, the following drawing shows the timeline of the data flow.



From that same document, the following table is presented :

Phase	Involving	Cycle rate	Completed
1	Station scheduling and production of PSF	Weekly	15 working days prior to uplink
2	Production of POS	Weekly	10 working days prior to uplink
3	Production of final products	Weekly	6 working days prior to uplink, nominal

From the perspective of breaking the above drawings & table into a view of the workings of the full chain versus timeline, the following data flows can be considered to be taking place [RD 3].

It must be stressed that as the Mission Planning chain assumes delivery of a set of 7 files (one per OD), then the 1st of these ODs corresponds to the 1st Uplink DTCP in the drawing of the previous page. The Last of these ODs corresponds to the 7th Uplink DTCP in the drawing of the previous page.

(a) Ground Station Scheduling data flow

4 working weeks before 1st Uplink DTCP : Flight Dynamics creates the Long Term Orbit file, which is then transferred to the Scheduling Office. The orbit information is taken by the scheduling office and merged with equivalent data from other missions based on agreed scheduling rules.

4 weeks before 1st Uplink DTCP : The Scheduling Office creates the ESTRACK Schedule Allocation File (ESAF) containing the schedule of DTCPs, which is then passed to Flight Dynamics.

(b) MOC Flight Dynamics & HSC Data Flow

3-4 weeks before 1st Uplink DTCP : Flight Dynamics incorporate the GSS information into the Planning Skeleton File (PSF). This file also contains windows for other spacecraft activities that impact on the science planning - for example windows for orbit manoeuvres that block out scientific pointings.

3 weeks before 1st Uplink DTCP : Flight Dynamics delivers 7 PSFs (one per OD) to the HSC.

Both the short-term orbit file (delivered weekly), the PSF and the proposals located in the HSC DB are then used by HSC to generate the planned observations for the next period. HSC produce the Planned Observation Sequence file (POS) that contains the data provided by the PSF, interspersed with instrument commanding and attitude requests.

2 weeks before 1st Uplink DTCP : Seven POS/ICP pairs (one pair per OD) are transferred to MOC and processed by Flight Dynamics to expand attitude-related Event Designators (EDs) where necessary. In this respect, the last POS/ICP corresponds to an uplink DTCP that is three weeks in the future.

Attitude / orbit related windows from the PSF are populated where appropriate. At this point the Reaction wheel momentum management commands will also be provided by FD. The resulting files are the Enhanced Planned Observation Sequence file (EPOS) and Attitude Parameters File (APF) pair. In addition to the expanded attitude commands this file still contains the PSF information and instrument commanding contained in the POS.

(c) MOC Flight Dynamics & MOC MCS Mission Planning Data Flow

1.5 weeks before 1st Uplink DTCP : The EPOS is passed to the Mission Planning System component of the MCS (Mission Control System) under the responsibility of the Flight Control Team. It is then processed by the MCS MPS to translate both instrument and attitude EDs to commands or sequences.

The processing at this stage also includes instrument-level checks/processing, for example onboard SSMM storage predictions will be made. These checks provide a double check of the validity of the POS, and in the case of the SSMM predictions allow the duration of some DTCP activities (MTL load and later data dumps) to be estimated in advance.

1.5 weeks before 1st Uplink DTCP : EPOS processing results in the Planned Spacecraft Operations File (PSOF) and the Spacecraft Parameters File (SPF).

Approx 1 week before 1st Uplink DTCP : In the last stage the final products of mission planning system are generated from the PSOF/SPF file pair. These are

- The MTL for uplink
- The manual stack of non-MTL commands for DTCP handling.
- The spacon activity summary, which contains a list of, planned activities and timings for the pass. This summary is a script for on-line execution to provide event information messages during the DTCP, e.g. start/stop of real-time science, start/stop of packet store dumps.

Since multiple ODs are covered by a single mission planning cycle, multiple sets of these final products are created, one for each DTCP. In the nominal cycle seven sets of products are created.

Important Note : In the discussion of dataflow below only a single file is referred to at each stage, e.g. POS, EPOS, PSOF. In general these may be implemented as multiple files. For example it is usual ESOC practise to separate commands and command parameters into two associated files, e.g. EPOS + Attitude Parameters File (APF) etc. Moreover most flight dynamics products will be delivered as a separate file per OD i.e. a single nominal (weekly) PSF or EPOS delivery consists of seven separate PSF or EPOS files, one per OD. Ideally the POS would also follow this structure.

4.2.2 Nominal Operational Email Addresses in use for MPS Interactions

HSC Mission Planning Group Email Addresses

POS Deliveries coming from the HSC originate from the following email address: HSC Community Support Group <hsccsg@sciops.esa.int>

with the following HSC Email addresses in copy : Leo.Metcalfe@sciops.esa.int, hscops@sciops.esa.int, gpilbratt@rssd.esa.int, herdp_ta@sciops.esa.in

MOC Mission Planning Email Addresses

POS Delivery Email being sent from the HSC to MOC are being sent to the following email addresses at the MOC side:

To : Micha.Schmidt@esa.int, Michael.Reichenbaecher@esa.int, Rainer.Kresken@esa.int, esoc_hp_mps@esa.int

CC : Gottlob.Gienger@esa.int, t, Luke.Lucas@esa.int, GertJan.Ourensma@esa.int, Cosimo.Greco@esa.int, Frank Dreger <Frank.Dreger@esa.int>, mtuttleb@esa.int, jyde@esa.int, jpalmer@esa.int

In addition, the ICC operations centre whose instrument has been scheduled is also placed in copy of these emails.

Updated MPS files : MOC => HSC

Any update made to files delivered by the MOC to the HSC i.e. PSF, Orbit, SDB, which are to required to be replace those already existing at the HSC & used in the planning process, must be informed to the HSC via the Operational email account : hscops@sciops.esa.int & hsccsg@sciops.esa.int

Updated MPS files : HSC => MOC

Any update made to mission planning files delivered by the HSC to the MOC i.e. POS, SIAM, SSO, which are required to replace those already existing at the MOC & being used in the planning process, must be informed to the MOC via the Operational email account : esoc_hp_mps@esa.int

4.2.3 Interactions with respect to Scheduling Summary Information

This procedural interface covers the interface between the MOC and the HSC regarding processing status of schedules (POS).

This interface is directly applicable to the Routine Operations phase where schedules are processed. The introduction of the scheduling process will occur during the commissioning phase in the lead up to the Calibration & Performance verification (CPV) phase.

If the HSC wishes to know the current status of a particular schedule or how far the schedule been processed within the MOC mission planning system, an e-mail should be sent or a telephone call made.

Note that in case of schedule rejection, the 'Instrument Malfunctions or Operations Problems' procedural interface (see section 2.1.2.1) will be used to inform either the HSC within one rejection of the schedule which will contain information as to the reason for rejection.

4.2.4 Template Notification Email being sent from HSC to the MOC for POS delivery

During the COP & PV phases, it has become clear that certain operational information is required to be known by the MOC for the planning process. Such information can include # of TCs in an OD, TM Data rate limits, Use of Burst mode etc.

Similarly, when the HSC delivers a POS (or set of POS files) files to the MOC, it sends a notification email.

It has been agreed to place in this notification email this additional information being requested by the MOC.

The following is the standard Template in use by the HSC.

==========

Dear all,

This is to inform you that we have sent the POS and ICP files corresponding to OD0153 (0153_0001.POS, 0153_0001.ICP) via the File Transfer System.

(a) OD approved by

This schedule has been approved by the deputy PS.

(b) MOC Specific Information:

Examples are shown below

(c) Further information on this OD can be found in:

http://www.herschel.be/twiki/bin/view/HSC/HSCMissionPlanningPV

Best regards,

==========

Contents of the MOC Specific Information section

The ICCs when they make a delivery to the HSC also have an email template which they fill in. In this template there are specific sections which are copied & pasted into the above Template when delivering to the MOC.

There are two sections in the ICC template (2 & 4) that input into point (b) above. Here are those two sections with the relevant information as detailed to the ICC that they must fill in:

2. TM & TC issues

(a) What is the # of TC counts for the OD?

(b) Has the TM limit been exceeded?

Answer Guideline : If TC is >17000 or TM limit is exceeded then please flag by "HSC TAKE NOTE". For the TCs, it is useful to put in the # of counts as this helps to ensure that the 34000 limit over 48 hours can be checked for two consecutive ODs.

4. Operations Issues

(a) Should FDS disable the checks of Gyro Propagation Requests (ATT_PROP) for this OD?
(b) Are there any Real Time Science Requests in the DTCP?
(c) For PACS, does this OD include burst mode?
(d) TM limit exceeded (>100%) - possibility of dump over two DTCPs?
(e) ICC to add anything specific to this OD which HSC & MOC should be aware of.

Answer guideline for (a) the gyro propagation. If the answer is YES, then Flight Dynamics will not consider On-Ground gyro propagation for this OD. If the answer is NO, then the ICC must have left the required time (1 hour) for FDS to have performed gyro calibration.

Answer guideline for (d) the TM limit. Although the question is asked in point 2, the question here relates to the operational impact. Clearly if we have the tm limit exceeded then we need to flag this to the MOC to warn them. It is also useful to have the ICC be aware already at OD delivery of the possibility of late delivery of some observation data to them.

4.3 MPS Contingency Replanning & Problems

4.3.1 Problems or Contingency Replanning during HSC Mission Planning

Problems could arise due to processing errors of MOC products in the HSC MPS chain. It is also a possibility that a contingency replanning may be requested from the HSC to the MOC due to specific instrument or planning anomalies which may impact on the nominal planning.

It is assumed that the representative of the HSC Mission Planning System will contact the corresponding MOC representative (FDS or FCT) via telephone, fax or e-mail within one hour of detection of a problem, with the communication method dependent on the time and severity of the problem.

The MOC email address to notify of such interactions shall be:

- esoc_hp_mps@esa.int
- Micha.schmidt@esa.int
- Frank.keck@esa.int
- Michael.Reichenbaecher@esa.int
- Rainer.Kresken@esa.int

4.3.2 Problems or Contingency Replanning during MOC Mission Planning

Problems could arise due to processing errors at Flight Dynamics or in the MCS MPS chain. It is also a possibility that a contingency replanning may be requested to the HSC from the MOC due to specific S/C or ground station anomalies which may impact on the nominal planning.

It is assumed that the MOC Flight Control Team (FCT) or Flight Dynamics will contact a representative of the HSC Mission Planning System via telephone, fax or e-mail within one hour of detection of a problem, with the communication method dependent on the time and severity of the problem.

The HSC email addresses to used for such interactions shall be :

- hscops@sciops.esa.int
- hscmps@sciops.esa.int

5 Interactions & Data Transfers Pertaining to DDS & FTS

5.1 Data Transfers pertaining to the DDS, FTS (non-ICC@MOC)

The following files are exchanged between the SGS & the MOC using these interfaces:

Data being transferred	Data Type Description	Generation Details	Transfer Mechanism
S/C TM Pkts	Spacecraft HK TM packets	Generated on the S/C	DDS
HK TM Pkts	Instrument HK TM packets	Generated on the S/C	DDS
SCIENCE TM Pkts	Instrument Science TM packets	Generated on the S/C	DDS
OOL	Out of Limit data	MOC MCS generated data	DDS
TCH	Telecommand History data	MOC MCS generated data	DDS
TCO	Time Correlation packets	MOC MCS generated data	DDS
OBSM packets	Instrument Image dump TM packets	Generated on the S/C	DDS
OBSM/IOBS	OBSM dump file	MOC OBSM generated data	FTS
Orbit file	Long Term & Short Term orbit files	FDS generated data	FTS
PSF	Planning Skeleton file	FDS generated data	FTS
TSF	Timeline Summary file	MOC MCS generated data	FTS
EPOS	Enhanced POS File	FDS generated data	FTS
AHF	Attitude History File	FDS generated data	FTS
HPSDB/MIB	Spacecraft DB / MIB files	MOC (DB) generated data	FTS
OEF	Orbit Events File	FDS generated data	FTS
STPF	Slew Time Predictor File	FDS generated data	FTS
OBDB	On Board DB file	FDS generated data	FTS

Table 8 Data to be transferred from MOC to HSC directly

Files being transferred	File Description	Generation Details	Transfer Mechanism
SIAM	Spacecraft Misalignment Matrix	Generated at HSC	FTS
POS	Preferred Observation Sequence	Generated at HSC	FTS
SSO	SSO Ephemerides file	Generated at HSC	FTS
IOBS	Instrument OBSM Image File	Generated at ICCs	FTS
TPF	Task Parameter File	Generated at ICCs	FTS

Table 9 Data to be transferred from the SGS to the MOC (via the HSC)[4]

[4] The reception of this data at the HSC from the ICCs is covered in [RD 2]. The ICC MIBs are transferred directly to the MOC via email with the HSC in copy.

5.2 Interactions relating to the Data Disposition System

5.2.1 Overview of the DDS & how it works

The Data Disposition Server is located on the MOC side with the DDS client software being run at the HSC to retrieve TM/TC & Aux data from that server.

The retrieval of the TM data is based upon a consolidation catalogue which is updated through two main consolidation processes – on-line & off-line consolidation.

As these are primarily software based interactions, the two software components (on the server & on the client side) have error recovery built in. In addition, there are messages generated which are flagged to the software maintenance on both sides where a machine or the interface itself falls over.

In general the only interactions between the HSC & the MOC is to inform of specific problems or recovery steps taken by the teams.

5.2.2 Relevant Documentation

The documentation relevant to the File Transfer System interfaces can be found at the following Wiki page :

http://www.herschel.be/twiki/bin/view/HSC/GroundSegmentInterfaces#3_SGS_MOC_Interfaces_for_DDS_FTS

5.2.3 Interactions between the HSC & MOC relating to the DDS

HSC => MOC Interactions for the DDS

An email is sent by the HSC Software Maintenance Team to the MOC Software Maintenance Team if there is a failure in the interface or there is a gap which cannot be explained i.e. inconsistency between the TM received & the status for that TM in the consolidation catalogue.

MOC => HSC interactions for the DDS

An email is sent by the MOC Software Maintenance Team or the SOM to inform that a gap has been filled in the consolidation catalogue or indeed to inform of a downtime of the DDS server.

5.2.4 Interactions between the HSC & MOC relating to the DDS – Emails

The Email address to use for contacting the MOC for issues relating to the DDS is:
esoc_hp_sws@esa.int

The Email address to use for contacting the MOC for issues relating to the DDS is :
hsc_sw_maint@sciops.esa.int

5.3 Interactions relating to the File Transfer System

5.3.1 Overview of the FTS & how it works

The File Transfer System (FTS) is a MOC controlled software that has a server on the MOC side (same server as for the DDS) and a client on the HSC side. The software interfaces via the TCPIP & FTP protocols.

The interface is controlled according to the FTS ICD [AD 5].

Files are tarred in a file which has an ending .HERS and then transmitted via the lease line over the FTS interface. Upon reception of a file at the centre in question, the software calls an action procedure whose task is to place the files in a location accessible by the final user software expected to process that file.

As these are primarily software based interactions, the two software components (on the server & on the client side) have error recovery built in. In addition, there are messages generated which are flagged to the software maintenance on both sides where a machine or the interface itself falls over.

In general the only interactions between the HSC & the MOC is to inform of specific problems or recovery steps taken by the teams.

5.3.2 Relevant Documentation

The documentation relevant to the File Transfer System interfaces can be found at the following Wiki page :

http://www.herschel.be/twiki/bin/view/HSC/GroundSegmentInterfaces#3_SGS_MOC_Interfaces_for_DDS_FTS

5.3.3 Interactions between the HSC & MOC relating to the FTS

HSC => MOC Interactions for the FTS

An email is sent by the HSC Software Maintenance Team to the MOC Software Maintenance Team if there is a failure in the interface or there is a file which has not yet been transmitted to the MOC due to a problem in the software on the MOC or HSC side.

MOC => HSC interactions for the FTS

An email is sent by the MOC Software Maintenance Team to the HSC Software Maintenance Team if there is a failure in the interface or there is a file which has not yet been transmitted to the HSC due to a problem in the software on the MOC or HSC side.

5.3.4 Interactions between the HSC & MOC relating to the FTS – Emails

The Email address to use for contacting the MOC for issues relating to the DDS is:
esoc_hp_sws@esa.int

The Email address to use for contacting the MOC for issues relating to the DDS is :
hsc_sw_maint@sciops.esa.int

6 Interactions between the SGS & MOC Flight Dynamics

6.1 List of the main interactions

The following direct interactions exist between the Science Ground Segment & the MOC Flight Dynamics Group.

- MPS Nominal & non-nominal Interactions (including Email Template)
- AHF Interactions
- Initial Attitude – after launch
- Delivery of specific data via email or FTP site
- Monthly Interactions Telecon

Each of these shall be dealt with in turn.

6.2 Relevant Documentation

The documentation relevant to the SGS-MOC Flight Dynamics interfaces can be found at the following Wiki page :

http://www.herschel.be/twiki/bin/view/HSC/GroundSegmentInterfaces#4_SGS_MOC_Interfaces_for_POS_PSF

6.3 MPS Nominal & Non-Nominal Interactions

The reader should look at chapter 4 for details on these interactions.

6.4 Attitude History File Interactions

Flight Dynamics provide to the HSC an attitude history file (AHF) for each Operational Day (OD) of the mission.

This file is generated by the Attitude Determination & Control Software and is delivered via the File Transfer System.

Reception of the AHF at the HSC will result in the automatic processing of this file by the Aux Processor software whereby a pointing product is generated and placed in the Herschel Science Archive.

The HSC Data Processing software which runs every night to process each observation executed in the previous OD relies totally on the presence of a pointing product being available in the archive before it can begin.

In this respect, any delay in the arrival of this file will automatically delay the start of the DP pipeline processing of an OD.

Flight Dynamics are requested to inform the Science Ground Segment of a delay in the delivery of this file and to indicate (high level only) the reasons for this delay e.g. gap in S/C HK, quality check failed etc.

Emails in use by FDS when a file has been sent

Upon successful generation of this file an email is sent from the email address : **Herschel ADC Team <heratt@mail-gw.estec.esa.int>** to the following email addresses to inform of its transfer:

hscops@sciops.esa.int
herdp_ta@sciops.esa.int
hifi-operations@sron.nl
pacs_ops@sciops.esa.int
SPIRE@stfc.ac.uk

6.5 Specific MPS Launch Interaction – Start Attitude for the first OD

The HSC Scientific Mission Planning System needs the start attitude for OD that is planned. The SMPS stores the final attitude for each POS generated and uses this as the start attitude for planning the next day.

After Launch, the HSC SMPS operators shall be informed by MOC of the start attitude for the first OD that is to be planned by the SMPS.

This information shall be sent to the following addresses :

- hscmps@sciops.esa.int & hscops@sciops.esa.int

It is expected that this information shall be provided as a quaternian.

6.6 Delivery of Specific data via Email or FTP

There exist certain deliveries being made from Flight Dynamics to the HSC & Science Ground Segment which involve the use of an FTP site. An example of this is the Matlab slew time predictor software & associated subroutines.

There also exists an interface between Flight Dynamics & the SGS for the delivery of an attitude constraints xml file via email.

In all cases, a formal email is required to be sent by the Flight Dynamics Group with respect to such deliveries which shall contain the following information :

- Email subject shall start with “Formal delivery of …….”
- If a file is being delivered by email, then the Email contents shall include this file in a tar or gzipped format.
- The email shall provide details of the name of the files/software being delivered and, if possible, a delivery note describing the changes since the last version.
- The email shall end with a request that the HSC shall acknowledge reception of the email. If no acknowledgment is received in 24 hours, then Flight Dynamics shall phone the HSC to confirm that it has arrived successfully.

6.7 Monthly HSC-MOC(FDS) Telecon

Please see section 2.1.4

7 Nominal Interactions between the SGS & MOC Flight Control Team

7.1 List of the main interactions

The following nominal interactions exist between the Science Ground Segment & the MOC Flight Control Team (note : S/C & Instrument anomalous interactions are dealt with in a separate chapter)

- MPS Nominal & non-nominal Interactions (including Email Template)
- MOIS Procedures & associated TPFs
- OBSM Interactions
- HPSDB interactions
- ICC@MOC Interactions
- Other Interactions : SPACON Post-Pass Email – DS2 (Science data) dump ended early

Each of these shall be dealt with in turn.

7.2 MPS Nominal & Non-Nominal Interactions

The reader should look at chapter 4 for details on these interactions.

7.3 MOIS Procedures & Associated TPFs

7.3.1 Relevant Documentation

The documentation relevant to the MOIS & TPF interfaces can be found at the following Wiki page :

http://www.herschel.be/twiki/bin/view/HSC/GroundSegmentInterfaces#5_SGS_MOC_Interfaces_for_TPF_Der

7.3.2 MOIS Import Files

The MOC Flight Operations Plan is made up of MOIS generated Procedures which are based upon inputs received by the MOC from industry (for the S/C) and the ICCs for the instruments in the relevant User Manuals.

It was agreed pre-launch that delivery of such procedures from the ICCs could be made using the MOIS Import File interface. This interface works as follows :

- The ICC in question using the CUSGUI software of the HCSS can generate an output xls file from each high level cus script contained in its instrument model.
- This .xls file is sent via email to the MOC
- It is then imported into the MOIS system whereby the FOP procedure is output + an associated command sequence is placed in the MOC Database.
- The resultant procedure is made available back to the ICC for review & comment.

7.3.3 Task Parameter Files (TPFs)

An extra component of this interface is the use of Task Parameter Files to update parameter values of certain commands in a command sequence. The TPF is generated according to a format defined in the corresponding ICC-MOC TPF ICD (see [AD 5] for the list of TPF ICDs).

Delivery of a TPF can be made from the ICC to the HSC (via FTP Ops server) and then from the HSC to the MOC (via File Transfer System). It can also be made directly from the ICC@MOC to the MCS directly.

7.3.4 Email Addresses for this interaction

The main individuals involved in these interactions at the MOC are :

- HIFI & PACS : Ralph.biggins@esa.int
- SPIRE : Luke.lucas@esa.int

7.4 OBSM Interactions

7.4.1 Relevant Documentation

The documentation relevant to the OBSM interfaces can be found at the following Wiki page :

http://www.herschel.be/twiki/bin/view/HSC/GroundSegmentInterfaces#6_SGS_MOC_Interfaces_for_OBSM

For the purpose of the sections shown below, the following documents contained in that wiki page are referenced :

[OBS-1] SCOS-2000 OBSM External Interfaces Control Document

[OBS-2] OBSM Import Image File naming convention

7.4.2 OBSM Image delivery from ICC to HSC – the process involved

OBSM Image Update Rules

The following rules are being followed by each ICC for the delivery of their OBSM images to the HSC.

(a) Updates to the On Board Software of an instrument shall be planned well in advance with both the HSC & MOC fully aware of the implications on the uplink & downlink of the software change. As a result, it is expected that during routine operations, the ICC in question shall have raised this issue in the Ground Segment Operations telecon/meeting which is to be held monthly

(b) It is expected that before any update to the software is made, a full test campaign will have been run at the ICC site on a representative copy of the instrument (whether simulator or flight spare) in order to validate the changes being made.

(c) All images being delivered to HSC shall be in the format defined in [OBS-1] and following the filenaming convention described in [OBS-2]

(d) All images being delivered to the HSC shall be under configuration control e.g. CVS, at the ICCs

(e) The delivery of an OBSM image file(s) to the HSC shall be as .IMG files consistent with the naming convention in [OBS-2]

(e) Delivery of an OBSM Image file shall be made to the HSC FTP Operational Server which is only accessible via the lease lines existing between the HSC and each of the ICCs.

(f) The delivery shall be made to the following directory on the HSC FTP Operational server : /home/hsc_icc/fromICCs/obsm/obsm_xxxx/ whereby xxxx corresponds to pacs, spire or hifi
- DPU_OBSW_User_Manual.pdf
- PADPRMDA_0000_0000904_REF_2009_159T102051.zip
- PADPRMPR_0000_0000904_REF_2009_159T102051.zip
- README_CCB_PADPRMPR_0000_0000904_REF_2009_159T102051.txt
- Release_Notes.pdf

(g) Delivery of an OBSM Image file shall be followed by an email sent to hscops@sciops.esa.int & cCCB@sciops.esa.int. This email shall contain :
- The readme file delivered by the ICC OBSW provider (This release note would nominally contain the list of SxRs and modifications related to this update). This readme file shall be the same name as the Image file but with README_ beforehand
- A readme file containing the delivery information described on the next page. This readme file shall be the same name as the Image file but with README_CCB_ beforehand

7.4.3 OBSM Image delivery from HSC to MOC – the process involved + Emails

Following reception of an OBSM Image file + delivery note from the ICC, the HSC may proceed to forward the images to the MOC to allow them to pre-process them and verify their correctness.

The images are wrapped in IOBS File Transfer System Wrappers and are then sent via the File Transfer System. An email like the one which follows is sent in parallel.

The email is sent to Liviu.stefanov@esa.int with the MOC SOM + the ICC in question + hscops@sciops.esa.int in copy.

==========Email Template ==========

Hi Liviu,

I have sent via the file transfer system the following IMG files in the associated FTS wrapper files :

IOBS_HSCSDA_D_090715T194500_00001.HERS =
PADPRMPR_0000_0000904_REF_2009_159T102051.IMG

IOBS_HSCSDA_D_090715T194500_00002.HERS =
PADPRMDA_0000_0000904_REF_2009_159T102051.IMG

Here is my log of the File Transfer taking place successfully.

herfts02% sendFile.sh
/home/hftsops/MOC_TRANSFER/obsm/PACS/IOBS_HSCSDA_D_090715T194500_00001.HERS
Sending file: IOBS_HSCSDA_D_090715T194500_00001.HERS
File IOBS_HSCSDA_D_090715T194500_00001.HERS transmitted successfully

herfts02% sendFile.sh
/home/hftsops/MOC_TRANSFER/obsm/PACS/IOBS_HSCSDA_D_090715T194500_00002.HERS
Sending file: IOBS_HSCSDA_D_090715T194500_00002.HERS
File IOBS_HSCSDA_D_090715T194500_00002.HERS transmitted successfully

Can you please confirm their arrival??

Also, please take note of the attached email within which is contained important information relating to this delivery from PACS,

Finally : Go ahead from the Science Ground Segment will only be given for this OBSM update during the core CCB to be held on Friday at 14:00.

regards
Larry

==========

7.4.4 The CCBs Involved in the go-ahead for an upload of a new Image

(a) Before delivery of an OBSM image is to be made to the HSC, a CCB shall have been run at the ICC to confirm that the image in question has been successfully tested and to complete the README_CCB_Imagefilename.txt Readme file as described below.

(b) At this point the Ground Segment Core CCB shall be called for agree upon the date & time that the uplink of the image shall be made. The Ground Segment Core CCB corresponds to the Core CCB with MOC & Project Scientist (for impact on science) attendance. MOC shall confirm that their pre-processing of the images was successful.

(c) The Ground Segment CCB shall give the go-ahead for the upload of this image during the DTCP of an agreed OD.

7.4.5 OBSM Image dump file delivery to ICCs – the process involved

Activation of the new Image on-board

Following a pre-agreed timeline, MOC shall uplink the image onto the instrument. Activation of the new image shall then take place again according to the pre-agreed timeline.

Delivery of image dumps to HSC and on to the ICCs

All Image dumps shall be sent in two ways to the HSC from the MOC.

(a) As OBSM Image files via the File Transfer System
(b) As OBSM Image dump packets via the DDS

The OBSM Image dump files sent via the File Transfer System shall be placed by the HSC onto the HSC FTP Operational Server in the following directory : /home/hsc_icc/toICCs/obsm/obsm_xxxx/ where xxxx corresponds to the ICC in question i.e. pacs, spire, hifi.

An email shall be sent to the ICCs to confirm delivery of the image dump file. The Email addresses to be used are :

HIFI_ICC <hifi-operations@sron.nl>,

PACS_ICC <pacs_ops@sciops.esa.int>

SPIRE_ICC <Spire@stfc.ac.uk>

The data sent from the DDS shall be propagated to the ICCs as part of the nightly propagation process.

7.5 MIB & HPSDB Interactions

The approach on how new MIBs are fed to MOC during operations and how the merged HPSDB is fed back through the HSC to the ICCs is described here.

7.5.1 Relevant Documentation

The MIB documentation can be found at the following Wiki page :

http://www.herschel.be/twiki/bin/view/HSC/GroundSegmentInterfaces#1_SGS_MOC_Spacecraft_Interfaces

7.5.2 MIB delivery from the ICCs to MOC – the process involved including emails

The delivery mechanism for the MIBs to be provided to the MOC shall be via email. The HSC shall be placed in copy of this email.

The MIB delivery should be accompanied by a delivery note defining what are the differences between this MIB version and the last version delivered by the ICC.

Details shall also be provided as to when this MIB should become “live” in the uplink/downlink chains of the ground segment.

7.5.3 Email addresses to use

The delivery of a MIB to the MOC shall be made to the following email addresses :

Aurelian.Tomescu@esa.int, Gabriel.Mihail@esa.int, Micha.Schmidt@esa.int, Frank.Keck@esa.int

The HSC shall be placed in copy with the following email address in use : hscops@sciops.esa.int

7.5.4 HPSDB file delivery to ICCs – the process involved

As the HSC receives a single tar file containing the HPSDB (which includes the 3 merged instrument MIBs) from the MOC during operations then this file will be copied to the HSC FTP Operational directory for access by the ICCs.

The directory is as follows : /home/hsc_icc/toICCs/mib

An email shall then be sent to a specific distribution which shall inform of the availability of a new HPSDB for download from this location.

Distribution List

The distribution list is as follows :

HSC : hscops@sciops.esa.int, hscics@sciops.esa.int, hsccsg@sciops.esa.int, Johannes.Riedinger@esa.int, Paul.Balm@esa.int, Daniel.Galan@esa.int,

HIFI : P.R.Roelfsema@sron.nl, David.Teyssier@esa.int, **Peer Zaal peer@sron.nl,** Albrecht de Jonge <A.R.W.de.Jonge@sron.nl>,

PACS : Bart.vandenbussche@ster.kuleuven.be, ohb@mpe.mpg.de, fgb@mpe.mpg.de, Erich Wiezorrek erw@mpe.mpg.de, rik@ster.kuleuven.be,

SPIRE : Spire Operations Centre" <Spire@stfc.ac.uk>,

Others : mpsphsccb@sciops.esa.int, herdp_ta@sciops.esa.int

Typical Email To Be Sent

Here is an example of a typical Email being sent :
==========
Dear all,

A HPSDB was delivered to us from the MOC that contains the three instrument merged MIBs. The MIBs in that delivery are as follows :

For Herschel Model including the following software:
· CDMS 3.6.2
· ACMS 4.0
· PACS Mib version 9.3
· HIFI Mib version 11.10
· SPIRE Mib version 3.0.B1 PR

The File placed on the FTP operational server is FTS--200811281500--DB--HERSCHEL.zip

It is located in the standard mib delivery directory namely : /home/hsc_icc/toICCs/mib
==========

7.5.5 HPSDB file validation & roll-out in the Science Ground Segment

A dedicated Test plan document exists which is followed by the various centres of the science ground segment to validate the newly delivered HPSDB.

A Core CCB is finally held whereby the test reports are provided from the centres involved and go-ahead for roll-out of the new HPSDB is given for a specific Uplink OD onwards.

7.6 ICC@MOC Interactions

Each Instrument Control Centre has a set of workstations located in the PISA room at MOC which can be used both locally and remotely for interactions via the RTSI to view real time Science & HK data.

In addition to the viewing of data, it is also possible for the ICC@MOC to make file transfers using the FTS for the case of TPFs.

The restarting of the Mission Control System may result in a restart of the RTSI interface for the ICC@MOC workstations thus it has been agreed between the MOC and the SGS that such a restart will always be accompanied by an email informing that this has occurred.

7.7 Other Operational Interactions – SPACON DS2 Completion report

It has been agreed with the MOC that if the dump of the Science Data Stream (DS2) has not completed by the end of a DTCP such that it must be stopped/aborted, then the SPACON on shift will send an email to the Science Ground Segment informing them of this.

Here is an example email reflecting this interaction in action :

==========

Dear all,

tonight we had to abort the VC-3 dump.

The last TM packet (PACS) received had a generation time of 257/14:03z.

Consolidation is completed up to 257/14:00:00z,
but only on LTA-A (DDS-A).
Unfortunately we had a problem with the A/B swap and LTA-B (DDS-B) did not receive any TM.

We are currently synchronising LTA-B with LTA-A, but this will take a while.

HSC could re-connect via DDS-A now to do the transfer,
or wait until we have LTA-B synchronised (then using DDS-B).

Regards,
Frank

==========

8 S/C & Instrument Contingency Interactions between SGS & MOC

8.1 Spacecraft & Instrument Anomalies & Notification of Problems

8.1.1 Background to the Identification of an Anomaly

The identification of an anomaly is primarily derived from the operator being informed of (or a software process reacting to), in some way, a change in the nominal operational status of the instrument. Changes can be flagged primarily through :

(a) The hitting of Soft & Hard Limits
(b) The generation of Instrument Event Packets
(c) The reaction of the FDIR to an event

(a) Soft & Hard Limits

Soft Limits are values set in the (MOC) Downlink MIB tables that provide a lower & upper limit which if reached e.g. for a voltage, are considered to be acceptable but important to be aware that they have been hit. These could be considered to be information messages rather than warning messages.

Hard limits are considered to be lower & upper limits which if reached are considered to be a warning that the values in question are hitting what is considered to be a boundary outside of which problems could arise with the instrument.

At the MOC, when an out of limit is generated, be it soft or hard, then an alarm is raised for the Spacecraft Controller (SPACON) to acknowledge, and react as defined by the procedure delivered to him/her from the ICCs.

Access to this limit data is provided through the Out of Limit Data sets which are retrieved by the HSC from the MOC DDS, imported into the HSC DB and propagated to the ICCs.

(b) Instrument Event Packets

All instruments have the capability to generate event packets. Such event packets can be generated for information purposes, as warnings or indeed as statements of a course of action having been performed by the instrument to deal with an anomaly.

These events are stored in the relevant Packet Store in the SSMM which, at start of DTCP, is dumped.

ESOC have been provided with a procedure from each ICC which describes the course of action the Flight Control Team must take whereby a certain event is generated by the instrument. In general, this action will be to inform the HSC & the ICC of the error in question.

Access to these event packets is provided through the Spacecraft & Instrument HK dump data which are retrieved by the HSC from the MOC DDS, imported into the HSC DB and propagated to the ICCs.

(c) Failure Detection Isolation & Recovery (FDIR)

All instruments (and the Spacecraft service module) have an FDIR implemented in their software which continuously monitors the status of the subsystems belonging to that instrument and which, where an anomaly

event packet is generated, may react to carry out a predefined course of action e.g. reconfigure to backup, switch to safe mode, switch off etc.

As the Spacecraft & the instruments are out of contact for 21 hours per day then the use of FDIR forms an important part of the autonomy process that each instrument must follow during the operational phases of the mission. It represents a safeguard in ensuring the safety of the instruments at all times during the operational day.

8.1.2 The types of Instrument anomalies that can be encountered

(a) Instrument Minor Anomalies

Minor anomalies can be considered to be those which hit soft limits or result in a behaviour which is expected or, if unexpected, considered to be acceptable from the perspective that the instrument proceeds with the nominally scheduled observation timeline.

There shall be little to no impact on the scientific operations of the instrument for the case of minor anomalies. The impact shall be such that no change to the planning of observations for that particular instrument shall be required.

The hitting of hard limits whereby it is a once off explained event is also considered to be a minor anomaly.

It is to be expected that the post-processing of the data from the instrument at the ICCs will raise a large number of such minor anomalies throughout the mission.

The running of the Quality Control Pipeline at the HSC may also result in the discovery of such minor anomalies.

(b) Instrument Major Anomalies

Major Anomalies can be those which

(i) Hit hard limits and which result in the instrument performing an FDIR to reconfigure or switch down the instrument
(ii) Involve the instrument being commanded to a safe mode condition
(iii) The instrument science being affected in a manner in which scheduled observations for that same instrument need to be altered

It is expected that most if not all anomalies in the major category shall result in an event being generated by the instrument to be downloaded at DTCP in the Critical Event Log dump.

It is expected that all major anomalies will be responded to by the instrument FDIR software to ensure & guarantee the safety of that instrument.

While post-processing of the downlink data is expected to highlight only minor anomalies, the identification of an anomaly whereby the instrument scientific output is suspect or tainted, will lead to the generation of an instrument major anomaly investigation being opened.

8.1.3 The type of Spacecraft Anomalies that can be encountered

This section shall address problems identified with the spacecraft by the MOC and how these problems shall be passed on to the HSC & the ICC

It shall also address interactions between the MOC and the HSC related to unexpected changes to spacecraft configuration.

To be updated for Issue 1.0 of the document

8.1.4 Notification of Problems between the MOC and the SGS

It is assumed that the MOC Flight Control Team will contact a representative of the HSC & ICCs via telephone or e-mail within one hour of detection of a problem (instrument malfunction, operational problem), with the communication method dependent on the time and severity of the problem.

Examples of instrument malfunctions and operations problems include, but are not limited to:

- One or more instruments in Safe Mode
- Communications failure between MOC and Ground Station
- Spacecraft malfunctions affecting the instruments

Note that during operations the anomaly reports affecting instruments will be available on line (URL: http://artse.esoc.esa.int) as soon as they are registered in the database by the FCT. Nominally they will be recorded in the ARTS system on the same day as they have been reported.

The anomaly reports affecting the ground interface between MOC and SGS (and their documentation) will be available on line (URL: http://artse.esoc.esa.int) as soon as they are registered in the database for ground anomalies by the FCT.

The anomaly reports will include all attachments deemed useful to describe the symptoms of the malfunction.

8.2 Operational Email Addresses & Phone # to be used in case of anomalies

Here is the list of email addresses & phone numbers that should be used by MOC for contacting the HSC & the ICCs in the case of operational anomalies.

8.2.1 Notification of Anomalies via Email

Where an email is to be sent to an ICC then the MOC shall send an email to the relevant ICC operational email address + put the HSC in copy.

HSC : hscops@sciops.esa.int

HIFI_ICC <hifi-operations@sron.nl>,

PACS_ICC <pacs_ops@sciops.esa.int>

SPIRE : "Spire Operations Centre" <spire@stfc.ac.uk> - NOTE THIS IS A NEW EMAIL ADDRESS FOR SPIRE

The email shall make reference to the problem encountered and shall provide technical details as necessary i.e. OOL parameter + value, Event ID received plus exact time of occurrence.

8.2.2 Notification of Anomalies via phone

If the issue is very urgent then clearly a phone call is the quicker option. In such a case, here is a list of phone numbers that can be called.

HSC : Leo Metcalfe – 70372, Laurence O'Rourke – 70363, Pedro Garcia – 70389, Anthony Marston - 70370

HIFI : Peter Roelfsema - +31.50.363.4043

PACS : Otto H. Bauer +49-89-30-000-3591 (+49-160-700-6562 mobile), Helmut Feuchtgruber - +49-89-30-000-3290

SPIRE : Tanya Lim - +44.1235.44.5045, K.King - +44.1235.44.6558, S.Sidher - +44.1235.44.5114

8.3 Recovery of an instrument from an anomaly

8.3.1 Timeline Restarts through the use of the Rejoin Command

What the MOC shall do in the case of each of the instruments whereby a timeline restart is required & the rejoin keyword or automatic rejoin is required.

- For SPIRE, the Rejoin keyword can be used. If the MTL interruption is not related to an instrument problem then SPIRE would like to rejoin the timeline at the next observation. Each observation will therefore be completely independent of the previous one and no assumptions will be made about the instrument configuration before the start or end of an observation.

- For HIFI & PACS will interface with the MOC to define when to rejoin manually the Mission Timeline based upon the "start" conditions having been met e.g. manual execution of prologue scripts when PACS instrument is in Standby etc etc.

This section shall define a more detailed description of these issues

8.3.2 Timeline Restarts through the use of the Engineering Setup Procedures

This section shall describe how a timeline shall restart whereby MOC shall execute the Engineering Setup procedures for a specific instrument.

To be described in Issues 1.0 of the document because these procedures are still only being defined.

8.3.3 Timeline Restarts through the use of the Lifeboat Procedures (TBC)